

TECHNICAL MANUAL GREEN STAR SA

PUBLIC & EDUCATION BUILDING v1

Public & Education Building Design / As Built v1



On the cover:

Mannenberg Human Settlements Contact Centre, Cape Town, South Africa.

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Green Building Council of South Africa

Green Star SA – Public & Education Building - Design and Public & Education Building – As
Built v1 2013

Technical Manual

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Authorisation & Disclaimer

The Green Star SA Rating System and the rating tools have been developed with the assistance and participation of representatives from many organisations. The rating tools are subject to further development in the future. The views and opinions expressed in this Technical Manual have been determined by the GBCSA and its Committees.

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Acknowledgements

GREEN STAR SA – PUBLIC & EDUCATION BUILDING V1 RATING TOOL

The Green Star SA – Public & Education Building v1 rating tool provides for both Green Star SA – Public & Education Building v1 Design and Green Star SA – Public & Education Building v1 As Built ratings, through separate documentation paths. The tool has been adapted from the Australian Green Star – Public Building tool, under license from the Green Building Council of Australia. The tool has established individual environmental measurement criteria with particular reference to the South African marketplace and environmental context.

The Green Building Council of South Africa (GBCSA) would like to acknowledge all the parties who have worked on and supported the development of the Green Star SA – Public & Education Building v1 rating tool.

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ADDITIONAL EXPERTISE

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Green Star SA Technical Advisory Group Members

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Green Star SA Credits

The property industry is well-placed to deliver significant long-term environmental improvements using a broad range of measures. More importantly, it is unique in that it can directly influence and create behavioural changes at all stages of the supply chain. However, there are inherent barriers within the industry that often act to ensure that efficiency measures are not adopted, despite the fact that a strong business case can be made for their implementation. Most significantly, these barriers relate to the developer/contractor/owner divisions or split incentives that often result in the benefits of efficiency or improved performance measures not accruing to the party that initiated them.

The Green Building Council of South Africa (GBCSA) was created in order to address some of these barriers. The GBCSA's objective is to promote sustainable development and the transition of the property industry towards sustainability by promoting green building programs, technologies and design practices. A key priority for the GBCSA has been the development of a comprehensive environmental rating system for buildings, known as Green Star SA.

Green Star SA separately evaluates the environmental initiatives of designs, projects and/or buildings based on a number of criteria, including energy and water efficiency, indoor environment quality and resource conservation.

Green Star SA was created to:

- Establish a common language and standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Identify building lifecycle impacts;
- Raise awareness of green building benefits;
- Recognise environmental leadership; and
- Transform the built environment to reduce the environmental impact of development.

Green Star SA will have rating tools for different phases of the building lifecycle (design, construction, operations, refurbishment or fitout) and for different building classes (office, retail, healthcare, education, residential, industrial, public buildings etc.).

Green Star SA has built on existing systems and tools in overseas markets, most notably the Green Star system developed by the Green Building Council of Australia (GBCA), by adapting and establishing individual environmental measurement criteria relevant to the South African marketplace and environmental context.

Green Star SA rating tools use the best regulatory standards to encourage the property industry to improve the environmental impact of development. The rating tools embrace local standards and guidelines, where applicable, to benchmark this improvement.

The GBCSA has developed Green Star SA to provide industry with an objective measurement for green buildings. In assessing those elements that should be rated and to drive change in the market, the GBCSA has been diligent in focusing on areas of environmental impact that are a direct consequence of a building's briefing, design, construction and maintenance – that is, those outcomes that can be directly influenced by stakeholders within the property industry.

Green Star SA Credits

Green Star SA establishes a number of categories under which specific key criteria are grouped and assessed. This framework is used by each and every Green Star SA rating tool. The basic Green Star SA structure is shown below.

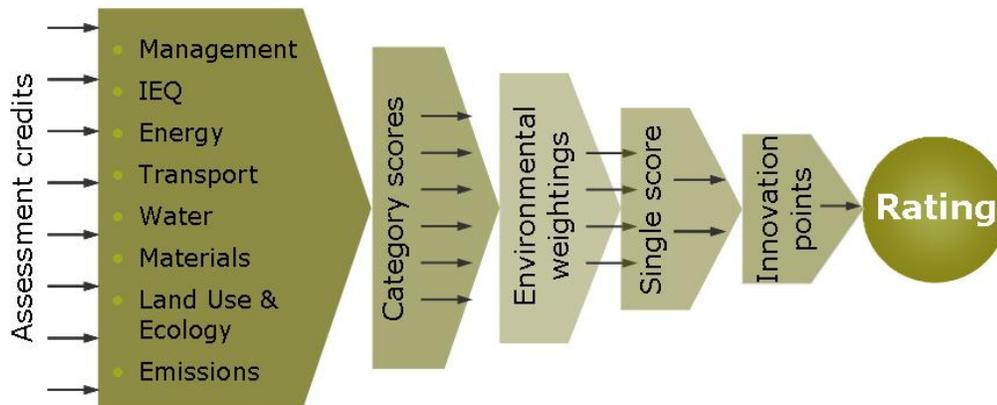


Figure 1: Structure of the Green Star SA rating system

Green Star SA rating tools include nine separate environmental impact categories:

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

The categories are divided into credits, each of which addresses an initiative that improves or has the potential to improve a design, project or building's environmental performance. Points are awarded in each credit for actions that demonstrate that the project has met the overall objectives of Green Star SA and the specific aims of the Green Star SA rating tool.

Once all credits in each category are assessed, a percentage score for the category is calculated. A Green Star SA environmental weighting factor is then applied to each of the project's category scores to reach a single score. Green Star SA environmental weighting factors vary across rating tools to reflect differing environmental concerns and imperatives for different building types and lifecycle phases.

Green Star SA Credits

By applying a weighting to each Category Score, Green Star SA ensures that each category is appropriately represented within the rating tool, in line with current knowledge and GBCSA opinion. The Green Star SA rating tools have the flexibility to allow for periodic updating of credits and weightings within the various tools. This is necessary to allow Green Star SA to adapt to best practice and remain at the leading edge of industry practice.

To encourage the development and spread of innovative technologies, designs and processes that could improve buildings' environmental performance, an 'Innovation' category is included in each Green Star SA rating tool. The Innovation category is not subject to an environmental weighting factor as the innovation could fall under any number of Green Star SA categories.

Category Score

The Category Score is determined for each category based on the percentage of credits achieved, as follows:

$$\text{Category Score} = \frac{\text{Number of points achieved}}{\text{Number of points available}}$$

For example, if 10 Energy points are achieved out of a total available of 26 then the Category Score is 38.5%.

NOTE: the Green Star SA rating is based on Weighted Category Scores and NOT the total number of points achieved.

Weighted Category Score

The Weighted Category Score is calculated as follows:

$$\text{Weighted Category Score} = \text{Category Score (\%)} \times \text{Weighting Factor (\%)} \times 100.$$

Using the example provided in the Category Score section above, the Weighted Category Score for Energy, with a weighting factor of 28%, is $0.385 \times 0.28 \times 100 = 10.78$.

All category weightings are provided in Appendix A.

Single Score

The single (i.e. overall) score is determined by adding together all the Weighted Category Scores plus the Innovation points. The maximum possible score for the weighted categories is 100, with an additional five points available for Innovation, making the maximum attainable score in Green Star SA 105.

The Green Star SA rating is determined by comparing the overall score with the rating scale shown below.

Green Star SA Credits

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'

Table 1: Green Star SA rating tool scores

As indicated above, the minimum Green Star SA rating is One Star and the maximum is Six Stars. In keeping with its position that Green Star SA recognises and rewards market leaders, the GBCSA will only formally certify designs, projects or buildings that achieve a Green Star SA rating of Four, Five or Six Stars.

Notwithstanding this, the use of Green Star SA rating tools is certainly not restricted to market leaders nor tied to a formal certification by the GBCSA. Green Star SA deliberately maintains the full range of ratings from One Star through to Six Stars so that designs, projects or buildings that do not qualify for certification can use the Green Star SA rating tools as a guide to track and improve their environmental initiatives.

GREEN STAR SA ACCREDITED PROFESSIONALS

To encourage the adoption of environmental initiatives from the earliest project stages throughout design, construction and operation of a building, all Green Star SA rating tools award two points in the Management category to projects that have a Green Star SA Accredited Professional as a member of their team. In the case of Green Star SA – Public & Education Building, the Green Star SA Accredited Professional's involvement must have commenced prior to schematic design and be engaged throughout the design, construction and delivery period. Please refer to Man-1 'Green Star SA Accredited Professional' section for further information.

Green Star SA Accredited Professionals are experienced building industry practitioners who have demonstrated their understanding of the Green Star SA rating system and the benefits of integrated design. To become a Green Star SA Accredited Professional, candidates must attend a GBCSA Green Star SA Accredited Professional course and pass the associated exam. Refer to the GBCSA website (<http://www.gbcsa.org.za>) for updates regarding how to maintain Green Star SA Accredited Professional Status. The GBCSA has developed an on-line directory of Green Star SA Accredited Professionals (see <http://www.gbcsa.org.za>) to enable easy identification and provide the contact details of these qualified service providers.

Green Star SA – Public & Education Building v1 Rating Tool

Green Star SA – Public & Education Building v1 validates the environmental initiatives of the design phase of new public & education buildings or base building refurbishment; or construction and procurement phase of a public & education building development.

Green Star SA – Public & Education Building v1 is a design and/or as built phase rating tool that aims to:

- Encourage the implementation of new and emerging technologies;
- Reduce the environmental impact of development through direct and indirect initiatives (e.g. it is difficult to quantify the environmental benefit of metering water and energy, but this will clearly improve awareness and encourage more efficient operational use);
- Encourage a new approach to designing and constructing buildings by rewarding best practice and excellence;
- Ensure that effective design strategies are implemented without overlay of operational management and user behaviour; and
- Allow different designs to have their environmental initiatives fairly benchmarked.

The rating tool is used to assess both the Design and As Built phases of new public & education building developments or base building refurbishment. The same Green Star SA - Public & Education Building tool is used for both Design and As Built certifications, but different documentation is required from the project team. The Green Star SA – Public & Education Building Design certification was created to ensure that environmental impacts were considered at the design stage of a building, and the documentation to validate these conditions is specific to that which can be demonstrated at the design stage only. The Green Star SA – Public & Education Building As Built certification assess the same design initiatives, but the validation documentation differs in that it is retrospective and therefore assesses that which is relevant to the construction of the building. The primary difference between Green Star SA – Public & Education Building Design and Green Star SA – Public & Education Building As Built is that the documentation required to verify environmental initiatives varies depending on whether the project is at the design phase or has been constructed.

It is important to note that the Green Star SA – Public & Education Building Technical Manual addresses both the Green Star SA – Public & Education Building Design and Green Star SA – Public & Education Building As Built certification in one Technical Manual.

ASSESSMENT CREDITS

The Green Star SA – Public & Education Building rating tool is divided into nine environmental categories, each of which has a number of credits.

For each credit the following topics are described in this Technical Manual:

- Aim of Credit;
- Credit Criteria;
- Documentation Requirements;
- Additional Guidance;

Green Star SA – Public & Education Building v1 Rating Tool

- Background; and
- References.

Points are awarded within credits for achieving performance-based objectives and for adopting policies and procedures to improve a project's environmental impact.

In some instances credits may not be applicable. This situation usually depends on the nature of the building and the inclusion or otherwise of a variety of typical building features. These specific instances are clearly defined in this Technical Manual. Whenever a credit is deemed 'Not Applicable', points are not awarded, and instead are excluded from the Points Available, used to calculate the Category Score. This modification prevents distortion of the Category Score (up or down) for issues that cannot be addressed and are not applicable to the project.

CONDITIONAL REQUIREMENTS

Green Star SA – Public & Education Building v1 has two criteria that must be achieved (known as 'Conditional Requirements') in order to obtain a Green Star SA – Public & Education Building v1 certified rating. The Conditional Requirements fall within the Energy and Land Use & Ecology categories. Please refer to these sections of the Technical Manual for further details.

ALLOCATION OF CREDITS WITHIN CATEGORIES

The credits in each category have an effective weighting by virtue of the number of points awarded versus the total points available. The points available correlate with, but are not always linearly proportional to, the environmental impact.

It is not the intent of Green Star SA – Public & Education Building v1 to benchmark the operational performance of buildings and, as a result, the tool provides comparable benchmarked outcomes rather than estimates of actual performance.

Green Star SA Certification

A development cannot publicly claim a Green Star SA rating unless the GBCSA has certified the rating. The GBCSA will commission two third-party Assessors to check and validate the project's self-rating and recommend (or oppose) a Green Star SA Certified Rating.

Green Star SA – Public & Education Building v1 certification identifies projects that have demonstrated a commitment to a specific level of environmental sustainability by informing the industry of the design performance of the project in terms that are widely understood and accepted.

The benefits of certification include:

- Gaining market recognition as a leader in the green building industry;
- Establishing a competitive commercial advantage when seeking occupants/users of the facility; and
- Validating the achievement through third party assessment.

ELIGIBILITY

To be eligible for Green Star SA assessment, projects must meet each of the following four Eligibility Criteria.

1. Spatial Differentiation
2. Space Use
3. Conditional Requirements
4. Timing of Certification

CONFIRMING ELIGIBILITY

It is the responsibility of each Project Team to check the most current Eligibility Criteria on the GBCSA website at the time of registration and to ensure that their project is eligible.

Whenever unsure, Project Teams can request an eligibility confirmation from the GBCSA by forwarding a brief description of the project to greenstarsa@gbcsa.org.za.

Registration does not guarantee assessment; no project will be assessed if it is deemed ineligible against the Eligibility Criteria current at the time of registration.

The GBCSA reserves the right to deny eligibility to assessment of any project that is deemed to compromise the Green Star SA brand, and to revise these criteria to better achieve the goals of the Green Star SA rating tools.

ELIGIBILITY CRITERION 1: SPATIAL DIFFERENTIATION

To meet the Spatial Differentiation criterion, the project must be clearly distinct. A Green Star SA rating must provide a meaningful result, and send a clear message to the marketplace, about a distinct project. Only distinct projects are eligible for assessment; project components are not eligible.

Green Star SA Certification

Shared building services (e.g. HVAC plant, or water treatment) or amenities (e.g. waste rooms or bicycle facilities) do not affect the building's eligibility for Green Star SA assessment. For further information, refer to the 'Guidelines for Interdependent Projects' below.

The following describes projects that meet this Eligibility Criterion:

- Functionally autonomous buildings that are:
 - Freestanding; or
 - On top of podium-type infrastructure or buildings (e.g. transport hubs, shared basements, etc.), provided that the building being rated is *visually distinct and recognisable** from the podium or base building; or
 - Of a podium nature, forming a base on which other buildings are constructed, provided that the building being rated is *visually distinct and recognisable** from any physically connected buildings; or
 - Connected to other buildings for secondary access only; or
 - Laterally adjacent to other functionally autonomous buildings; or
 - Buildings that are being extended.
- Building extensions (eligible for a BUILDING EXTENSION Rating – see 'Options for Building Extensions' below).

Options for Building Extensions:

There are two options available for an assessment of a building extension:

1. The building extension and the initial building are rated as one building under the current relevant Green Star SA tool (refer to the sections for the eligibility criteria for this option).
2. The building extension is rated separately and will receive a Green Star SA – BUILDING EXTENSION rating if successful.
 - The Green Star SA rating achieved by the extension will only relate to and can only be marketed for the extension, as will be made evident on the Certificate and logo (i.e., Green Star SA — Public & Education Building v1 BUILDING EXTENSION), and will not extend to the remainder of the building or any part thereof.

* In order to have a meaningful result and send a clear message to the marketplace, buildings being rated should be visually distinct and recognisable as functionally autonomous. This is to ensure that the marketplace has a clear image of which building carries the rating and thus that there is no confusion in this regard with respect to connected buildings and infrastructure. The GBCSA may in its absolute discretion decline eligibility to a project should it feel that this or any other criteria is not sufficiently met.

Green Star SA Certification

- The primary building does not need to have, or qualify for, a Green Star SA certified rating in order for the extension to be eligible.

A project can qualify for assessment as a building extension if it meets all of the following criteria:

The extension has full functional independence from the initial building;

The extension has a distinct address or name, e.g. 'West Wing';

The initial building's main function is not to service the extension;

If the project scope includes work to the initial building, it only includes refurbishment or modification to the initial building's spaces/structures that support the extension. If the modifications affect primary spaces/structures in the initial building, the entire development will be deemed one building;

There is a clearly defined 'Project site' used consistently throughout the submission:

- i. for a vertical extension, the 'site' will be defined as the area occupied by the extension's footprint only; or
- ii. for a lateral extension, the 'site' will be defined as the area occupied by the extension's footprint plus adjacent area extending to the boundary of the site of the initial building;

All services and incoming mains supplies are separated or sub-metered (or the entire system(s) must comply with the Credit Criteria); and

Either of the following attributes applies to the extension:

- i. It has a different street address from the initial building; OR
- ii. It accounts for at least 20% of the total GFA and is no smaller than 1,000m² GFA.

Options for Multiple Building Developments:

It is recognised that developments are sometimes split over several buildings. Such developments have the following options for Green Star SA assessments:

1. Single building certification, where selected campus buildings individually undergo assessment and receive individual ratings; OR
2. Single certification for multiple buildings, where all the buildings are certified at the same time and awarded one rating. Please contact the GBCSA for further information about this option.

Green Star SA Certification

A multiple-building development can be eligible for a single rating if it meets all the following criteria:

- a. It consists of buildings individually eligible for assessment under the same Green Star SA tool;
- b. It is under one ownership OR under single property management and control;
- c. It is recognised by a distinct name;
- d. It represents one project scope (even if buildings within that scope are completed at different times); and
- e. All buildings on the site are certified.

A submission for a multiple-building development must comply with the additional guidance provided by the GBCSA on request.

Guidelines for Interdependent Projects:

If well-designed and operated, shared services and amenities can result in outcomes which are superior to individual solutions. The following guidelines apply to any shared services and amenities:

Energy generation, refrigeration and water treatment services

- a. Both shared and off-site services can contribute to a project's Green Star SA rating; however, in all cases a Credit Interpretation Request (CIR) must be submitted to initiate a GBCSA ruling on the manner in which the Certified Assessors are to evaluate compliance.
- b. The GBCSA strongly supports the use of shared/centralised energy or treatment facilities (sometimes beyond the site boundary of the development being assessed). Energy, Water and Emissions credits can be achieved with a shared plant as long as the use of such facilities by the development seeking Green Star SA certification is not subject to operational uncertainty.
- c. For shared mechanical plants, projects must justify how the plant is apportioned; energy modelling is then conducted for the building as if it were served by a dedicated plant.
- d. For shared grey- and blackwater treatment facilities, projects must justify how the treatment plant is apportioned. For Wat-1 'Occupant Amenity Water', the Potable Water Calculator will estimate the potable water consumption of the building. Any project can use the manual calculations option and enter the final estimated potable water consumption in L/person/day (1 person per 15m²), taking into account reused water bought from off-site (or the use of cooling tower discharge, condensed water, etc.), and provide evidence to substantiate the offset.

As Green Star SA rating tools assess the inherent attributes of buildings, external amenities can only be rewarded if they are provided for the life of the building to the same degree of

Green Star SA Certification

service and certainty as internal facilities. As a result, the following applies to amenities that are located on separate premises and not within the assessed building:

- The scope of assessment is not extended beyond the assessed building, i.e. the building within which the amenities are housed does not need to meet the Credit Criteria of any claimed credits - only the amenities will be assessed against the Credit Criteria of the credit towards which they contribute;
- The assessed building and the amenities must be under the same ownership and cannot change ownership separately (i.e. they are on the same title or equivalent);
- The assessed building and the amenities must be under the same management and cannot change management separately (e.g. the same facility management to ensure recycling waste storage is processed as designed);
- The amenities must be completed by the date of practical completion of the assessed building; and
- The amenities must fully meet the Credit Criteria and be documented in strict accordance with the Technical Manual.

Should any of the above conditions not be met, the external amenities cannot contribute to the Building's Green Star SA rating unless a Credit Interpretation Request (CIR) is submitted to the GBCSA and granted to acknowledge alternative yet equivalent compliance.

ELIGIBILITY CRITERION 2: SPACE USE

The Green Star SA Public & Education Building v1 rating tool has been designed to assess new buildings, building renovations, building extensions and multiple building projects (A submission for a multiple-building development must comply with the multiple building certification guideline document which is available on request from the GBCSA).

For a building to be eligible, the primary function of the building as defined by SANS 10400 must be classified as one or more of the following building classifications in SANS 10400-A:2010 Table 1 and at least 80% of the building gross floor area (GFA*) must support the eligible primary function of the building. Note that most of the supporting spaces are likely to be of the same classification as the building itself, but could also include ancillary spaces supporting the primary function (e.g. office space supporting an A3 Places of instruction building). Residential type spaces including dormitory and hotel spaces are not considered as supporting areas:

- A1 Entertainment and Public Assembly
- A2 Theatrical and indoor sport
- A3 Places of instruction
- A4 Worship
- C1 Exhibition
- C2 Museum;

**The GFA must be measured to exclude car parks.*

Green Star SA Certification

Based on the criterion above, examples of buildings that would be eligible for a rating under the Public & Education Building tool include (but are not limited to);

- Community Centres
- Library/Museum/Gallery Buildings
- Basic Education buildings (Schools)
- Higher Education Buildings
- Theatres/Cinemas/Music Halls
- Places of Worship
- Convention / Exhibition Centres

For building types with the following primary functions, a project specific eligibility ruling would first need to be sought from the GBCSA prior to registration for certification under the Green Star SA - Public & Education Building v1 rating tool:

- Court buildings
- Airport terminal buildings
- Public transport terminal buildings
- Restaurants
- Indoor sports / leisure centres

The tool excludes the following buildings: Stadia, aquatic centres, and buildings that are eligible to achieve a rating under the 'Space Use' Eligibility Criterion of other Green Star SA tools.

ELIGIBILITY CRITERION 3: CONDITIONAL REQUIREMENTS

The Green Star SA rating tools have a number of Conditional Requirements (such as minimal energy efficiency and protecting land of high agricultural value). Regardless of how many other credits the building achieves, it will not be eligible for a Green Star SA Certified rating unless all of the rating tool's Conditional Requirements are met.

There are two Conditional Requirements in Green Star SA – Public & Education Building v1:

- Ene – 0 Conditional Requirement
Refer to the energy category of the rating tool and accompanying Technical Manual for further details.
- Eco – 0 Conditional Requirement
Refer to the Land Use and Ecology category of the rating tool and accompanying Technical Manual for further details.

Green Star SA Certification

ELIGIBILITY CRITERION 4: TIMING OF CERTIFICATION

Green Star SA rating tools correspond to specific phases within a building project, and as such certification must be achieved within the timeframe applicable to the relevant rating tool.

- Submissions for a 'Design' Certified Rating can be lodged as soon as the required evidence is available; this could be prior to commencement of construction. The Certified Rating can be achieved prior to practical completion, but must be achieved no later than 24 months after practical completion.
- Submissions for an 'As Built' Certified Rating can be lodged following the practical completion of the project. The Certified Rating must be achieved within 24 months after practical completion.

Green Star SA Certification

CERTIFICATION PROCESS

Up to date information on the Green Star SA certification process is outlined in detail on the GBCSA website (www.gbcsa.org.za). Templates, forms and checklists are available on this website to guide projects through the process.

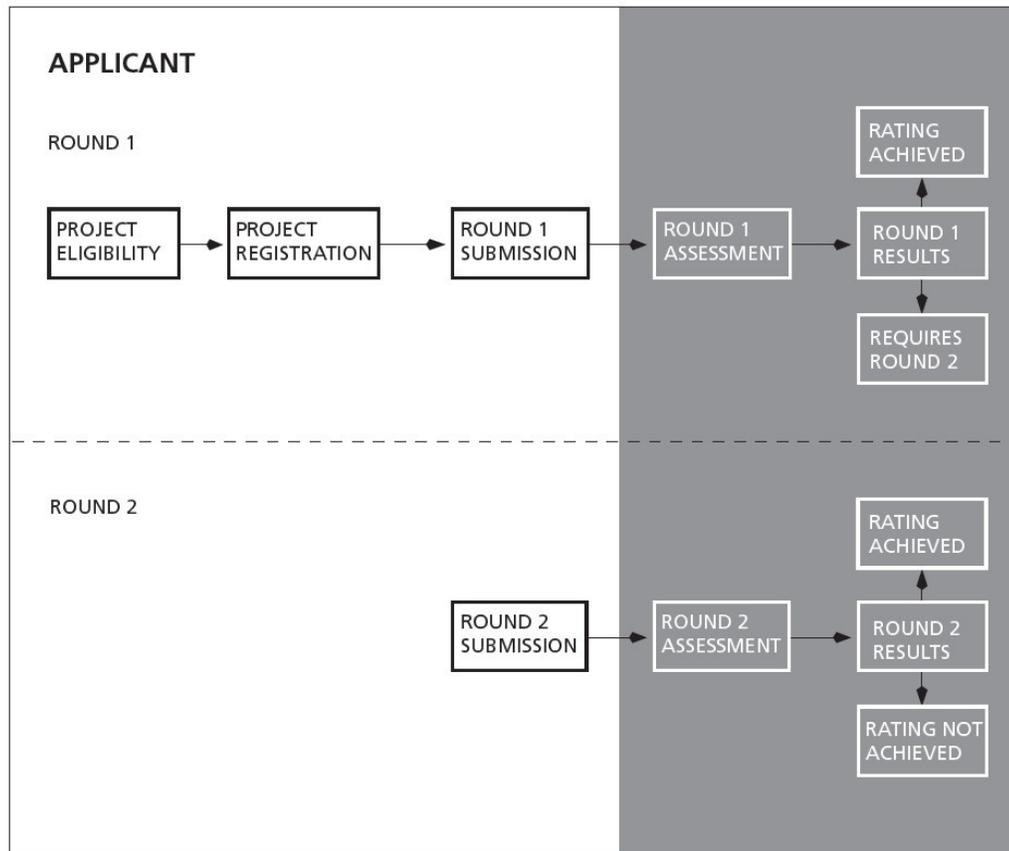


Figure 2: Overview of certification process (adapted from GBCA).

Registration

Registering a project with the GBCSA declares the intent to pursue certification under a specific rating tool and is the first step in the certification process. Registration establishes a connection with the GBCSA and gives the project access to essential information and assistance with the submission process. Projects should register as soon as possible during the project, though there is no deadline during the design or construction process. Registration takes place through a form in the Green Star SA certification section of the GBCSA website (www.gbcsa.org.za).

Part one of the Certification Fee (50%) must be paid to the GBCSA upon registration of a project, and an executed Certification Agreement (sent to the project owner upon registration)

Green Star SA Certification

must be received by the GBCSA to finalise a project's registration. Details of the Certification Fees can be found on the GBCSA website. Part two of the certification fee – the other 50% - is due when the project submits for Round 1 certification.

Please note that registering a project simply declares the intent to pursue certification and should not be confused with actual project certification which is awarded by the GBCSA once a project has demonstrated its achievement of a certain rating level.

Preparing the Submission(s)

Once your project is registered, the project team should prepare documentation, drawings and calculations to satisfy the Green Star SA credit documentation requirements. If appointed, the Green Star SA Accredited Professional should take responsibility for the quality of submission.

It is important to ensure that documentation for all claimed credits adheres to the Documentation Requirements outlined in the Green Star SA – Public & Education Building v1 Technical Manual as there are only two rounds of Assessment.

Assessors will not award the point(s) unless it is demonstrated that all the requirements have been met exactly as detailed in the Technical Manual. See the GBCS website for the most up to date templates and submissions forms.

Round 1 Submission

From the date of receipt of the Round 1 submission at the GBCSA offices, the GBCSA provide the Round 1 assessment results in 7 weeks.

Part two of the Certification Fee (50%) must be paid to the GBCSA on or before the Round 1 submission date, and projects must also provide the completed Round 1 pre-submission checklist found on the GBCSA website when they submit.

Please note that if a Credit Interpretation Request (CIR) or Technical Clarification (TC) has been submitted, an assessment cannot take place until it has been resolved.

The GBCSA will conduct a pre-assessment submission quality review of a project submission prior to the commissioning of a review by the Assessors. A project may be required to resubmit the submission prior to Round 1 assessment if the submission quality review suggests that the quality of the submission would result in an erroneous or extended assessment. There is no fee associated with the pre-assessment completed by the GBCSA.

Round 1 Assessment

The Assessment Panel, containing two third-party Assessors, will review the submission. Recommendations will then be made to the GBCSA. The GBCSA reserves the right to question the findings of the Certification Assessment Panel.

The GBCSA will forward the results of the Round 1 assessment to the project contact and the applicant. The project may accept the results as the final rating or request to resubmit documentation for credits 'to be confirmed' for a Round 2 assessment.

Green Star SA Certification

Round 2 Submission

Upon receipt of the results of the Round 1 Assessment, the project may request to resubmit documentation for credits 'to be confirmed'. Each project has only one opportunity for resubmission, which may include:

- Additional/revised documentation to demonstrate fulfilment of Credit Criteria;
- Alteration to project design that results in meeting Credit Criteria; and
- Credit Interpretation Requests (CIRs) to clarify alternative compliance.

From the date of receipt of the Round 2 submission at the GBCSA offices, the GBCSA provide the Round 2 assessment results in 5 weeks.

Projects must also provide the completed Round 2 pre-submission checklist found on the GBCSA website when they submit.

Round 2 Assessment

Assessment of the Round 2 submission will follow the procedures outlined above for Round 1 assessment.

Certified Rating Awarded

If the assessment validated the project's achievement of the score of 45 or above, the GBCSA will award a Certified Rating and notify the Applicant.

Certified Rating not Awarded

If a desired Certified Rating is not achieved, the project may be eligible to Appeal select credits for a fee to re-asses. Please contact the GBCSA for further details.

Technical Clarifications and Credit Interpretation Requests

The Green Star SA Technical Clarifications (TC) and Credit Interpretation Request (CIR) rulings provide an essential source of information to all projects undertaking Green Star SA assessment. They are available on the GBCSA website (www.gbcsa.org.za).

Technical Clarifications often represent the GBCSA answers to technical queries and complement Green Star SA Technical Manuals (e.g. the Assessment Team will use the Technical Clarifications as public precedent). They do not amend but clarify the Credit Criteria or Compliance Requirements. They are an extension of the Technical Manual; it is the responsibility of the project teams to stay up-to-date with this section of the GBCSA website.

The CIR rulings offer alternative compliance options whenever those have been deemed equivalent in meeting the Aim of Credit. A registered project may submit a CIR if the project team feels that the Aim of Credit has clearly been satisfied via a solution that does not adhere to the stated Credit Criteria/Additional Guidance of the relevant Technical Manual.

Green Star SA Updates & Feedback

Updating the Green Star SA – Public & Education Building rating tool

Green Star SA – Public & Education Building v1 was developed on the basis of information available at the time of its development. Some issues have not been addressed in Green Star SA – Public & Education Building v1 due to the following:

- Cost of undertaking assessment and concerns of the reliability and accuracy of data relevant to South Africa (e.g. embodied energy, Life Cycle Assessment etc.);
- Lack of clear benchmarks or guidelines relating to buildings; and
- Lack of standards of measurement in South Africa and availability of suppliers' data (e.g. material toxicity).

As more research is undertaken in the green building area, Green Star SA rating tools are updated to reflect new information, practices, tools and references.

Green Star SA rating tools may also be updated as a result of credit interpretations from the certification process. In these cases, the GBCSA reviews the credit and, if the new credit interpretation is adopted, the relevant Green Star SA rating tool and the associated Technical Manual is updated to reflect the change. All Green Star SA tools have an allocated version number to reflect these changes.

Green Star SA rating tools may also be revised on the basis of stakeholder feedback.

Feedback on Green Star SA – Public & Education Building v1

The GBCSA encourages feedback on all Green Star SA rating tools, including Green Star SA – Public & Education Building v1.

Feedback is to be sent to greenstarsa@gbcsa.org.za for consideration by the GBCSA.

Glossary

Accredited Professional

A building professional who has attended the Green Star SA Accredited Professional training course, has passed the associated examination and is registered with the Green Building Council of South Africa as an Accredited Professional.

Active Cooling/Heating

A heating or cooling process or system which consumes a form of primary energy to store, collect and distribute thermal energy in order to provide space heating or cooling within a building.

Active Solar Strategies

Mechanisms, such as photovoltaics, which are designed to actively collect the energy of sunlight and use it.*

Admittance

A measure of how easy it is for heat to be absorbed/emitted by a construction: the rate of heat flow between the internal surface of a construction and the environmental temperature in the space, for each degree of deviation of the space temperature about its mean value (W/m^2K).

AFFL

Above Finished Floor Level.

Air Handling Unit (AHU)

Equipment that includes a fan or blower, heating and/or cooling coils, regulator controls, condensate drain pans, and air filters.*

Alternative Energy

Energy from a source other than the conventional fossil-fuel sources of oil, natural gas and coal.*

Alternative Energy Sources

Energy sources that can be substituted for the conventional sources such as fossil fuels (coal, oil, natural gas), nuclear power, and large-scale hydroelectric power, e.g. solar, wind, geothermal, biomass.*

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

See <http://www.ashrae.org>.

Asbestos

A naturally occurring soft fibrous mineral commonly used in fireproofing materials and considered to be highly carcinogenic in particulate form.

Assessor

A person or persons, independent of the GBCSA, independent of the project client, design team and contractor, nominated by the GBCSA, knowledgeable and with experience in the green building industry, or who has such other appropriate assessment qualifications as the GBCSA may from time to time determine.

Biodiversity

The totality of living animals, plants, fungi and micro-organisms in a region; the variety of life in all forms, levels and combinations.*

Glossary

Biomass

Plant matter such as trees, grasses, agricultural crops or other biological material; all materials of recent plant or animal origin.*

Blackwater

Water which has been mixed with waste from toilets. Blackwater requires biological or chemical treatment and disinfection before reuse.

BMS

See Building Management System.

Breeze Path

A continuous path which connects ventilation openings across a space, and shows how air can flow through the space.

Building

The base building development seeking Green Star SA certification.

Building Envelope

The exterior surface of a building's construction: the walls, windows, roof and floor; also referred to as 'building shell'.*

Building Maintenance Guide (BMG)

A detailed guide for the building owner or manager on assessing and maintaining the building's services and external building fabric.

Building Management Control System (BMCS)

As per BMS.

Building Management System (BMS)

The BMS automatically controls the building services systems to maintain temperature, humidity, ventilation rates and lighting levels to pre-determined load requirements and to provide safe, efficient operation of equipment.

Building Research Establishment Environmental Assessment Method (BREEAM)

The UK-based BREEAM green building rating system assesses the environmental performance of both new and existing buildings. See <http://www.breeam.org>.

Building Users' Guide (BUG)

A simple and easy to use guide for the non technical building user which, through practical recommendations, encourages the use of the green building features of the design.

Carbon Dioxide (CO₂)

Odourless gas commonly sourced by respiration, and is the result of the oxidation (including active combustion and respiration) of carbon based substances; it has been widely used as a measure of the ventilation adequacy of a space; a principal greenhouse gas.*

Carbon Monoxide (CO)

An odourless gas that is given off during the process of incomplete combustion. Breathing in of CO gas reduces the ability of the blood to absorb oxygen and can be fatal.

Car Parking Area

Car parking areas include drive aisles and access areas situated therein.

Glossary

Chartered Institute of Building Services Engineers (CIBSE)

See <http://www.cibse.org>.

Chlorofluorocarbons (CFCs)

CFCs are refrigerants or blowing agents which cause ozone depletion when released in the atmosphere.

CIR

See Credit Interpretation Request.

Client

The building/project owner or developer responsible for the development/refurbishment of the building and for the engagement (directly or indirectly) of the design team and the contractor.

Climate Change

The change expected to occur to the world's climate due to human activities that emit greenhouse gases, such as burning fossil fuel (cars and electricity generation) and deforestation.

CLO Constant

The CLO Constant refers to the clothing variable used to assess the Predicted Mean Vote (PMV). It recognises that people are warmer if they are wearing more clothes.

Chain of Custody (CoC)

The path taken by raw materials, processed materials, and products from the forest to the consumer, including all successive stages of processing, transformation, manufacturing and distribution. All parties in the chain of custody must be CoC certified by FSC.

Cogeneration

The simultaneous production of electrical or mechanical energy (power) and useful thermal energy from the same fuel/energy source.*

Commissioning

The advancement of an installation from the state of static completion to full working order to the specified requirements. It includes the setting to work of an installation, the regulation of the system and the fine tuning of the system.

Computational Fluid Dynamics (CFD)

Numerical analysis of fluid flows. A computer is used to perform the millions of calculations required to simulate the interaction of fluids, for example looking at air movement within buildings.

Constructed Wetland

A human-made habitat for waterfowl and other forms of wildlife, often using greywater or rainwater catchments' overflow.*

Contaminant

A substance that is not naturally present in the environment or that is present in unnatural concentrations or amounts, and which can (in sufficient concentration) adversely alter an environment.

Glossary

Contract Value

The Rand value that will be required to complete the works for the entire project, including site works (landscaping, external paving, etc). The contract value must include contractor fee, contingencies and any other items included as part of the contract amount, but exclude demolition works, consultants fees, design fees, project management fees, VAT, works outside the site area, and buildings or areas within the site that are not being assessed for purposes of Green Star SA. In the Green Star SA Public & Education Building v1 tool the contract value excludes occupant allowances, even if these form part of the contract value.

Contractor

The main contractor or builder engaged to complete the scope of works for the project.

Construction Commencement

The time at which the Project Site is handed over from the Principal Agent to the Contractor to commence the scope of works of the contract.

Conventional Delivery

Finishes and services are applied to common areas. Tenancies are delivered with ceilings, floor coverings and lighting systems (no paint). Ducts from air supply and return risers, electrical and hydraulic services are installed above the ceiling from the riser throughout the tenancy areas.

Common Area

See 'List of Areas', 'Technical Manual & Submission Guidance' Section

CPRT

See Current Public Transport Record

CSIR

Council for Scientific & Industrial Research – See <http://www.csir.co.za>.

CSIRO

Australian Commonwealth Scientific and Industrial Research Organization – See <http://www.csiro.au>.

Credit Interpretation Request

Credit Interpretation Requests are submitted prior to assessment by a project that clearly meets the Aim of Credit but does not adhere to the stated Credit Criteria of the relevant Technical Manual. CIRs are considered by the GBCSA with the consultation from the Technical Working Group and other independent consultants, and the resulting rulings may set precedent and be used to update Green Star SA rating tools.

Cross Ventilation

When air flows naturally along one or more breeze paths, between ventilation openings on opposing or adjacent walls of a space or via a combination of wall and roof openings.

Current Public Transport Record

A survey of public transport undertaken regularly by Local and District Municipalities as mandated by National Government.

Curtilage

The ground adjacent to a dwelling and appertaining to it, as a yard, garden, or court.

Glossary

Daylight Autonomy (DA)

The fraction of occupied times per year, when the required minimum illuminance level at a point can be maintained by daylight alone.

Daylight Factor (DF)

The proportion of internal illuminance (light level) compared to the external illuminance, expressed as a percentage. Daylight Factor represents the proportion of external light which illuminates a given internal surface.

Daylight Illuminance (DI)

The illuminance (light level) achieved from daylight.

DEAT

See Department of Environmental Affairs and Tourism (South Africa).

Deconstruction

A process to carefully dismantle or remove useable materials from structures, as an alternative to demolition; it maximises the recovery of valuable building materials for reuse and recycling and minimises the amount of waste landfilled.*

Deemed to Satisfy

Prescriptive provisions which satisfy performance requirements, or stated level of performance.

Department of Environmental Affairs and Tourism (South Africa)

See <http://www.deat.gov.za>.

Department of Health (South Africa)

See <http://www.doh.gov.za>.

Department of Transport (South Africa)

See <http://www.dot.gov.za>.

Department of Water Affairs (South Africa)

See <http://www.dwa.gov.za>.

Design Intent Report

A report detailing the basic function and operation of the building services incorporated in the building, including initiatives intended to enhance energy efficiency, minimise greenhouse gas emissions, conserve water, and improve indoor environmental quality

Design Team

The professionals normally engaged in the design and contract administration of a building project. These typically include architects, engineers (e.g. structural, civil, mechanical, electrical, hydraulics, fire etc.), project manager, cost consultant and building surveyor plus other specialists including green building consultant, landscape architect, acoustics consultant, façade engineer, lighting consultant, etc.

Development Footprint

The extent of all disturbance to the site, including hardscape footprint (building footprint, parking areas, roads and all paved or sealed surfaces), construction related disturbances and

Glossary

softscape footprint (landscaping and water detention & treatment areas) excluding areas of natural or rehabilitated vegetation.

Displacement Ventilation

Supply air is introduced to the space at or near the floor level, at a low velocity, at a temperature only slightly below the desired room temperature. The cooler supply air 'displaces' the warmer room air, creating a zone of fresh cool air at the occupied level. Heat and contaminants produced by activities in the space rise to the ceiling level where they are exhausted from the space. This results in an efficient and low power ventilation system.

For the purposes of Green Star SA certification, for an underfloor air distribution system to qualify as a displacement ventilation system, the air velocity at the diffuser may not exceed 0.5m/s (as per ASHRAE PR 949) and return air must be at ceiling level. Supply air must always be provided at a temperature below room air temperature. Note that floor supply of warm air with a ceiling return has a low air change effectiveness (± 0.7). As such, for a system to qualify as displacement ventilation, if heating is provided, it may not be provided at floor level with ceiling return. Should project teams wish to motivate systems with velocities, temperatures or locations for supply / return air that are not in compliance with these parameters, it must be clearly justified how induction of foul air in the room will not take place, and thus that displacement ventilation will occur as opposed to the mixing of foul air and supply air in the room.

DOH

See Department of Health (South Africa).

DOT

See Department of Transport (South Africa).

DTS

See Deemed to Satisfy.

DWA

See Department of Water Affairs (South Africa).

Ecology

A branch of science concerned with the interrelationship of organisms and their environment.*

Ecosystem

An interconnected and symbiotic grouping of animals, plants, fungi and micro-organisms that sustains life through biological, geological and chemical activity.*

Education Building

Defined as buildings classified as "A3 Place of Instruction" under SANS 10400-A:200.*

Eligible Project

A project that complies with the requirements contained in the Green Star SA Eligibility section of this Technical Manual.

Embodied Energy

Glossary

Energy that is used during the entire life cycle of the commodity for manufacturing, transporting and disposing of the commodity as well as the inherent energy captured within the product itself; this term does not always correlate to the life cycle environmental impact.*

Emission Controls

Any measure that reduces emissions into air, water or soil. The most effective emission controls involve the redesign of the process so less waste is produced at the source.*

Emissions

The release of gases, liquids and/or solids from any process or industry; liquid emissions are commonly referred to as effluents.*

Environmental Impact

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from human activity, industry or natural disaster.*

EPA

Environment Protection Agency – See <http://www.epa.gov>.

EMP

Environmental Management Plan.

EMS

Environmental Management System.

Environmental Tobacco Smoke

Also known as second-hand smoke, consists of airborne particles emitted from the burning of cigarettes, pipes and cigars, and exhaled by smokers. The particles contain compounds some of which are known to cause cancer.

ESKOM

South Africa Electricity Supply Commission – See <http://www.eskom.co.za>

Equivalent Area

The area of a sharp edged circular orifice which would pass the same air flow rate and at the same applied pressure difference as a ventilation opening.

Extension

A wing or structure added to an existing building.

Fair Market Value

The equivalent market value of an existing item or material within a project which is claimed as reused for the purposes of Green Stare SA.

Forestry Stewardship Council

See <http://www.fsc.org>.

FFL

Finished Floor Level.

Free Area

The geometric open area of a ventilation opening.

Glossary

Functionally Autonomous Building

A building that does not rely on any other building for primary access or identification.

FSC

See Forest Stewardship Council.

FSC Certification

A certification system for timber products which confirms that timber has been harvested in a sustainable manner.

GBCSA

See Green Building Council of South Africa.

Gross Floor Area

See 'List of Areas', 'Technical Manual & Submission Guidance' Section.

GHG

See Greenhouse Gas.

Global Warming Potential (GWP)

Global Warming Potential provides a measure of the potential for damage that a chemical has relative to one unit of carbon dioxide, the primary greenhouse gas.

Greenbelt Zones

Zones or areas in or around a city where the removal of native vegetation is prohibited and/or parks and other open, undeveloped, and vegetated space is protected.*

Green Building

A Building that incorporates design, construction and operational practices that significantly reduce or eliminate its negative impact on the environment and its occupants; an opportunity to use resources efficiently while creating healthier environments for people to live and work in.

Green Building Council of South Africa (GBCSA)

A national, not-for-profit organisation that is committed to developing an environmentally sustainable property industry for South Africa by encouraging the adoption of green building practices. See <http://www.gbcsa.org.za>.

Greenfield Site

Land on which no development has previously taken place; usually understood to be on the periphery of an existing built-up area.* Includes agricultural or forestry disturbances.

Greenhouse Effect

(1) The warming of the earth's surface and lower atmosphere as a result of carbon dioxide and water vapour, which absorb and reradiate infrared radiation, in the atmosphere; (2) An intensification of this warming effect from human-induced increase in carbon dioxide and other greenhouse gases in the atmosphere from the burning of fossil fuels.*

Greenhouse Gases (GHGs)

Trace gases such as carbon dioxide, water vapour, methane, and CFCs that are relatively transparent to the higher-energy sunlight, but trap the lower-energy infrared radiation.*

Greenwash

Glossary

Disinformation disseminated by an organisation so as to present an environmentally responsible public image.*

Greywater

Waste water recovered from basins, showers, washing machines and other water sources that do not contain food or human waste.

Grid

A term used to describe the network of wires and cables which transport electricity from a power plant.*

Ground Water

A general term for the water beneath the Earth's surface.

GWP

See Global Warming Potential.

Habitat

(1) The natural home of an animal or plant; (2) The sum of the environmental conditions that determine the existence of a community in a specific place.*

Habitat Fragmentation

Habitat disruption where natural habitat is broken into small, relatively isolated sections.*

Hardscape

Pavers, sidewalks, raised planters, retaining walls, site furnishings and other non-living design elements used to enhance landscaped areas.

Hazardous Waste

Waste that is particularly dangerous or destructive; specifically characterised by one or more of the following properties: ignitable, corrosive, reactive or toxic.*

Heating, Ventilation and Air Conditioning (HVAC)

Mechanical systems that provide heating, ventilation and air conditioning in buildings.

Heat Recovery Ventilation

A system that reclaims the heat from warm exhaust air exiting a building and uses it to pre-heat entering fresh air.*

HDPE

See High Density Poly Ethylene.

High Density Poly Ethylene

A type of plastic that can be used to make pipes and other plastic products as an alternative to PVC.

HVAC

See Heating, Ventilation and Air Conditioning.

Hydrochlorofluorocarbons (HCFCs)

HCFCs are found in refrigerants and blowing agents that cause ozone depletion when released in the atmosphere.

Glossary

Hydrofluorocarbons (HFCs)

HFCs are commonly used to replace HCFC refrigerants and blowing agents to reduce the ozone depletion potential (ODP); however, HFC products have a high Global Warming Potential (GWP).

IEQ

See Indoor Environment Quality.

Illuminance

The luminous flux incident on a unit area of a surface. The unit is the lux which is one lumen per square meter.

Independent Chair

A person independent of the GBCSA, nominated by the GBCSA, knowledgeable and with experience in the green building industry, who has such appropriate assessment qualifications as the GBCSA may from time to time determine who is responsible for reviewing the report of the Assessors prior to the Assessors making a recommendation to the GBCSA in respect of the development.

Independent Commissioning Agent

An experienced and qualified commissioning agent who carries out commissioning on behalf of the building owner or tenant.

Indicators

(1) A measurement or reporting tool used to gauge how well a society is achieving its economic environmental and societal goals; (2) A species of plant or animal, or a community, whose occurrence serves as evidence that certain environmental conditions exist.*

Indoor Environment Quality (IEQ)

Covers issues such as indoor air quality, thermal comfort, illumination, daylight, views, acoustics and occupant control of building systems.

Integrated Fitout

A fitout where the tenancy design and construction is fully coordinated with the base building design and construction.

Intergovernmental Panel on Climate Change (IPCC)

UN agency set up to provide the decision-makers and others interested in climate change with an objective source of information about climate change. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation. Findings of the IPCC played a role in the establishment of the Kyoto Protocol under the UN Framework Convention on Climate Change.

Interdependent Projects

Projects that share services and amenities.

IPCC

See Intergovernmental Panel on Climate Change.

ISO 14001:2004

Glossary

An international standard which specifies requirements for an Environmental Management System (EMS).

Justify

Where project teams are requested to provide justification for certain claims within the Green Star SA submission, the actual quantitative or qualitative impact of the specific claim must be clearly demonstrated in relation to the Green Star SA Technical Manual requirements in order to prove compliance. Quantitative demonstration should be via referenced calculations or simulations, whereas qualitative demonstration should be referenced by supporting documentation or evidence such as recognised standards, guidelines or research papers.

Kyoto Protocol

An international agreement reached in 1997 in Kyoto, Japan to address the problems of climate change (see also IPCC).

Landfill

An area where solid waste is deposited. In a suitable area, a hole in the ground is lined so that materials will not escape, and is filled with layers of rubble/waste as the waste is progressively deposited. When completely filled, it is typically capped and sealed.

Leadership in Energy and Environmental Design (LEED)

The US-based LEED Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. See <http://www.usgbc.org/leed>.

LEED

See Leadership in Energy and Environmental Design.

Life Cycle

All phases associated with the life of a product (i.e. creation, distribution, sale, installation, use, care and disposal/reuse/recycle).*

Life Cycle Assessment (LCA)

An evaluation of the environmental effects of a product or activity holistically, by analysing the entire life cycle of a particular material, process, product, technology, service or activity. The LCA consists of three complimentary components: inventory analysis, impact analysis, and improvement analysis, together with an integrative procedure known as scoping.*

Light Pollution

Waste light from buildings that is directed upward to the sky or is directed away from the site.

Luminous Efficacy

A measure of how well a light source produces visible light; the ratio of luminous flux to power.

Maintained illuminance

The average illuminance over the reference surface at the time maintenance has to be carried out by replacing lamps and/or cleaning the equipment and room surfaces (if applicable).

Mall area

The common space between tenancies that acts as the walking space between tenants. Malls can be covered or open air.

Glossary

Material Cost

The cost of a material may include transport/shipping costs to the project site, but may not include installation costs, equipment for installation, contractor fee, contingencies, VAT or any other amounts.

Mechanical Ventilation

Ventilation systems which use fans or other electrically operated air movement devices to provide ventilation to a building. Wind driven turbine ventilators and mechanically operated windows are not classified as 'mechanical ventilation'.

Mechanically Assisted Natural Ventilation

Systems that rely, partially or fully, on fans to move non-conditioned air through a space.

MET Values

MET refers to human metabolic rate and corresponds to the amount of heat (sensible and latent) released from the human body. It is used to size air conditioning equipment and to assess the Predicted Mean Vote (PMV) when calculating thermal comfort.

Mixed-Mode Ventilation

A ventilation strategy that combines natural ventilation and mechanical ventilation, allowing the building to be ventilated either naturally or mechanically according to the season or ambient temperatures.

Mixed-Use Development

The use of a single building for different purposes simultaneously.

Mould

Mould is a fungus that typically grows in a filamentous cobweb-like mass under damp conditions and is capable of producing staggering numbers of reproductive spores in as little as a few days. Moulds are non-chlorophyll containing entities, which require organic matter, living or dead, for survival. Moulds are extraordinarily diverse in character and their relationship with humans span the positive (e.g. food, antibiotics) to the negative (e.g. pathogens, antigens, toxins).*

Natural Ventilation

The process of supplying and removing air in building spaces by natural means, by using openings in the façade (e.g. windows), non-powered ventilators, solar chimneys and infiltration processes. A building can still be termed 'naturally ventilated' if it contains propeller type ceiling fans provided they only recirculate air and their energy use is included in the energy modelling.

Nominated Area

See 'List of Areas' in 'Technical Manual & Submission Guidance'.

Non-Potable Water

Water collected on-site or recycled/recovered from a previous use such as blackwater or greywater recovery. It does not include water from rivers, lakes or groundwater (borehole water) unless the water has previously been used.

Non-Renewable Resources

Resources that cannot be replaced in the environment (e.g. fossil fuels) because they form at a rate far slower than their consumption.*

Glossary

O&M Manual

Operations and Maintenance Manual.

Occupied Space

Areas that are predominantly:

Work spaces (e.g. cellular offices, open plan offices, meeting rooms, food preparation areas, laboratories, consulting rooms, workshops - small scale and high density it work spaces);

Large event spaces (e.g. dry sports halls, swimming pool areas, halls, arts theatres, libraries, assembly areas, sales areas – general, sales areas – chilled, performance areas (stage), check in areas, baggage reclaim areas, security check areas, fitness suites, gyms, fitness studios and ice rinks);

Common areas (e.g. receptions, waiting rooms, eating/drinking areas, laundries, common rooms/staff rooms/lounges, public circulation areas, foyers and lobbies); and

Learning spaces (e.g. classrooms and lecture rooms) are all expected to form part of the Occupied Space.

Most corridors are to be excluded from the calculation of Occupied Space. Where corridors are exclusively used for transit between spaces (i.e. do not act as a foyer, lounge, waiting space, or reception), and where these corridors are bound in both sides by a wall these are to be excluded. Where a corridor is part of a shared space, this corridor, or section of a corridor, cannot be excluded and is considered part of the adjacent space. Occupied Space also excludes enclosed fire stairs, storage areas, toilets, tea kitchens, changing facilities, bathrooms, display areas, IT equipment rooms and plant-rooms.

ODP

See Ozone Depleting Potential.

OECD

See Organisation for Economic Co-operation and Development

OHS

Occupational Health and Safety.

Organically Certified Products

Products certified by a specialist organic certification body.

Organisation for Economic Co-operation and Development (OECD)

See www.oecd.org.

Ozone (O₃)

A naturally occurring, highly reactive, irritating trace gas comprising of tri-atomic oxygen formed by recombination of oxygen in the presence of ultraviolet radiation.*

Ozone Depletion

Destruction of the Earth's ozone layer, which can be caused by the photolytic breakdown of certain chlorine and/or bromine-containing compounds (e.g. chlorofluorocarbons), which catalytically decompose ozone molecules.*

Ozone Depleting Potential

Glossary

ODP provides a measure of the potential damage that a chemical has relative to that of refrigerant type CFC11. CFC11 has an ODP of one and is the most damaging of CFCs.

Ozone Hole

A thinning break in the ozone layer. Designation of the amount of such depletion as an 'ozone hole' is made when the detected amount of depletion exceeds 50%. Seasonal ozone holes have been observed over the Antarctic and Arctic regions, part of Canada, and the extreme northeast United States.*

Ozone Layer

The protective layer in the stratosphere layer of the atmosphere, about 24 kilometres above the ground, that absorbs some of the sun's ultraviolet rays, thereby reducing the amount of potentially harmful radiation that reaches the earth's surface.*

Passive Cooling/Heating

A process of cooling/heating a building in which no power or fuel is consumed. This is distinct from natural ventilation, which relates only to air supply and extract, although natural ventilation may provide passive cooling in some weather conditions. Other examples of passive cooling include cooling from thermal mass, while passive heating strategies include heating using solar gains through windows and reducing infiltration to prevent heat escaping.

Passive Design

Design that reduces the energy consumption of a building by taking advantage of natural heating, cooling and lighting.*

Passive Solar Design

Design that uses the inherent characteristics of a building rather than mechanical systems to capture heat and light from the sun.*

Photovoltaics

The use of semiconductor technology to generate electricity directly from the sunlight.*

Pollution

Generally, the presence in the environment of a substance that, because of its chemical composition or quantity, prevents the functioning of natural processes and produces undesirable environmental and health effects; can be seen as the human-induced alteration of the physical, biological, chemical and radiological integrity of water and other media.*

PPB

Parts per Billion.

PPM

Parts per Million.

PMV

See Predicted Mean Vote.

PPD

See Predicted Percent Dissatisfied.

Poly Vinyl Chloride (PVC)

Glossary

A form of plastic that is used typically in buildings for electrical tubing, electrical insulation around wires and piping for plumbing installations. It is also sometimes used in carpets and other building materials.

Post-Consumer Recycled Content

A product composition that contains some percentage of material diverted from the product user's waste stream.

Post-Industrial Recycled Content

A product composition that contains some percentage of manufacturing waste material that has been reclaimed from a process generating the same or a similar product. This includes returns of material from the distribution chain, but excludes re-utilisation of materials such as re-work, re-grind or scrap generated in a process and capable of being reclaimed within the same process that generated it.*

Potable Water

Water that is drinkable i.e. safe to be consumed.

Practical Completion

The stage of completion where the works or a section thereof, as certified by the principle agent, is substantially complete and can effectively be used for the purpose intended (JBCC Series 2000).

Precautionary Principle

The decision-making principle that advises that, in face of uncertainty, the best course of action is to assume that a potential problem is real and should be addressed.*

Predicted Mean Vote (PMV)

PMV is an index that predicts the mean value of the votes of a large group of persons on the 7-point thermal sensation scale, from +3 (hot) to -3 (cold), based on the heat balance of the human body. Thermal balance is obtained when the internal heat production in the body is equal to the loss of heat to the environment. In a moderate environment, the human thermoregulatory system will automatically attempt to modify skin temperature and sweat secretion to maintain heat balance. A PMV of -1 to +1 corresponds to a Predicted Percent Dissatisfied (PPD) of no more than 25% (i.e. 25% of people are dissatisfied or uncomfortable). A PMV of -0.5 to +0.5 corresponds to a PPD of 10%. A PMV of zero would still mean 5% of occupants are dissatisfied or uncomfortable.

Predicted Percent Dissatisfied (PPD)

PPD is an index that establishes a quantitative prediction of the percentage of thermally dissatisfied people who feel too cool or too warm. For the purposes of the international standard (ISO 7730) quoted in the Technical Manual, thermally dissatisfied people are those who will vote hot, warm, cool or cold on the 7-point thermal sensation scale (PMV).

Principal Agent

The party named in the contract data and/or appointed by the employer with full authority and obligation to act in terms of the agreement (JBCC Series 2000).

Primary Function

The space function accounting for over 50% of the GFA.

Project Site

Glossary

The land or place on, over, under, in or through which the scope of works is to be completed, as defined for the purposes of Green Star SA certification.

Project Team

Comprising the Design Team members and Construction Team members; generally those responsible for the definition, delivery and completion of the scope of works for the project.

Project Value

See 'Contract Value'.

Psychrometric Chart

A chart showing the air's dry and wet bulb temperatures, humidity, moisture content and enthalpy. It is used by mechanical engineers to illustrate the condition (temperature, humidity and enthalpy) of air at each point of the air conditioning process. This information assists with sizing air conditioning equipment to maintain comfortable internal air temperatures and relative humidity.

PVC

See Poly Vinyl Chloride.

Reclamation

Restoration of materials found in the waste stream to a beneficial use that may be other than the original use.*

Recyclable

Commonly referred to as the ability of a product or material to be recovered from, or otherwise diverted from, the solid waste stream for the purposes of recycling.*

Recycled Content

Materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer). Pre-consumer material does not include materials normally reused by industry within the original manufacturing process, and is also termed 'post-industrial'.*

Recycling

A process by which materials that would otherwise become waste are collected, separated or processed and returned to the economic mainstream to be reused in the form of raw materials or finished goods. Horizontal Recycling – A recycling system that turns a majority of the original product back into a similar product as the original. Downcycling – a term coined to disparagingly describe creation of a product of lesser intrinsic value manufactured from a material at the end of its service life that had higher initial end use value. Upcycling – a subjective term used to describe the creation of a product with higher intrinsic value, manufactured from a material at the end of its useful life, which had a lower initial end use value.*

Redevelopment

The restoration and improvement of an existing structure or property.

Refurbishment

The upgrading of either (or both) a building's fabric and services with the aim of enhancing its ability to attract tenants, improve rental growth and maximise market value. Refurbishment (Full) – Where a building, or portion of a building, is vacated and withdrawn from stock for

Glossary

refurbishment, including replacement of plant and services. Refurbishment (Partial) – Where a building or portion of a building is vacated and withdrawn from stock for refurbishment, which normally is restricted to cosmetic improvements.

Relative Humidity RH)

Ratio of the amount of water vapour in air at a specific temperature to the maximum capacity of the air to hold moisture at that temperature.

Relevant Project Team Member

A member of the Project Team; no specific profession or skills are required for the purpose of 'Documentation Requirements'.

Remediation

Efforts to counteract some or all of the effects of pollution after it has been released into an environment.*

Renewable Energy

An energy source that, from an earth perspective, is continually replenished.*

Renewable Resources

Resources that can be replenished at a rate equal to or greater than its rate of depletion (i.e. solar, wind, geothermal and biomass resources).*

RH

See Relative Humidity.

Riparian Buffer Zone

Describe lands adjacent to streams where vegetation is strongly influenced by the presence of water.

SABS

See South African Bureau of Standards.

SANS

See South African National Standard.

SAPOA

See South African Property Owners Association.

Shared Building Infrastructure

Infrastructure shared by two or more buildings, including, but not limited to: waste services, delivery yards, toilet facilities and car parks.

Sick Building Syndrome

(1) A human health condition in which infections linger, caused by exposure to contaminants within a building as a result of poor ventilation; (2) Building whose occupants experience acute health and/or comfort effects that appear to be linked to time spent therein, but where no specific illness or cause can be identified. Complaints may be localised in a particular room or zone, or may spread throughout the building and may abate on leaving the building.*

Site

See Project Site.

Glossary

Solar Reflectance Index (SRI)

A value that incorporates both solar reflectance and emittance in a single value to represent a material's temperature in the sun. SRI quantifies how hot a surface would get relative to standard black and standard white surfaces. It is calculated using equations based on previously measured values of solar reflectance and emittance as laid out in the American Society for Testing and Materials Standard E 1980. It is expressed as a fraction (0.0 to 1.0) or percentage (0% to 100%).

South African Bureau of Standards (SABS)

See <http://www.sabs.co.za>

South African National Standard (SANS)

Standards written by SABS which are normally not mandatory unless referenced by legislation.

South African Institute of Architects (SAIA)

See <http://www.saia.org.za>

South African Property Owners Association (SAPOA)

See <http://www.sapoa.org.za>

Source Reduction

As applied to solid waste, reducing the generation of waste in the first place (as opposed to later re-using or recycling waste).*

Specifications

Specifications refer to written documentation that are prepared for and submitted to a contractor, at the tender stage of a project, in order for a contractor to price a building development. Many credits require extracts from specifications to be submitted to show compliance with their Credit Criteria. Circumstances under which alternatives to extracts to specifications are allowed to be submitted in compliance with the Documentation Requirements of a credit, are provided in the 'Standard Documentation Types – Guidance' section of this Technical Manual.

SRI

See Solar Reflectance Index

Suitably Qualified Professional

A person suitably experienced by profession, training, or demonstrable experience, to calculate, confirm, commit or provide comment on, the field, subject or topic as required for the purpose of 'Documentation Requirements' as necessary.

Sustainable Development

An approach to progress that meets the needs of the present without compromising the ability of future generations to meet their needs.*

Supporting Documentation

With reference to 'Documentation Requirements'; other documentation submitted within the same credit of a submission.

TFG

See Tenancy Fitout Guide.

Glossary

TRY

See Test Reference Year.

TWG

See Technical Working Group.

Technical Working Group (TWG)

An advisory panel convened by the GBCSA and designated as the 'Technical Working Group'.

Tenancy Fitout Guide (TFG)

A detailed guide for the design team responsible for the fitout containing information on the green building features of the base building and recommendations on how to achieve the green building potential of the tenancy.

Test Reference Year (TRY)

A year's worth of recorded hourly weather data which represents a 'typical' year of weather data for that specific location.

Thermal Comfort

A means of describing occupant comfort which takes into account air temperature, radiant temperature, humidity, draught, clothing value and activity rates.

Thermostatic Control

A device which measures the room temperature and automatically switches the heating/cooling system on and off according to the set point temperature which can be adjusted by the occupant(s).

Timeclock Control

A device which allows the occupant(s) to set times at which a specific system (e.g. geyser or HVAC system) is switched on and off. Both one day (24 hour) and 7 day timeclock controls are available, the latter allowing different settings to be used at weekends.

Tri-Generation

A form of energy generation where electrical energy is produced on-site (typically via gas) whilst at the same time waste heat is extracted from the equipment to provide energy to other systems (such as mechanical systems).

Uniform Design Sky

A modelled design sky with a standard, constant illuminance across the entire hemisphere.

VAV Systems

Variable Air Volume air conditioning systems.

Ventilation

The process of supplying and removing air in building spaces by natural or mechanical means.

Ventilation Opening

An opening in the external wall, floor or roof of a room, which is designed to allow air movement into or out of the building or room by natural, passive means.

Virgin Materials

Glossary

Previously unprocessed materials. A tree that is cut into lumber to make pallets is an example of a virgin material. Lumber recovered from broken pallets to make new pallets is not a virgin material but a recyclable material (US EPA).

VLT

See Visual Light Transmittance.

Visual Light Transmittance (VLT)

Refers to the amount of visual light a material allows to be transferred through itself.

VOC

See Volatile Organic Compounds.

Volatile Organic Compounds (VOCs)

VOCs are organic compounds that produce vapours readily at room temperature and normal atmospheric pressure.

Waste Management Plan (WMP)

A document which outlines how construction and demolition waste will be collected for recycling and recycled, and how the recycling of that waste will be recorded.

WC

Water closet (i.e. toilet).

WHB

Wash Hand Basin.

Work Setting

A table or workstation with a chair. Tables which have more than one chair provided are considered to be equivalent to one work setting for each two chairs provided.

Xeriscape

Water-conserving landscape or landscape requiring no additional watering. For Green Star SA purposes, it is acceptable to irrigate a xeriscape garden during the first year, but once established the landscape must not be irrigated.

* Definitions taken from 'Glossary: Green Glossary for High Performance Green Buildings' (2004), produced in partnership by Antron and IFMA (International Facility Management Association).

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A GUIDE TO THE STRUCTURE OF GREEN STAR SA CREDITS

Aim of Credit

Asserts which environmental issue this credit is targeting, what the guiding principles behind the credit are, and what the desired environmental outcomes are.

Credit Criteria

Explains clearly how the Aim of Credit section is to be met. Where the Aim of Credit is the guiding principle, Credit Criteria outlines measures that must be undertaken within a project to achieve it. It is important to read this section carefully as every project must meet the criteria outlined in this section for the credit to be awarded. Green Star SA rates building attributes, not operations; a solution that is not an inherent building attribute and relies on operational measures to achieve desired performance cannot meet the Aim of Credit. This section also outlines how points are either awarded or 'Not Applicable' within the Green Star SA rating tool.

Documentation Requirements

Describes the requirements that a project needs to meet for its submission to be successful when assessed by the Assessors.

All projects must meet the Documentation Requirements to be awarded the credit points. Please note that the Assessors are not in a position to make assumptions on this matter, but must make a decision based on evidence provided. All documentation must therefore be provided to the letter of the Technical Manual. In addition, the Assessors reserve the right to request additional documentation in order to clarify any credit point.

Each credit has a submission checklist that lists the documentation requirements for the assessment of a Design and an As Built rating. All evidence collated must meet requirements set out in the 'Design Rating' or 'As Built Rating' documentation section of each credit in the Technical Manual. Note that each project should submit documentation relevant to Design or As Built, not both, depending upon which certification is being pursued.

Additional Guidance

This section contains additional information which is applicable to some projects. All information in Additional Guidance is mandatory. The Assessors reserve the right to determine whether or not the project needs to meet the requirements of this section.

Background

Explains why the issue in the credit is important, with relevant information and statistics; it also explains how the issue is pertinent to the type of project addressed by the tool.

References & Further Information

All credits within the Green Star SA rating tools are based on research; some of this research is provided as reference material in this section.

Technical Manual & Submission Guidance

LIST OF AREAS

Gross Floor Area (GFA)

The total floor area of all parts of a building that are permanently covered and can be protected from the elements but excluding car parking areas, measured at each covered floor level over the external walls to the external finished surface. For the purposes of the Green Star SA submission, Gross Floor Area must be calculated as the building Construction Area, less the area of car parking, as per Section 4.2.1 of the SAPOA publication '*Method for Measuring Floor Areas in Buildings*¹'. Gross floor area should be defined and used consistently throughout the Green Star SA submission.

Occupied Space (OS)

Areas that are predominantly:

- Work spaces (e.g. cellular offices, open plan offices, meeting rooms, food preparation areas, laboratories, consulting rooms, workshops - small scale and high density it work spaces);
- Large event spaces (e.g. dry sports halls, swimming pool areas, halls, arts theatres, libraries, assembly areas, sales areas – general, sales areas – chilled, performance areas (stage), check in areas, baggage reclaim areas, security check areas, fitness suites, gyms, fitness studios and ice rinks);
- Common areas (e.g. receptions, waiting rooms, eating/drinking areas, laundries, common rooms/staff rooms/lounges, public circulation areas, foyers and lobbies); and
- Learning spaces (e.g. classrooms and lecture rooms) are all expected to form part of the Occupied Space.

Most corridors are to be excluded from the calculation of Occupied space. Where corridors are exclusively used for transit between spaces (i.e. do not act as a foyer, lounge, waiting space, or reception), and where these corridors are bound in both sides by a wall these are to be excluded. Where a corridor is part of a shared space, this corridor, or section of a corridor, cannot be excluded and is considered part of the adjacent space.

Occupied space also excludes enclosed fire stairs, storage areas, toilets, tea kitchens, changing facilities, bathrooms, display areas, IT equipment rooms and plant-rooms.

See Space Type Definitions for a complete list of space types and their definitions.

Nominated Area (NA)

A credit specific dynamic area definition used to delineate the area that is relevant to individual credits. Refer to each credit and the modelling protocol guide for the credit-specific definition of the Nominated Area.

¹ *Method for Measuring Floor Areas in Buildings, South African Property Owners Association (SAPOA), 2005.*

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SPACE TYPE DEFINITIONS

The following provides an overview of the space types and their definitions² applicable to Public and Education Buildings. All areas within the building will have one of the following space types associated to it and must be used consistently throughout the credits.

Common Public Building Spaces

- Cellular office - Enclosed office space, commonly of low density.
- Changing facilities - An area used for changing, containing showers. This activity should be assigned to the shower area and all associated changing areas. For areas which can be used for changing but which do not contain showers, such as a cloak room/locker room, refer to the common room/staff room/lounge category.
- Circulation area (corridors and stairways) - non public – Circulation areas used for transient circulation purposes only, such as stairways and corridors. For public circulation areas where occupants may remain for extended periods of time e.g. gallery and exhibition circulation areas and break-out spaces, see ‘Public circulation Areas’ below.
- Common room/staff room/lounge - An area for relaxing, taking breaks or meeting in a non work capacity For areas which are occupied predominantly 5 days a week.
- Eating/drinking area - An area specifically designed for eating and drinking. For areas where food and drink may be consumed but where this is not the specific function of the area, use “common/staff room” and for areas with transient occupancy, use “tea making”.
- Food preparation area - An area where food is prepared.
- Hall/lecture theatre/assembly area - An area which can accommodate a large number of seated people.
- High density IT work space - High density desk based work space with correspondingly dense IT.
- IT equipment - An area dedicated to IT equipment such as a printers, faxes and copiers with transient occupancy.
- Meeting room - An area specifically used for people to have meetings, not for everyday desk working. For everyday desk working areas refer to the appropriate office category.
- Open plan office - Shared office space commonly of higher density than a cellular office.

² Space types and definitions are derived from the UK Dept. of Communities and Local Government's National Calculation Methodology (NCM) Activity Databases.

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- Plant room - Areas containing the main HVAC equipment for the building eg: boilers/air conditioning plant.
- Public circulation areas - All public circulation areas. For non public circulation spaces use "Circulation areas (corridors and stairways) - non public"
- Reception - The area in a building which is used for public entry from the outside or other building areas.
- Storage area - Areas for un-chilled storage with low transient occupancy.
- Tea Kitchen - Areas used for making hot drinks, often containing a refrigerator with transient occupancy. For larger areas containing seating and a small hot drinks making area refer to "Common room/staff room".
- Toilet - Any toilet areas. If toilets are subsidiary to changing/shower activities refer to "changing facilities"

Specialised Public Building Spaces:

- Baggage Reclaim area - The area within an airport where baggage is reclaimed from conveyor belts.
- Cell (police/prison) - A room which accommodates one or more prisoners.
- Check in area - Area within an airport where travellers check in for their flight, containing check in desks and conveyor belt.
- Classroom - All teaching areas other than for science or practical classes, for which refer to "Laboratory" or "Workshop - small scale".
- Consulting room - An area used for medical consultation.
- Display area - An area where display lighting is used to illuminate items.
- Dry sports hall - An area where indoor sports can be played.
- Fitness Studio - An area used for exercising/dance, usually with high person density but with no machines.
- Fitness suite/gym - An area used for exercise containing machines.
- Ice rink - An area which contains an ice rink.
- Laboratory - A facility that provides controlled conditions in which scientific research, experiments, and measurement may be performed.
- Laundry - An area used only for washing and/or drying clothes using washing machines and/or tumble dryers. This is not for where there is an individual washing machines within another space (eg a food preparation area).
- Performance area (stage) - For stages with dedicated lighting and equipment in addition to that within the remainder of the space. For stages within other activity areas

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- which do not have specific lighting or additional electrical equipment, do not define these as separate spaces.
- Sales area – chilled - A storage area containing items which need to be chilled. The area itself can be conditioned.
 - Sales area – general All Sales areas which do not have a large concentration of fridges/freezers or electrical appliances.
 - Security check area - For the security areas of an airport containing equipment such as X-ray machines.
 - Storage area – chilled - A storage area containing items which need to be chilled. The area itself can be conditioned.
 - Storage area - cold room (<0degC) - A storage area kept at below 0degC. Cooling load is assumed to be a process load and therefore not included in the calculation.
 - Swimming pool - The area in which a swimming pool is contained. This activity should be used for the whole pool hall.
 - Workshop - small scale - An area for sedentary-light practical work. Often containing some machinery.

SUBMISSION GENERAL SECTION

In addition to the documentation which must be submitted as per the 'Documentation Requirements' stipulated for each credit, the project' Green Star SA submissions (both Round 1 and Round 2) must contain a 'General Section' containing the following information:

Project overview document which provides a brief summary and description of the project. This need not be detailed, however should contain enough information to allow the Assessors to become familiar with the project prior to the assessment (a project brief would suffice).

Project program document clearly demonstrating the key dates of 'Schematic Design', 'Design Development', 'Contract Documentation', Tender, Construction Commencement and Practical Completion.

Architectural drawings clearly issued 'For Tender', 'For Construction' or 'As Built' (as appropriate), including the following;

- Plan drawings of all levels (typical drawings may be submitted), marked-up to show the Occupied Space for each level;
- Elevation drawings of all facades;
- Section drawings (where applicable)

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Building services drawings clearly issued 'For Tender', 'For Construction' or 'As Built' (as appropriate), including the following;

- Mechanical services drawings;
- Electrical services drawings; and,
- Wet services drawings.

Where a building service is included on the architectural drawings (above) it is not necessary to re-submit.

Site documentation comprising of either;

- A site plan identifying the existing building(s) or structure(s) (if present), the extent of both the development footprint and the boundary of the project site (for the purposes of the Green Star SA submission) and the erf size;

OR

- An aerial photograph identifying the existing building(s) or structure(s) (if present), the extent of both the development footprint and boundary of the project site (for the purposes of the Green Star SA submission) and the erf size.

Area schedule identifying the development area parameters, including the site area, development footprint area, landscape area, building footprint area, Gross Floor Area (GFA), and Occupied space. This information must correlate with that entered into the 'Building Input' page of the Green Star SA – Public & Education Building v1 rating tool spreadsheet.

Rating tool spreadsheet in the form of the spreadsheet file, with all credits and calculators completed (as applicable).

GBCSA correspondence between the GBCSA and the Project Team pertaining to general queries, Eligibility Rulings, Technical Clarifications (TCs) or Credit Interpretation Requests (CIRs).

Applicant Declaration & Pre-Submission Checklist as contained in the rating tool spreadsheet, completed and signed where appropriate.

Project Teams must ensure that all documentation above is included in the 'General' section of the submission. Submissions lacking this information will not pass the pre-assessment submission quality review and will be returned to the project team.

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STANDARD DOCUMENTATION TYPES - GUIDANCE

To provide further guidance pertaining to the compilation of Green Star SA submissions, key requirements of the most common 'Documentation Requirements' are provided below.

The intent of this guidance is to communicate the intent of the documentation, the core characteristics of the specific piece of documentation and tips to assist Assessors in assessing the documentation. In general, high-quality submissions with respect to the guidance below will achieve a greater number of points within Round 1 than a poor quality submission.

Characteristics of high-quality submissions include;

- Diligent selection of the required documentation and the avoidance of excessive or superfluous or un-solicited information (i.e. "less is more");
- Documentation is concise and well defined;
- Effort has been made to lead the Assessors to key pieces of information (e.g. through the use of highlights, clouds, arrows etc.); and,
- Information is consistent across the submission (e.g. areas, occupancy, servicing strategies).

The following guidance is provided for the most common pieces of documentation only. Project Teams should use their judgement in applying the same principles to other pieces of documentation in accordance with the Green Star SA – Public & Education Building Technical Manual.

Calculator extract

Description & This is simply a print-off of the completed applicable Green Star SA calculator embedded with the rating tool spreadsheet. The intent is to demonstrate the data entered into the calculator and the resulting calculator input.

Key Requirements: The data entered into the calculator must be consistent with the information demonstrated in other 'supporting documentation'. Where data entered into the calculator cannot be confirmed by the Assessors within supporting documentation, the point(s) will not be awarded.

Quality Tips: Key information MUST be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: Print options for calculators are pre-set within the rating tool.

Extract(s) from Commissioning Report(s)

Description & The Commissioning Report(s) are the reports prepared that summarise the commissioning process, confirming that commissioning has been completed and indicate that the system/service/equipment has been commissioned and operates as intended by the design. As Green Star SA is documentation based, this document is the only method of communicating to the Assessors that the design is functioning as

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intended.

Key Requirements: It is essential that the Commissioning Report covers ALL systems/services/equipment referenced with the submission. For example, if an energy recovery system is claimed in Ene-1 to improve energy efficiency and reduce GHG emissions, it must be clearly demonstrated within the Commissioning Report that the energy recovery system has been commissioned and operates as intended. Where confirmation of commissioning cannot be sufficiently demonstrated within the extract(s) provided from the Commissioning Report, point(s) cannot be awarded.

Quality Tips: The Commissioning Report(s) cover page and contents page should be provided with extract(s) for each applicable system/service/equipment as necessary. Key information MUST be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors. Excessive information must be avoided; raw commissioning data must not be provided.

Indicative Page Limit: The pages required will be dependent on the number of services included within the scope of Green Star SA (i.e. a more complex building will require more services to be covered than a simple one).

Extract(s) from Contract

Description & Intent: A contract represents a legal agreement between two (or more) parties. For the purpose of Green Star SA, a contract outlines the legal commitment by a party to satisfy a Green Star SA requirement. The intent of this documentation requirement is to demonstrate the legal obligation to the Assessors with regards to a particular Green Star SA requirement (e.g. the Contractor must recycle a stated percentage of demolition & construction waste).

Key Requirements: The contract must be valid and legally binding. As such it must be signed by representatives of the applicable parties.

Quality Tips: Where the Contract is a large document, extract(s) should include the cover page, contents, the specific Green Star SA requirements and the page where the parties have signed. The full contract should NOT be submitted, only the necessary extracts. Key information MUST be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: Regardless of the size of project, all extract(s) necessary to demonstrate the contractual agreement should typically be less than 5 pages (\pm 2 pages).

Extract(s) from tender documentation

Description & Tender documentation is documentation that is prepared for and

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Intent: submitted to a contractor, at the tender stage of a project, in order for a contractor to price a building development. Tender documentation typically consists of both drawings and specifications. For the purposes of Green Star SA, tender documentation demonstrates the intent to procure a green building to the Assessors. This intent may be demonstrated through drawing(s) and/or extract(s) of specification(s). The GBCSA acknowledges that sufficient information to demonstrate the procurement of a design initiative may be provided on a drawing or within a specification.

For Design submissions, Construction drawings or specifications are deemed as equivalent to tender documentation provided they contain all information requested in the relevant credit. Also, Site Instructions and Contract Instructions are acceptable provided that they provide all information requested in the specific credit, and are supported by documentary evidence of the acceptance of such an instruction by the relevant party.

Key Requirements: Regardless of the type of tender documentation submitted, the documentation MUST demonstrate the necessary information as required by the applicable Green Star SA Technical Manual. Should an extract(s) from tender documentation fail to demonstrate information deemed required by the applicable Green Star SA Technical Manual, point(s) will not be awarded.

Quality Tips: Key information MUST be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: The number of drawings/pages will be dependent on the size and complexity of the project, however only extracts from specifications should be submitted. I.e. if the portion of the specification which shows compliance as per the Technical Manual is two pages long, then only the two page extract should be submitted and not the full specification.

Extract(s) from Quantity Surveyor report

Description & Intent: The Quantity Surveyor report is a report that outlines all the necessary information with regards to the project in terms of quantity and cost. A specific report may or may not be prepared which addresses the Green Star SA related issues only. The intent of this report is to communicate quantities, costs and/or calculations completed to demonstrate compliance with credit criteria. Calculations may be completed by the Quantity Surveyor, or the information confirmed by the Quantity Surveyor may be used by suitably qualified professionals or relevant project team members to complete calculations.

Key Requirements: The Quantity Surveyor report must clearly identify the necessary information as requested within the Green Star SA Technical Manual for

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the specific credit.

Quality Tips: Key information MUST be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: The length of the report extract required will vary depending on the project as well as the specific credit, but should typically be less than 5 pages long (± 2 pages).

Manufacturer product datasheet(s)

Description Intent: & Manufacturer product datasheet(s) are information sheets prepared by the product manufacturer to communicate essential information about a product or material. The intent of this document is to demonstrate key data which may indicate, or contribute to, compliance with Green Star SA requirements. The manufacturer product datasheet(s) must be official documents from the manufacturer and MUST NOT be screen captures from websites, sales/marketing brochures etc. Written confirmation from the manufacturer on official company letterhead can be considered to constitute a product datasheet.

Key Requirements: Where a manufacturer product datasheet is needed to confirm a specific characteristic, the datasheet must also demonstrate the method/standards used to derive the data (e.g. VOC content of paints, formaldehyde emissions from composite wood etc.).

Quality Tips: Key information MUST be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: Manufacturer product datasheet(s) should be no more than 2 pages (± 2 pages).

Short report

Description Intent: & For the purposes of Green Star SA, short reports are used to communicate key aspects of the design to the Assessors and to demonstrate compliance with Credit Criteria. Short reports should be viewed as a “summary” or “introduction” of the design initiative and provide the Assessor with an overview of how the project has met the specific Credit Criteria. After reading a short report, an Assessor should be fully aware of how the project has met the Credit Criteria, with the necessary calculations or summary provided.

Key Requirements: Short reports must reference the supporting documentation and reflect the design. They provide a key link between the Assessors and the supporting documentation. All data referenced within the short report must be evident in the supporting documentation. It is important to emphasise that the short reports themselves DO NOT form part of tender documentation or as built documentation; they merely communicate this information and demonstrate calculations (where

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necessary).

Quality Tips: The short report must be consistent with the supporting documentation. Key information **MUST** be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: Short reports should be no more than 5 pages (± 2 pages).

Statement of confirmation

Description & Intent: A statement of confirmation communicates the confirmation of a particular aspect of the project to the Assessors. The intent of this documentation is obtain a legally binding confirmation.

Key Requirements: It must be demonstrated who is confirming the information and it must be clear what information is being confirmed. Statement of confirmation **MUST** be signed by the party confirming the information.

Quality Tips: Statement of confirmation must be signed by the relevant party and key information highlighted.

Indicative Page Limit: Statement of confirmation should be no more than 2 pages (± 1 page).

Tender / As Built drawing(s)

Description & Intent: Tender / Construction drawings are documentation that is prepared for and submitted to a contractor, at the tender stage of a project, in order for a contractor to price a building development or construct a building development. Drawings provide geometrical/spatial information to the Contractor. It is important to note that these drawings are formal contract documents.

As Built drawings are documents that are prepared by the contractor, or by the professional team informed by the contractor, and show the details of the final constructed development. As Built drawings must include any variations from the original design which have taken place during construction.

Key Requirements: The drawings must be clearly marked "For Tender" or "For Construction" (Design rating) or "As Installed" or "As Built" (As Built rating).

Quality Tips: Key information **MUST** be highlighted (e.g. through the use of highlights, clouds, arrows etc.) to guide Assessors.

Indicative Page Limit: The number of drawings/pages will be dependent on the size and complexity of the project, but only the drawings needed to show the specific items requested by the credit must be submitted.

Credit Summary Table

POINTS
AVAILABLE

CATEGORY	TITLE	CREDIT NO.	POINTS AVAILABLE
Management			
	Green Star SA Accredited Professional	Man - 1	2
	Commissioning	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
	Building Management Systems	Man - 10	1
	Learning Resources	Man - 13	1
	Life Cycle Costing	Man - 14	1
	Maintainability	Man - 15	1
	TOTAL		17
Indoor Environment Quality			
	Ventilation	IEQ - 1	2
	Carbon Dioxide Monitoring and Control	IEQ - 3	1
	Daylight	IEQ - 4	3
	Daylight Glare Control	IEQ - 5	1
	Electric Lighting Levels	IEQ - 7	1
	External Views	IEQ - 8	2
	Thermal Comfort	IEQ - 9	2
	Hazardous Materials	IEQ - 11	1
	Internal Noise Levels	IEQ - 12	3
	Volatile Organic Compounds	IEQ - 13	3
	Formaldehyde Minimisation	IEQ - 14	1
	Mould Prevention	IEQ - 15	1
	Dedicated Exhaust Riser	IEQ - 16	1
	Stairs	IEQ - 23	1
	TOTAL		23
Energy			
	Conditional Requirement	Ene - 0	0
	Greenhouse Gas Emissions	Ene - 1	20
	Energy Sub-metering	Ene - 2	3
	Lighting Zoning	Ene - 4	2
	Maximum Electrical Demand Reduction	Ene - 5	3
	Unoccupied Spaces	Ene - 11	2
	TOTAL		30

Credit Summary TablePOINTS
AVAILABLE

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
	Vehicle Operating Emissions	Tra – 7	2
		TOTAL	16
Water			
	Potable Water	Wat – 1	12
	Water Sub-Metering	Wat – 2	3
		TOTAL	15
Materials			
	Recycling Waste Storage	Mat – 1	3
	Building Reuse	Mat – 2	5
	Recycled Content and Re-used Materials	Mat – 3	2
	Concrete	Mat – 5	3
	Steel	Mat – 6	3
	Timber	Mat – 8	2
	Design for Disassembly	Mat – 9	1
	Dematerialisation	Mat – 10	1
	Local Sourcing	Mat – 11	2
	Masonry	Mat – 13	2
		TOTAL	24
Land Use & Ecology			
	Conditional Requirement	Eco – 0	0
	Topsoil	Eco – 1	1
	Reuse of Land	Eco – 2	2
	Reclaimed Contaminated Land	Eco – 3	2
	Change of Ecological Value	Eco – 4	4
	Urban Heat Island	Eco – 5	2
	Community Facilities	Eco – 8	1
		TOTAL	12

Credit Summary TablePOINTS
AVAILABLE

Emissions		
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
Atmospheric Deterioration Avoidance	Emi - 11	6
	TOTAL	17
Innovation		
Innovative Strategies & Technologies	Inn-1	
Exceeding Green Star SA Benchmarks	Inn-2	5
Environmental Design Initiatives	Inn-3	
	TOTAL	5

Management

The credits within the Management Category promote the adoption of environmental principles from project inception, design and construction phases, to commissioning, tuning and operation of the building and its systems.

Management initiatives may include: engaging a professional with a thorough understanding of green building principles and Green Star SA; recycling demolition and construction waste; managing construction activities to minimise pollution and maximise soil and air quality protection; enhanced commissioning and tuning of building systems.

Green Star SA rating tools aim to recognise and reward building attributes that reduce the building's environmental impact throughout its lifecycle. Since much of a building's impact is attributed to the operational phase of its lifecycle, proper commissioning and tuning can ensure that all systems operate to their design potential. Personnel training, and ongoing information management, enable building users to contribute to the building's environmental performance.

Green Star SA rewards project teams for developing a comprehensive Building Users' Guide to inform the building owner, tenants and personnel of the environmental features in the building and the requirements for their maintenance. Additionally, Green Star SA makes recommendations on resource consumption.

In South Africa, construction and demolition waste accounts for at least 25% of all waste generated (Gauteng Provincial State of the Environment Report (SoER) June 2004) and in developed countries it is often as much as 40%. Implementation of appropriate strategies during the construction phase of a building can significantly reduce this figure.

The Management Category aims to highlight the importance of a holistic and thoroughly integrated design process.

Man-1 Green Star SA Accredited ProfessionalPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise the engagement of professionals who can assist the project team with the integration of Green Star SA aims and processes throughout design and construction phases.

CREDIT CRITERIA

Two points are awarded where:

- A member of the design team is a Green Star SA Accredited Professional and has;
 - Been engaged by the Building Owner to provide green building advice from the schematic design phase through to construction completion;
 - AND
 - Provided guidance to the project team regarding, or was responsible for, the Green Star SA documentation submission compilation.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Proof of accreditation 2. Statement of confirmation 	<ol style="list-style-type: none"> 1. Proof of accreditation 2. Statement of confirmation

Proof of accreditation must take the form of either:

- A copy of the nominated Green Star SA Accredited Professional's accreditation certificate;
- OR
- A printout of the relevant page of the online Green Star SA Accredited Professional Directory, found on the GBCSA website.

Statement of confirmation from the Building Owner in the form of signed correspondence, confirming the engagement/appointment of the Green Star SA Accredited Professional by;

- Detailing the date of engagement/appointment (i.e. dates from/to); and
- Describing their scope of works and confirming that they have provided guidance to the project team regarding, or were responsible for, the Green Star SA submission compilation.

ADDITIONAL GUIDANCE

To be deemed 'engaged', in line with the Aim of Credit, the Green Star SA Accredited Professional must contribute substantially to the project and the submission compilation.

Where the Green Star SA Accredited Professional's scope of works is outlined in a fee proposal provided to the Building Owner, upon which they are engaged, the fee proposal may be submitted to demonstrate the 'scope of works' aspect of the 'Statement of Confirmation', provided the fee proposal is referenced in the signed 'Statement of Confirmation', or the fee proposal itself is signed by the Building Owner.

Should the role of the Green Star SA Accredited Professional be fulfilled by different individuals throughout the project program, the evidence listed under Documentation Requirements must be submitted for each Accredited Professional. Where the 'Statement of Confirmation' makes reference to the company appointed for Accredited Professional services, and not the individual Accredited Professionals, a signed letter from the appointed company must be provided listing all individuals fulfilling the role of Accredited Professional on the specific project.

BACKGROUND

It is hoped that Green Star SA Accredited Professionals will be of assistance in informing and advising clients and fellow designers on environmentally sustainable solutions, promote integrated design approach, and generally leading projects to better environmental outcomes.

REFERENCES & FURTHER INFORMATION

Green Building Council of South Africa
<http://www.gbcsa.org.za>

Green Star SA Accredited Professional Database
<http://www.gbcsa.org.za>

Man-2 Commissioning

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise commissioning and handover initiatives that ensure all building services can operate to optimal design potential.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required to be performed for all applicable building services as defined in Table Man 2.1;
- AND
- The works outlined above are done in exact accordance with CIBSE Commissioning Codes. Alternatively, ASHRAE Guideline 1-1996 - The HVAC Commissioning Process can be used for the mechanical services (only).

An additional point is awarded where:

- The point above is achieved;
- AND
- The Design Team and Contractor transfer ‘Project Knowledge’ to the building Owner/Manager through the provision of the following:
 - Documented design intent;
 - As Built drawings (complete set);
 - Operations and Maintenance (O&M) Manual;
 - Commissioning Report(s), in accordance with the Additional Guidance; and
 - Training of building management staff, in accordance with the Additional Guidance.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation	1. Extract(s) from Commissioning Report(s) Where additional point claimed:

Man-2 CommissioningPOINTS
AVAILABLE**2**

3. Project program	2. Statement of confirmation (1) 3. Statement of confirmation (2)
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Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Identifying each system that is to be pre-commissioned, commissioned and monitored (with reference to Table Man 2.1);
- Identifying the parties responsible for the commissioning, and
- Identifying what commissioning process will be applied (with reference to Table 2.1)
- Describing the basic function and operation of the building services incorporated in the building, including initiatives intended to enhance energy efficiency, minimise greenhouse gas emissions, conserve water, and improve indoor environmental quality.

Extract(s) from tender documentation clearly demonstrating the contractual requirement that:

- For each relevant system that pre-commissioning, commissioning and quality monitoring are to be in exact accordance with CIBSE Commissioning Codes, or alternatively ASHRAE Guideline 1-1996 - The HVAC Commissioning Process for the mechanical services.

Additionally where additional point claimed:

- The Contractor provide the Building Owner with the following 'Project Knowledge' at development handover:
 - Design intent report;
 - As Built drawings (complete set);
 - Operations and Maintenance (O&M) Manual;
 - Commissioning Report(s); and
 - Training of building management staff.

Project program demonstrating the inclusion of a commissioning period, showing relevant key dates or milestones and allocated time.

Extract(s) from Commissioning Report(s) clearly demonstrating:

- That pre-commissioning, commissioning and quality monitoring were completed in exact accordance with CIBSE Commissioning Codes (or nominated commissioning where applicable as per table Man 2.1), or alternatively ASHRAE Guideline 1-1996 - The HVAC Commissioning Process for the mechanical services;
- Commissioning dates, records of all functional/commissioning testing undertaken, list any future seasonal testing, and include a written list of outstanding commissioning issues (if applicable);
- The outcomes and changes made to the systems as a result of the commissioning process, accounting for all of the recommendations; and
- Appended extracts of commissioning records for major plant and equipment (with reference to Table Man 2.1) as deemed appropriate by the relevant project team

Man-2 Commissioning

POINTS AVAILABLE **2**

members involved in the commissioning process and as referenced in the Commissioning Report.

Statement of confirmation (1) from the Building Owner in the form of signed correspondence, listing all documents provided and confirming that the 'Project Knowledge', as per the Credit Criteria, was received.

Statement of confirmation (2) from the Facility Manager or nearest equivalent for the building in the form of signed correspondence, confirming that training has been provided in accordance with the Additional Guidance.

ADDITIONAL GUIDANCE

Applicable building services and commissioning codes

Table Man 14.1 below shows which services are required to be addressed under the Man-2 credit, and also shows which ASHRAE / CIBSE documents are applicable to each in terms of the credit criteria. Where no suitable ASHRAE / CIBSE document is available, the project team's 'Nominated Commissioning' applies. Please note further guidance on 'Nominated Commissioning' given below this table.

Service / Sub-Service	Discipline	Man-2 Commissioning									
		Within Scope of Credit?	ASHRAE Guideline 1996	CIBSE Code M - Management	CIBSE Code A - Air Distribution	CIBSE Code B - Boilers	CIBSE Code C - Auto. Controls	CIBSE Code L - Lighting	CIBSE Code R - Refrigeration	CIBSE Code W - Water Distribution	* Nominated Commissioning
1 HVAC Services											
cooling plant		✓	✓	✓				✓			
heating plant		✓	✓	✓		✓		✓			
air distribution		✓	✓	✓	✓						
water distribution		✓	✓	✓					✓		
HVAC controls		✓	✓	✓			✓				
2 Electrical Services											
lighting (& controls) - interior		✓		✓			✓				
lighting (& controls) - exterior		✓		✓			✓				
electrical distribution (including controls)		✓		✓						✓	
generators (<100hr) - emergency		x									
generators (>100hr) - co/trigen, peak		✓		✓			✓			✓	
renewable energy systems		✓		✓						✓	

Service / Discipline	Man-2 Commissioning
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Man-2 Commissioning

POINTS AVAILABLE **2**

Sub-Service		Within Scope of Credit?	ASHRAE Guideline 1996	CIBSE Code M - Management	CIBSE Code A - Air Distribution	CIBSE Code B - Boilers	CIBSE Code C - Auto. Controls	CIBSE Code L - Lighting	CIBSE Code R - Refrigeration	CIBSE Code W - Water Distribution	* Nominated Commissioning
3	Vertical Transportation										
	lifts/escalators	✓		✓							✓
4	Wet Services										
	DHW systems - boilers	✓		✓		✓					
	DHW systems - heat pumps	✓		✓					✓		
	DHW systems - solar	✓		✓							✓
	DHW systems - direct electric	✓		✓							✓
	water distribution	✓		✓						✓	
	water recycling systems - black/grey/rain	✓		✓						✓	✓
	wet services controls	✓		✓			✓				
5	Fire Services										
	water distribution	✓		✓						✓	
	controls	✓		✓			✓				
6	ICT Services										
	electrical distribution	x									
	ICT controls	x									
	security	x									
7	Controls										
	BMS/BAS/DDC systems	✓		✓			✓				
	metering (energy/water)	✓		✓							✓
8	Miscellaneous										
	irrigation controls	✓		✓							✓
	irrigation system	✓		✓							✓

Table Man - 2.1: Building services to be commissioned and required codes

***Nominated Commissioning**

Where there is neither an applicable CIBSE Commissioning Code nor applicable ASHRAE Commissioning Guideline to the commissioning of systems, it is at the Project Teams' discretion as to the most appropriate commissioning methodology and process applicable to the equipment.

In this case, for a Design rating, the Project Team must demonstrate, that;

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required to be performed for the specific system, by providing the nominated commissioning methodology within the Contract Documentation; and,

Man-2 Commissioning

POINTS
AVAILABLE

2

- The activities required by the nominated commissioning methodology are included within the project timeline/programme.

For an As Built submission, the Project Team must demonstrate, that;

- The outcomes of the nominated commissioning methodology and system(s) commissioning have been included within the Commissioning Report.

Demonstrating the application of the CIBSE Commissioning Codes

To provide Project Teams with further guidance regarding the information which would be expected to be included within Commissioning Report(s) demonstrating the use and adherence to the CIBSE Commissioning Codes, this information, as per the Codes, may include, but is not limited to, the following;

- Particular and definitive commissioning specifications from the design engineer of each service/discipline setting out clearly what is expected of the commissioning specialist (independent or otherwise). This should include commissioning tolerances on all commissioning parameters and a clear description of how it is intended that the system should operate and the design parameters. The design engineer should also produce 'cause and effect' sheets showing how the design is intended to operate. Also, commissioning specification details of safety controls and interlocks to protect the equipment and personnel during the commissioning process;
- Requirements for witnessing including full details of tolerances applicable to all parameters;
- Commissioning program including specific period of time for client witnessing;
- Appropriate health and safety risk assessment and method statements for the tasks to be completed;
- Commissioning method statement for each system;
- Pre-commissioning checklists for each system;
- Commissioning checklists; and,
- Commissioning certification for each system countersigned by the design engineer, commissioning specialist (independent or otherwise) and the accepting authority (where relevant), and including the record sheets provided in each CIBSE code.

The above items have been determined from a review of the CIBSE Commissioning Codes identifying key issues to be addressed with regards to the correct documentation of a CIBSE Commissioning Code compliant commissioning process of building services.

This list is not exhaustive and it is expected that all Project Teams complete their own review of the CIBSE documents and synthesize the important information which they, in their professional opinion and experience, believe are important and represent an improvement from conventional commissioning practices in South Africa and demonstrate the use of the CIBSE Commissioning Codes.

Commissioning Reports

Commissioning Reports are intended to provide a concise overview of the entire commissioning process and outcomes for each discipline (as applicable). It is a summary document of the key findings and outcomes as indicated in the commissioning records. Complete sets of actual commissioning datasheets or commissioning records should not be submitted, however Project Teams are encouraged to submit extracts to support the commissioning report (i.e. for major plant and equipment only).

Man-2 Commissioning

POINTS
AVAILABLE

2

Onsite electrical generation systems

Onsite electrical generation systems which are provided for the explicit purpose of operation during emergency or network load-shedding periods, and operate for less than 100 hours per year under normal electricity network conditions (i.e. routine test operation runtime) are excluded from the scope of the Credit Criteria of Man-2 Commissioning Clauses.

Onsite electrical generation systems which are provided for the explicit purpose of project site load lopping or base-load energy generation (i.e. cogeneration or tri-generation), and operate for 100 hours or more under normal electricity network conditions, are included within the scope of the Credit Criteria of Man-2 Commissioning Clauses, however the GBCSA acknowledges that there is neither an applicable CIBSE Commissioning Code, nor is the ASHRAE Commissioning Guideline 1-1996 applicable, to the commissioning of on-site electrical generation systems. As such these documents are not applicable to this equipment and for such generation systems, it is at the Project Teams' discretion as to the most appropriate commissioning methodology and process applicable to the equipment.

This is specifically applicable to the generation equipment only (i.e. engine/turbine and alternator assembly). All other building services which interface with the generation system (e.g. automatic controls, water distribution systems, ventilation systems etc.) must be addressed as per the Credit Criteria and in line with table Man 2.1.

Training of building management staff

Training must be undertaken for each relevant system to ensure that the Building Managers and maintenance staff members have all the information and understanding needed to operate and maintain the commissioned features and systems of the building.

The training provided must include at a minimum:

- Information provided in the documented design intent (including energy/environmental features);
- Review of controls set up, programming, alarms and troubleshooting;
- Review of O&M Manuals;
- Where the second point in credit Man-15 Maintainability is claimed, review of Building Maintenance Guide;
- Building operation (start up, normal operation, unoccupied operation, seasonal changeover, and shutdown);
- Measures that can be taken to optimise energy efficiency;
- Occupational Health & Safety issues;
- Maintenance requirements and sourcing replacements; and
- Procedures for obtaining and addressing occupant satisfaction feedback.

For the purposes of a Green Star SA As Built submission, confirmation is required from the Facility Manager (or nearest equivalent for the building) that the training provided was comprehensive and addressed the minimum requirements above.

BACKGROUND

Transfer of building information at commissioning stage

Few buildings work as initially intended by their design teams. As responsibility passes from the Design Team to the Contractor to the Building Owner to the operation and maintenance team, there are significant opportunities for processes to go wrong, for misunderstandings, and for strategy to give way to practical expediency.

Man-2 Commissioning

POINTS
AVAILABLE

2

The successful transfer of building information at commissioning stage will allow:

- Building operators to understand in detail what they need to do to operate the facility and further tune it to continuously improve and respond to changes in circumstance;
- Maintenance personnel to understand how to service the particular systems, not only for reliable operations, but also for energy efficiency;
- Occupants to understand the limits within which they must function to maintain the design performance; and
- Future modifiers to understand the design basis for the building and the systems so that these are not compromised by any changes.

Chartered Institution of Building Services Engineers (CIBSE) Commissioning Codes

Commissioning is defined by CIBSE as the advancement of an installation from the state of static completion to full working order to the specified requirements. It includes the setting to work of an installation, the regulation of the system and the fine-tuning of the system.

Commissioning of buildings and building services is vitally important to the safe and energy efficient operation of buildings but it is not always carried out – or carried out systematically. The CIBSE Commissioning Codes set out clearly and systematically the steps required to commission building services in a proper and timely manner and will make a significant contribution to achieving properly commissioned buildings. This key step in the construction of a building enables the systems to operate as they were designed to do.

CIBSE Commissioning Code M: Commissioning Management

This code provides an overview of the management arrangements required to ensure that building services systems are commissioned to meet the objectives of the U.K Building Regulations. It is applicable to the management of commissioning of all building services systems, including new-build and retrofit applications. Commissioning of specific systems is addressed by the following:

- CIBSE Commissioning Code A: Air distribution systems
- CIBSE Commissioning Code B: Boilers
- CIBSE Commissioning Code C: Automatic Controls
- CIBSE Commissioning Code L: Lighting
- CIBSE Commissioning Code R: Refrigerating systems
- CIBSE Commissioning Code W: Water distribution systems

ASHRAE Guideline 1-1996 - The HVAC Commissioning Process

The purpose of this guideline is to describe the commissioning process that will ensure heating, ventilating, and air-conditioning (HVAC) systems perform in conformity with design intent. The procedures, methods, and Documentation Requirements in this guideline cover each phase of the commissioning process for all types and sizes of HVAC systems, from pre-design through final acceptance and post-occupancy, including changes in building and occupancy requirements after initial occupancy. This guideline provides procedures for the preparation of documentation of:

- Owner's assumptions and requirements;
- Design intent, Basis of Design, and expected performance;
- Verification and functional performance testing; and
- Operation and maintenance criteria.

Man-2 Commissioning

POINTS
AVAILABLE**2**

This guideline specifically details the process for:

- Conducting verification and functional performance testing and
- Maintaining system performance to meet the current design intent after initial occupancy.

This guideline also includes a program for training of operation and maintenance personnel.

REFERENCES & FURTHER INFORMATION

American Society of Heating, Refrigeration and Air-Conditioning Engineers
<http://www.ashrae.org>

Building Commissioning Association
<http://www.bcxa.org>

The Building Services Research and Information Association
<http://www.bsria.org>

California Commissioning Collaborative
<http://www.cacx.org>

Chartered Institution of Building Services Engineers
<http://www.cibse.org>

Commissioning Specialists Association
<http://www.csa.org.uk>

Office of Energy Efficiency and Renewable Energy Federal Management Program
<http://www.eere.energy.gov>

Man-3 Building Tuning

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise commissioning initiatives that ensure optimum occupant comfort as well as energy and water efficient services performance throughout the year.

CREDIT CRITERIA

Two points are awarded where:

- At practical completion the Building Owner implements a comprehensive building tuning program that;
 - Continues for a period of no less than 12 months after commencement;
 - Involves a relevant member of the Design Team;
 - Includes the monitoring and tuning of all applicable building services as defined in Table Man-3.1; and,
 - Requires monthly monitoring and the outcomes are reported to the Building Owner quarterly to allow corrective action to be taken;

AND

- At 12 months after practical completion;
 - A full re-commissioning service is undertaken; and,
 - A 'Building Tuning Report' on the outcomes of the tuning program is provided to both the Building Owner and the Design Team.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Extract(s) from tender documentation 2. Project program 	<ol style="list-style-type: none"> 1. Extract(s) from contract (1) 2. Extract(s) from contract (2)

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- A minimum 12-month tuning program which includes no less than monthly monitoring, quarterly reviews and reporting, and clearly stipulates the scope of works as defined in the Additional Guidance for this credit;
- A full re-commissioning service carried out 12 months after practical completion;
- A 'Building Tuning Report' generated for the Building Owner; and,
- Listing the roles and responsibilities of the various parties to be involved during the building tuning program.

Man-3 Building TuningPOINTS
AVAILABLE**2**

Project program demonstrating the inclusion of the building tuning program showing milestones or specifying dates for the monitoring periods, quarterly reporting and re-commissioning works.

Extract(s) from contract (1) signed by the Building Owner and Contractor, clearly demonstrating the contractual requirement for:

- The scope of works, program, milestones/dates, and deliverables of the building tuning program;
- A 'Building Tuning Report' be generated by the building tuning team once the building tuning program has been finalised.

Extract(s) from contract (2) signed by the Building Owner and relevant design team member, clearly demonstrating the contractual requirement for;

- The scope of engagement during the building tuning program; and
- That the design team member is required to review the Building Tuning Report as generated by the building tuning team.

ADDITIONAL GUIDANCE**Building tuning team**

The Building Tuning Team consists of all the contractors committed to the tuning of all the individual building services. It may also include the Independent Commissioning Agent, and/or design team members, if appropriate.

Scope of services included in Man 3 credit

Table Man 3.1 below shows which services are within the scope of the Man-3 credit.

Service / Discipline Sub-Service		Man-3 Building Tuning
		Within Scope of Credit?
1	HVAC Services	
	cooling plant	✓
	heating plant	✓
	air distribution	✓
	water distribution	✓
	HVAC controls	✓
2	Electrical Services	
	lighting (& controls) – interior	✓
	lighting (& controls) - exterior	✓
	electrical distribution (including controls)	✓
	generators (<100hr) - emergency	✗
	generators (>100hr) - co/trigen, peak	✓
	renewable energy systems	✓

Man-3 Building TuningPOINTS
AVAILABLE**2**

Service / Discipline Sub-Service		Man-3 Building Tuning
		Within Scope of Credit?
3	Vertical Transportation	
	lifts/escalators	✓
4	Wet Services	
	DHW systems - boilers	✓
	DHW systems - heat pumps	✓
	DHW systems - solar	✓
	DHW systems - direct electric	✓
	water distribution	x
	water recycling systems - black/grey/rain	✓
	wet services controls	✓
5	Fire Services	
	water distribution	x
	controls	x
6	ICT Services	
	electrical distribution	x
	ICT controls	x
	security	x
7	Controls	
	BMS/BAS/DDC systems	✓
	metering (energy/water)	✓
8	Miscellaneous	
	irrigation controls	✓
	irrigation system	✓

Table Man 3.1: Building services within scope of Man 3 credit

Onsite electrical generation systems which are provided for the explicit purpose of operation during emergency or network load-shedding periods, and operate for less than 100 hours per year under normal electricity network conditions (i.e. routine test operation runtime) are excluded from the scope of the Credit Criteria of Man-3 Building Tuning.

Onsite electrical generation systems which are provided for the explicit purpose of project site load lopping or base-load energy generation (i.e. cogeneration or tri-generation), and operate for 100 hours or more under normal electricity network conditions, are included within the scope of the Credit Criteria of Man-3 Building Tuning.

Building tuning contractsBuilding Tuning Contract with Contractor:

Where the requirements for building tuning as stipulated in the Green Star SA – PEB v1 Technical Manual are contained within the overall contract signed by the contractor (or in

Man-3 Building Tuning

POINTS
AVAILABLE

2

specifications referenced within the contract, it is acceptable to submit a signed copy of this contract referencing areas where the requirements for building tuning are defined. i.e. a separate building tuning contract need not be drawn up if all requirements are contained in the overall building contract.

The building tuning contract between the Building Owner and Contractor must clearly stipulate the requirement for the following scope of works:

- Verification that systems are performing to their design potential during all variations in climate and occupancy;
- Optimisation of time schedules to best match occupant needs and system performance; and
- Alignment of the systems' operation to the attributes of the built space they serve.

Building Tuning Contract with Relevant Design Team Member:

Should the signed letter of appointment with the relevant design team members contain the requirement to review the Building Tuning Report as per the Green Star SA – PEB v1 Technical Manual, it is acceptable to include this signed appointment letter in place of a dedicated Building Tuning Contract.

The intention in both cases above is simply to have a contractual agreement that the building tuning requirements are required to be implemented by the contractor and that the relevant design team members are required to review the building tuning report produced. This contractual agreement need not be in a dedicated building tuning contract, but can be contained within a greater contract document.

Re-commissioning

Re-commissioning refers to the process of undertaking a review of all systems to the scope of the initial pre-occupancy commissioning. Re-commissioning is intended to incorporate any modifications identified as necessary or beneficial during the building tuning period and to improve the performance of building operation. The term does not refer to the re-setting of the systems to the initial commissioning settings.

It is likely that some Green Star SA projects will not be in a position to commence the 12 month building tuning period immediately upon practical completion for reasons which may limit the beneficial outcomes intended (e.g. speculative development with low occupancy levels etc.). It is therefore acceptable that the 12 month building tuning period commences at a date after the Green Star SA project's practical completion date. However the 12 month building tuning period must commence within 2 years of the practical completion of the Green Star SA project (in acknowledgement of Green Star SA 'Eligibility Criterion 4: Timing of Certification').

BACKGROUND

Commissioning has traditionally been undertaken in a limited period of time at the end of the project, often with little budget remaining. It is done with the ambient climatic conditions at the time and usually with the building unoccupied.

It is now commonly accepted that a period of troubleshooting or 'sea trials' is required after the initial handover and occupation in order for buildings to achieve maximum energy performance. This must include post-occupancy evaluation, preferably involving the design

Man-3 Building Tuning

POINTS
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team to give useful feedback to all stakeholders. Building tuning also aims to ensure that the systems are functioning correctly during all weather seasons, and is particularly valuable in buildings which are intended to operate in 'mixed mode' or with more sophisticated or complicated control systems.

REFERENCES & FURTHER INFORMATION

Refer to Man-2 Commissioning for commissioning references.

Chartered Institution of Building Services Engineers, Guide F - Energy Efficiency in Buildings, 2004

<http://www.cibse.org>

Chartered Institution of Building Services Engineers, Guide M - Maintenance Engineering and Management, 2008

<http://www.cibse.org>

The Building Services Research and Information Association, Feedback for Better Building Services Design (AG 21/98), 1998

<http://www.bsria.co.uk>

Man-4 Independent Commissioning AgentPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the appointment of an Independent Commissioning Agent from project design through to handover.

CREDIT CRITERIA

One point is awarded where:

- A suitably qualified or experienced person, not directly involved in the day-to-day project design or implementation, is appointed as 'Independent Commissioning Agent' (ICA) by the Building Owner to:
 - Provide independent advice on commissioning issues to the Building Owner and the Design Team;
 - Produce input within the design phase covering commissioning of building services;
 - Produce an appropriate guide to commissioning at detailed design stage;
 - Introduce commissioning standards and strategies, and monitor and verify the commissioning of all building systems;
 - Produce a Commissioning Report summarising the commissioning, major findings and recommendations of the commissioning process; and,
 - Where applicable, be involved in the building tuning program.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. ICA curriculum vitae 2. Extract(s) from Commissioning Guide 	<ol style="list-style-type: none"> 1. ICA curriculum vitae 2. Extract(s) from Commissioning Report(s)

ICA curriculum vitae demonstrating qualifications and experience relevant to the project as detailed in the Additional Guidance section.

Extract(s) from Commissioning Guide prepared by the Independent Commissioning Agent, clearly demonstrating:

- The contents of the guide, date of issue and author;
- Identifying and describing each building service system that is to be commissioned;
- Providing for each applicable building services system;
 - An outline of the applicable commissioning standard and a brief summary of how it is to be applied;

Man-4 Independent Commissioning AgentPOINTS
AVAILABLE**1**

- Nominating the roles and responsibilities for the commissioning process, and specifying the involved parties;
- An allocation of time to complete the commissioning process;

Extract(s) from Commissioning Report(s) prepared by the Independent Commissioning Agent clearly demonstrating:

- Commissioning dates, records of all functional/commissioning testing undertaken, list any future seasonal testing, and include a written list of outstanding commissioning issues (if applicable);
- The outcomes and changes made to the systems as a result of the commissioning process, accounting for all of the recommendations; and
- Appended extracts of commissioning records for major plant and equipment (including but not limited to chillers, boilers, heat pumps, air handling units, water treatment/recycling systems and onsite generation systems) as deemed appropriate by the Independent Commissioning Agent..

ADDITIONAL GUIDANCE

The role of the Independent Commissioning Agent can be fulfilled by multiple professionals with different expertise, provided that all Credit Criteria are met, including involvement of the Independent Commissioning Agent(s) from the beginning of schematic design, for each individual agent.

The Independent Commissioning Agent must meet the following criteria:

- Be suitably qualified or experienced (i.e. be a registered professional engineer or qualified technician with relevant, documented working knowledge of either designing or commissioning the type of HVAC, hydraulic, electrical and fire suppression systems used in the project);
- Not be directly involved in the day-to-day project design or implementation;
- Be an objective advocate of the building owner, with the following responsibilities:
 - Be engaged by, and report directly to, the building owner;
 - Provide maintenance and commissioning advice to the project team from the beginning of schematic design through practical completion of the project, interacting with the team throughout all stages of construction;
 - Be involved, at a minimum, at the beginning of each major stage in the documentation of the project (schematic design, design development, construction documentation, tendering and specifications) at the beginning of construction and regularly involved during the construction phase of the project;
 - Introduce commissioning standards and strategies early in the design process;
 - Review the 'Design Intent' as well as preliminary working drawings;
 - Review the commissioning process that covers the following wherever present: air distribution systems, boilers, automatic controls, lighting, refrigeration systems and water distribution systems;
 - Coordinate with the building owner, design team and contractor throughout the commissioning, testing and adjustment phases;
 - Observe, review and approve results of all testing undertaken by the contractor;

Man-4 Independent Commissioning Agent

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- Monitor and verify the commissioning of all systems;
- Prepare a Commissioning Report including recommendations to the Building Owner on the performance of commissioned building systems; and
- Be involved in the building tuning program and the final re-commissioning of the building.

Design phase input from the ICA could take the form of short reports, notes or comments marked-up on drawings, or guidance provided within meetings as evidenced by meeting minutes.

Commissioning Reports

Commissioning Reports are intended to provide a concise overview of the entire commissioning process and outcomes for each discipline (as applicable). It is a summary document of the key findings and outcomes as indicated in the commissioning records. Complete sets of actual commissioning datasheets or commissioning records should not be submitted, however Project Teams are encouraged to submit extracts to support the commissioning report (i.e. for major plant and equipment only).

BACKGROUND

Maintenance and commissioning are all too often given a low priority during the early design stages, particularly since the design team may have little practical experience of the issues involved.

If safe access for maintenance of plant is not provided, then plant will not be maintained and will not operate efficiently. For example, it is unreasonable to expect maintenance personnel to climb ladders while carrying heavy tools or bulky filters. Similarly, access doors into plant rooms must be wide enough to allow removal and replacement of equipment, and so on.

An Independent Commissioning Agent provides an extra set of eyes for the Project Team and may be more likely than the Design Team and Contractor to be able to highlight any problems and make sure that correctional measures are taken. Independent Commissioning Agents have become a common requirement for commissioning work internationally.

By involving the agent early on in the design process, many of the operational and maintenance problems can be 'designed out' of a building.

A formal risk assessment can be a useful tool in deciding on the severity and likelihood of various risks (both during construction and during operation and maintenance) and allowing the team to decide whether these are acceptable residual risks or whether the design must be altered to avoid them.

REFERENCES & FURTHER INFORMATION

Refer to Man-2 Commissioning for references.

Man-5 Building Users' Guide

POINTS
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AIM OF CREDIT

To encourage and recognise information management that enables building users to optimise the building's environmental performance.

CREDIT CRITERIA

One point is awarded where:

- A simple and easy-to-read 'Building Users' Guide', which includes information relevant for the building users, occupants and tenants' representatives, is developed;
- AND
- The Building Users' Guide, at a minimum, contains the sections and information in accordance with the Additional Guidance.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Building Users' Guide 	<ol style="list-style-type: none"> 1. Building Users' Guide 2. Statement of confirmation

A complete Building Users' Guide which includes all required information outlined under the Additional Guidance.

Statement of confirmation from the Building Owner in the form of signed correspondence, confirming receipt of the final Building Users' Guide and that it has satisfied the Credit Criteria.

ADDITIONAL GUIDANCE

The Building Users' Guide, at a minimum, must include the following sections and information:

Energy & Environmental Strategy:

- Descriptions of the initiatives intended to enhance energy efficiency (and associated greenhouse gas emissions), water efficiency and indoor environment quality;
- Descriptions of initiatives which have been incorporated into the building for the purposes of Green Star SA certification; and,

Man-5 Building Users' Guide

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- Quantification of the potential water, energy and greenhouse gas emissions, and financial (i.e. operational) savings.

Monitoring and Targeting:

- Outline of the energy and water targets or benchmarks for the building;
- Descriptions of the automated energy and water metering strategy for the building (if applicable);

In compiling the Building Users' Guide and noting Monitoring and Targeting initiatives for Indoor Environmental Quality, project teams may address (but are not limited to) the following:

- An explanation of the importance of good Indoor Environmental Quality and the related benefits;
- Benchmarks and monitoring initiatives for Ventilation Rates;
- Benchmarks and monitoring initiatives for Carbon Dioxide Monitoring;
- Benchmarks and monitoring initiatives for Thermal Comfort;
- Benchmarks and monitoring initiatives for Day-lighting Measures;
- Any other relevant data that may be extracted from and/or controlled by, that building's Building Management System and;
- Any other relevant information, aligned with the Green Star SA Indoor Environmental Quality initiatives the project has employed and/or is targeting.

Building Services:

- Descriptions of the basic function and operation, and simplified system diagrams, of the building services including, at a minimum:
 - Ventilation system;
 - Heating system;
 - Cooling system;
 - Electrical system;
 - Lighting system; and,
 - Domestic hot water system.

Transport Facilities:

- Descriptions of the car parking requirements and provision of cyclist facilities, conditions of access, and appropriate use;
- Overview of local public transport information, maps and links to timetables; and,
- Details on alternative methods of transport to the workplace, such as car-sharing and carpooling, bicycle paths etc.

Materials & Waste & Recycling:

- Information on recycling, including what can be recycled, where the waste storage areas are, and the schedules for waste and recycling removal;
- Information on any other waste management processes present such as composting or worm farm facilities (where applicable), as well as schedules for waste and recycling removal.

Man-5 Building Users' Guide

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Community Facilities:

- Where the project has included community facilities (as per credit Eco-8), descriptions of on-site community facilities provided, their location and instructions for use.

Landscape Management and Biodiversity Features

- Descriptions of the site landscape and biodiversity features;

Expansion/Re-fit Considerations and Preferred Materials

- Descriptions of the materials or products which have been incorporated into the building to improve indoor environment quality; and,
- Descriptions of the materials or products which have been incorporated into the building because of their improved sustainability performance (e.g. recycled content material, FSC certified timber, etc.). Include a list of environmental recommendations for consideration, highlighting in particular the areas covered in the Building Users' Guide. Consider examples such as use of environmentally friendly materials, reuse of other materials, or exhausts for printing and photocopying rooms.

Additional Information & References

- Must include links to online information such as websites, publications, and organisations relating to energy and water conservation, efficient building operation, indoor air quality or sick building syndrome, and environmental design features.

The Building Users' Guide must be a concise and user-friendly document, suitable for a layperson. It is not intended as a supplementary document to the Operations & Maintenance Manual for maintenance staff, and as such must not include detailed information on maintenance and spare parts, etc.

Simplified diagrams are aimed, and intended, for the use of the building occupants and need to communicate the depicted service/system in a very basic and clear way that can be readily understood by the general public. Any drawing/diagram that contains technical detail generally is not considered to be "simplified".

For basic function and operation, it is not necessary to describe the function of simple amenity taps, or lighting systems without automatic control features. The intent of providing information on basic function and operation is only intended for those systems whose use and operation may not be immediately intuitive to building occupants. For example, the basic functions of a lighting system that includes daylight sensors or occupancy sensors would need to be described, however a lighting system with only simple manual controls (i.e. on/off switches) would not.

The provision of a building Operation and Maintenance (O&M) manual does not meet the Building Users' Guide requirement. The O&M manual typically only provides detailed specialist information required by building manager and staff/contractors, not information intended for occupants.

BACKGROUND

Although there are many ways in which a building can be designed and constructed in an ecologically sustainable manner, the sustainability focus can be lost once the building has been occupied (SHFA, 2008). Unless it is operated efficiently, a highly sustainable building

Man-5 Building Users' Guide

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can still perform poorly. In handing over a building, the owner places trust in its tenants to utilise the building according to its design. Building users can only do this if they are aware of all aspects of the building design. Such awareness is generated through the Building Users' Guide.

The Building Users' Guide is expected to provide details on the everyday operation of the building and the systems building occupants encounter, making it easy for all occupants within the building to understand. The aim of the credit is to ensure that design features are used efficiently and that changes to tenant space are managed in the most environmentally appropriate manner.

This credit targets management personnel, building occupants and tenant representatives who make facilities management decisions and who monitor internal facility performance against environmental measures. Information contained in the Building Users' Guide should be passed on to the personnel making those management decisions and performing reviews of facilities, so that they are aware of the environmental impacts of the building and the tenancies.

REFERENCES & FURTHER INFORMATION

Chartered Institute of Building Service Engineers, TM31 Building Log Book Toolkit, 2006
<http://www.cibse.org>

Green Building Council Australia, Clean Up Your Business Guide, 2007
<http://www.gbca.org.au/publications/gbca-clean-up-your-business-guide/1417.htm>

New South Wales Department of Environment and Climate Change - National Australian Built Environment Rating System
<http://www.nabers.com.au>

Queensland Government - Department of Public Works, Ecologically Sustainable Office Fitout Guideline, 2000
<http://www.build.qld.gov.au/qgao/esd.asp>

State Government of Victoria - Sustainable Energy Authority, Energy and Greenhouse Management Toolkit
<http://www.sustainability.vic.gov.au/www/html/1938-energy-and-greenhouse-management-toolkit.asp>

Sydney Harbour Foreshore Authority, Green Building User Guide: Enabling a Sustainable Future, 2008
<http://www.shfa.nsw.gov.au>

Sydney Harbour Foreshore Authority, Sustainable Development Fitout Guide: Enabling a Sustainable Future, 2008
<http://www.shfa.nsw.gov.au>

Man-6 Environmental Management

POINTS AVAILABLE **2**

AIM OF CREDIT

To encourage and recognise the adoption of a formal environmental management system in line with established guidelines during construction.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- The Contractor implements a comprehensive, project-specific Environmental Management Plan (EMP) throughout the construction phase of the project (i.e. from construction commencement to practical completion);
AND
- The EMP is in accordance with the relevant sections of the Provincial Government of the Western Cape Environmental Management Plan Guidelines (2005) as evidenced by correlation with Table Man-6.1 of the Additional Guidance;
AND
- The Contractor and Sub-Contractors achieve compliance with the EMP.

One point is awarded where:

- The Contractor has valid ISO14001 Environmental Management System (EMS) certification throughout the construction phase of the project (i.e. from construction commencement to practical completion);
AND
- All Sub-Contractors relevant to the project and engaged by the Contractor, adhere to all applicable ISO14001 requirements.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
<p>Submit all the evidence and ensure it readily confirms compliance.</p> <hr/> <p>1. Short report</p> <p>Additionally where first point claimed and contract not awarded:</p> <p>2. Extract(s) from tender documentation</p> <p>Additionally where first point claimed and</p>	<p>Submit all the evidence and ensure it readily confirms compliance.</p> <hr/> <p>Where first point claimed:</p> <p>1. EMP compliance report</p> <p>2. Environmental Management Plan</p> <p>Additionally where second point claimed:</p>

Man-6 Environmental ManagementPOINTS
AVAILABLE**2**

<p>contract awarded:</p> <p>3. Environmental Management Plan</p> <p>Additionally where second point claimed and contract not awarded:</p> <p>4. Extract(s) from tender documentation</p> <p>Additionally where second point claimed and contract awarded:</p> <p>5. ISO14001 certificate</p> <p>6. Statement of confirmation</p>	<p>3. ISO14001 certificate</p> <p>4. Statement of confirmation</p>
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Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Confirming if the principle building contract has been awarded or not, and where awarded, the name of the Contractor.

Additionally where first point claimed and contract awarded:

- Clearly correlating the provisions of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005) with the provisions of the project-specific EMP. Compliance must be demonstrated through the completion of Table Man-6.1 EMP *Compliance Checklist*.

Environmental Management Plan prepared by a suitably qualified professional that is comprehensive and project-specific, and:

- Clearly demonstrating compliance with the relevant requirements of the Provincial Government of the Western Cape Environmental Management Plan Guidelines (2005; CSIR & PGWC) as per Table Man-6.1.
- Demonstrating that subcontractors must adhere to the provisions of the EMP.
- Outlining the roles and responsibilities of each individual involved in Environmental Management of the construction site and designating the individual responsible for monitoring and auditing compliance with the requirements of the EMP.
- Signed off by the Contractor indicating implementation of the EMP from commencement of construction.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

Where first point claimed:

- The Contractor to implement and achieve compliance with a project specific EMP, developed for the project and in accordance with the relevant requirements of the Provincial Government of the Western Cape Environmental Management Plan Guidelines (2005) as per table Man-6.1;

Additionally where second point claimed:

Man-6 Environmental Management

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- The Contractor to have ISO14001 certification at commencement of construction and that the Contractor will maintain this certification throughout the full construction phase of the project; and
- That any Sub-Contractors relevant to the project and engaged by the Contractor are to adhere to all applicable ISO14001 requirements.

EMP Compliance Report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by;

- Confirming the dates of construction commencement and practical completion;
- Clearly correlating the relevant provisions of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005) with the provisions of the project-specific EMP. Compliance must be demonstrated through the completion of Table Man-6.1 *EMP Compliance Checklist*; and,
- Describing the requirements, roles and responsibilities of the compliance auditing process that were undertaken during the construction phase of the project; and,
- Confirming that compliance with the project specific EMP was achieved by the Contractor and Sub-Contractors.

ISO14001 certificate of the Contractor that is current and valid throughout the entire construction phase of the project, demonstrating that an appropriate EMS is operating within the company.

Statement of confirmation in the form of signed correspondence from the Contractor confirming;

- The dates of construction commencement and practical completion; and
- That any Sub-Contractors relevant to the project will, or did, adhere to all applicable ISO14001 requirements.

ADDITIONAL GUIDANCE

For the purposes of Green Star SA, the date of 'construction commencement' is deemed to be the date upon which the project site is handed over to the Contractor. The 'total construction phase' is deemed to extend from the date of receipt of the site by the Contractor from the Building Owner, to the date of practical completion when the site is handed back to the Building Owner from the Contractor.

The EMP must be implemented from the date of construction commencement and cannot be awarded where construction has commenced without a project-specific EMP, irrespective of how soon after construction commencement the EMP is implemented. Where this cannot be reliably confirmed, the point will not be awarded.

Where demolition activity is undertaken on the project site within 2 years from the date of practical construction commencement (the date upon which the clean project site is handed over to the main contractor), and the site has remained under the same ownership, the demolition activity must be included within the scope of the project specific Environmental Management Plan. Where this was not achieved, compliance with credit cannot be achieved and points will not be awarded.

Environmental Management Plan (EMP)

The project specific EMP must clearly demonstrate compliance.

Man-6 Environmental ManagementPOINTS
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The EMP must be fully comprehensive and project-specific. The GBCSA expects that where an EMP has been correctly implemented, internal audit documentation is generated for ongoing compliance during construction.

The EMP need not be produced by the Contractor, so long as the EMP is specific to the project and it is clear that the Contractor and all Sub-Contractors are contractually required to adhere to it.

Compliance with the relevant sections of the Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005) is to be demonstrated by completion of the checklist as provided in Table Man-6.1 below.

	EMP Element	Location in EMP
1	EAP (Environmental Assessment Practitioner) Provides information to the credibility and expertise of the EAP to prepare an EMP.	
1.1	<i>Details of the EAP</i> <i>Have details of the EAP been provided?</i>	
1.2	<i>EAP Registration</i> <i>Is the EAP registered with the relevant Registration Authority in terms of Section 24H of the National Environmental Management Amendment Act (NEMA), Act 107 of 1998?</i> <i>OR</i> <i>Until such a Registration Authority is established, is the EAP registered with either the Interim Certification Board (ICB) of the Environmental Assessment Practitioners Association of South Africa (EAPSA) or with the SACNASP (SA Council for Natural Scientific Professionals)?</i>	
2	Background Provides an overview of the project which provides a foundation for understanding the project	
2.1	<i>Introduction</i> <i>Are details of the proponent responsible for the EMP provided?</i> <i>Has the purpose of the EMP been stated? (e.g. EMP developed as part of an EIA process but also seeks to fulfil the requirements of the GBCSA certification process)</i>	
2.2	<i>Project Description</i> <i>Has a brief description of the project been provided?</i> <i>Is a brief description of the affected environment (biophysical, social and economic) provided? (Reference to EIA reports may be made if relevant)</i> <i>Are potential areas of sensitivity onsite or adjacent to the site (including wetlands, rivers etc.) identified?</i> <i>Is a map of the site included?</i>	
2.3	<i>EMP Context</i> <i>Have the boundaries of the EMP been described (i.e. timeline and phases of the project to which applies i.e. planning and design, pre-construction and construction, operations etc.)?</i>	
2.4	<i>EMP Objectives</i>	

Man-6 Environmental Management

POINTS AVAILABLE **2**

	EMP Element	Location in EMP														
	<i>Have EMP objectives been clearly stated (i.e. to ensure environmental performance and reduce environmental risk etc.)?</i>															
2.5	Environmental Policy <i>Have the proponent's environmental management policies and commitments that apply to the EMP been described?</i>															
3	Environmental Management Provides the context for the environmental commitments (legislated and or company commitments.)															
3.1	Environmental Management Structure and Responsibility <i>Has an organisational structure including the description of roles and responsibilities been specified for implementing the EMP?</i>															
3.2	Approval and Licensing Requirements <i>Does the EMP identify the project's regulatory framework including a list of licenses, approvals or permits required to be obtained under the legislation? (copies of these must be included as an Appendix)</i>															
3.3	Reporting <i>Does the EMP describe a system of reporting which includes; a description of a typical report; document control procedures, system for documenting environmental training, and frequency of report?</i>															
3.4	Environmental Training <i>Does the EMP specify the program for employees to undergo environmental awareness training as well as training with regards to their responsibilities under the EMP?</i>															
3.5	Emergency Contacts and Response <i>Does the EMP nominate a contact person including 24 hour details for emergencies, who has the authority to stop or direct works?</i> <i>Does the EMP include procedures for emergency response?</i>															
4	Implementation This section provides the bulk of the document and aside from section 4.4 can be quite easily tabulated for ease of representation and site guidance. E.g. of table format is as follows: <table border="1"> <thead> <tr> <th>Project activity</th> <th>Potential environmental impact</th> <th>Risk category</th> <th>Environmental control</th> <th>Environmental Control implementation</th> <th>Responsibility</th> <th>Frequency of monitoring</th> </tr> </thead> <tbody> <tr> <td>Plant maintenance</td> <td>Contamination of soil due to fuel and oil leakage</td> <td>medium</td> <td>Dedicated plant maintenance areas with efficient drainage channels into municipal effluent systems.</td> <td>Once-off</td> <td>Site manager</td> <td>Weekly</td> </tr> </tbody> </table>	Project activity	Potential environmental impact	Risk category	Environmental control	Environmental Control implementation	Responsibility	Frequency of monitoring	Plant maintenance	Contamination of soil due to fuel and oil leakage	medium	Dedicated plant maintenance areas with efficient drainage channels into municipal effluent systems.	Once-off	Site manager	Weekly	
Project activity	Potential environmental impact	Risk category	Environmental control	Environmental Control implementation	Responsibility	Frequency of monitoring										
Plant maintenance	Contamination of soil due to fuel and oil leakage	medium	Dedicated plant maintenance areas with efficient drainage channels into municipal effluent systems.	Once-off	Site manager	Weekly										
4.1	Risk Assessment <i>Is a list of activities to be carried out (this must include activities undertaken onsite by subcontractors or suppliers) included?</i> <i>Does the EMP identify the actual and potential impacts associated with each</i>															

Man-6 Environmental ManagementPOINTS
AVAILABLE**2**

	EMP Element	Location in EMP
	<i>activity?</i>	
	<i>Does the EMP categorise the risk in terms of significance?</i>	
4.2	Environmental Management Activities and Control	
	<i>Does the EMP specify all the environmental management activities, mitigation and control measures that will be used to prevent or minimise the environmental impacts?</i>	
	<i>Does the EMP assign responsibility for control measures to specific personnel and provide timeframes for their implementation?</i>	
4.4	Environmental Schedules	
	<i>Does the EMP provide schedules, registers, forms etc. which will be used as for the day-to-day environmental management of the site. These will include but not be limited to: Site inspection checklist, Environmental incident register, Environmental training register, Complaints report, Non-compliance and corrective action report etc.?</i>	
4.5	Contractor responsibilities	
	<i>Have the EMP requirements been formally transferred (e.g. included in tender documents) to the contractor and sub-contractors?</i>	
5	Monitoring and Review	
	Provides a methodology for a system of ensuring that the EMP is being implemented as intended, as well as remains relevant to site activities.	
5.1	Environmental Auditing	
	<i>Does the EMP describe the programme and procedure for periodic auditing, covering both internal and external auditing?</i>	
5.2	Corrective Action	
	<i>Does the EMP define procedures for non-compliance and corrective actions as well as stipulate a responsible individual for investigating and non-compliance, taking action and completing corrective and preventative action?</i>	
5.3	EMP Review	
	<i>Does the EMP describe the responsible individual and frequency of EMP review?</i>	
	<i>Does the EMP plan for informing site/project team of changes?</i>	

Table Man-6.1: EMP compliance checklist³

The GBCSA note that it is the project team's responsibility to ensure that all legislative requirements relating to the EMP are achieved in accordance with the National Environmental Management Act (NEMA). The Green Star SA requirements listed above are intended to be applied alongside and in addition to any legislative requirements. As such, should any of the Green Star SA requirements listed for the EMP be in contravention with legislative requirements for the project, the project team is to comply with the said legislative requirements and clearly justify within the short report and Man-6.1 compliance checklist why the specific Green Star SA requirement could not be applied.

³ Based on Provincial Government of the Western Cape (PGWC) Environmental Management Plan Guidelines (2005; CSIR & PGWC)

Man-6 Environmental Management

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The EMP need not be produced by the contractor, so long as the EMP is specific to the project and it is clear that the contractor and all subcontractors are contractually required to adhere to it. The EMP is to be produced by an Environmental Assessment Practitioner (EAP) who is registered with the the Interim Certification Board (ICB) of the Environmental Assessment Practitioners Association of South Africa (EAPSA) or with the SACNASP (SA Council for Natural Scientific Professionals).

Environmental Management Systems (EMS) Certification

ISO14001 is a requirement of the Contractor and must be valid for the entire construction phase of the project. All Sub-Contractors relevant to the project and engaged by the Contractor must adhere to the requirements of the EMS.

ISO14001 Alternatives

For smaller organisations (fewer than 30 staff) simpler tools other than ISO14001 are acceptable where the results are externally available to customers and the public and internally to staff and other building occupants. An external auditor's report confirming evidence of effective use of an appropriate tool must be provided to achieve the credit.

All systems are to follow the basic stages of top level commitment, identification of impacts, review, target setting, action plan, monitoring and reporting. The process is to be frequent and on-going. Any of these systems must set out the following:

- A degree of high level commitment;
- Key responsibilities with names attached;
- Key environmental impacts identified and prioritised as part of a review process;
- Targets and an action plan; and
- Monitoring processes, with the reporting of this monitoring to senior management.

The commitment to future provision of the EMP does not meet the Credit Criteria. The EMP must be fully comprehensive and project-specific. The GBCSA expects that where an EMP has been correctly implemented, an internal audit trail is kept as evidence for on-going compliance during construction.

BACKGROUND

Construction and demolition are responsible for significant environmental impacts, especially at the local level. These arise from site disturbance, pollution, construction waste, and water and energy use. It is important that responsibility is taken for creating and executing management procedures to minimise or avoid these impacts. ISO14001 is applicable worldwide and provides management tools for organisations or project teams to control their environmental impacts and to improve their environmental performance. These tools can provide significant tangible economic benefits, including:

- Reduced raw material/resource use;
- Reduced energy consumption;
- Improved process efficiency;
- Reduced waste generation and disposal costs; and
- Utilisation of recoverable resources.

Man-6 Environmental ManagementPOINTS
AVAILABLE**2****REFERENCES & FURTHER INFORMATION**

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<http://www.environment.gov.za/polleg/legislation/natenvgmtact/natenvgmtact.htm>

National Environmental Management Act, 107 of 1998, as amended: Environmental Impact Assessment Regulations R544; 18 June 2010: Listing Notice 1: List of Activities and Competent Authorities identified in terms of Sections 24(2) and 24D.

<http://www.environment.gov.za/polleg/legislation/natenvgmtact/natenvgmtact.htm>

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<http://www.environment.gov.za/polleg/legislation/natenvgmtact/natenvgmtact.htm>

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<http://www.environment.gov.za/polleg/legislation/natenvgmtact/natenvgmtact.htm>

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Man-7 Waste Management

POINTS
AVAILABLE**3**

AIM OF CREDIT

To encourage and recognise management practices that minimise the amount of demolition and construction waste going to disposal.

CREDIT CRITERIA

Up to three points are awarded where:

- The Contractor develops and implements a Waste Management Plan (WMP) throughout the construction phase of the project (i.e. from construction commencement to practical completion);
- AND
- The Contractor retains waste records and issues quarterly reports to the Building Owner;
- AND
- The Contractor diverts a minimum percentage (by mass) of all demolition and construction waste for reuse or recycling, awarded as follows:
 - 30% for one point;
 - 50% for two points;
 - 70% for three points.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. Waste Management Plan 3. Quarterly waste reports

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the Contractor to;

- Develop a Waste Management Plan prior to the start of construction or demolition works, and implement it throughout the construction phase of the project (i.e. from construction commencement to practical completion);
- Issue the Building Owner with quarterly waste reports identifying the total waste generated (in mass) and the percentage diverted from disposal;
- Recycle the stated percentage (by mass) of construction and demolition waste.

Man-7 Waste ManagementPOINTS
AVAILABLE**3**

Short report prepared by a relevant project team member that demonstrates how the Credit Criteria has been met by:

- Providing a tabulated summary of all categories of waste with their corresponding total quantities (in mass) as identified in the quarterly waste reports; and,
- Demonstrating that the diversion from disposal percentage was achieved for the project; and
- Referencing appended receipts and other appropriate records (e.g. evidence of reuse).

Waste Management Plan developed in accordance with the Additional Guidance and implemented for the project.

Quarterly waste reports issued to the Building Owner showing the categories of waste, their corresponding quantities (in mass) for the period, the percentage diverted from disposal and how that diverted is reused/recycled.

ADDITIONAL GUIDANCE

It must be clearly demonstrated that the quarterly waste reports accounts for all of the demolition and construction waste and that the stipulated proportion of waste has been reused or recycled.

Where demolition activity is undertaken on the project site within 2 years from the date of practical construction commencement (the date upon which the clean project site is handed over to the main contractor), and the site has remained under the same ownership, the demolition waste generated throughout the scope of the whole demolition contract must be included in calculations demonstrating compliance with the Credit Criteria

Waste management plan

The Waste Management Plan must detail, as a minimum, the following;

- How all generated waste was monitored;
- Which type of waste streams were collected for recycling or reuse; and
- The roles and responsibilities of those involved in the waste management process

Conversion of volume to mass

If waste is measured by volume rather than mass, the data must be converted to mass using the densities provided in Table Man-7.1.

Solid Waste Type	Density (kg/m³)
Cardboard	60
Gypsum Wallboard	300
Rubble	830
Steel	600
Wood	180

Man-7 Waste Management

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Mixed waste 210

Table Man-7.1: Densities to be assumed for various solid waste types

For any materials that are not listed in Table Man-7.1, Project Teams may propose their own densities along with accompanying calculations and justifications by Credit Interpretation Request (CIR). Project teams must demonstrate within the CIR how the density was arrived at and how calculations were done. The densities of some materials can vary widely depending on their composition and manufacture (e.g. concrete could include asphalt, gravel or many other materials). The CIR must also demonstrate that calculations have taken into account the difference between the density of the material in transport/crushed form, rather than in solid form/in situ.

Informal recycling

Where informal recycling is utilized, the waste material must be weighed beforehand and a record of the informal recyclers collectors must be kept including their acknowledgement of collection of such materials and quantities.

Bulk recycling

If a sub-contractor is engaged to sort and recycle construction waste on the project's behalf and does it on a 'bulk' basis, not on a project basis, the credit can be claimed if the sub-contractor can provide evidence of diverting the percentage of waste as an average.

Recycling on site

Projects that crush and reuse existing concrete, masonry or asphalt on site (that would otherwise be hauled off-site) must include these materials in the credit calculations as reused /recycled. Debris processed into a recycled content commodity with a market value (e.g. alternative daily cover material, land reclamation material, foundation/road sub-base) must be included in the credit calculation as reused or recycled material.

Exclusions

Any waste that is not normally sent to conventional disposal (i.e. landfill) is not addressed by this credit, such as topsoil or excavation fill (contaminated or otherwise), land clearing debris (e.g. foliage, felled timber, ground covers), or hazardous waste that must be disposed of in accordance with applicable legislation (e.g. asbestos, contaminated fill/topsoil etc.). Quantities of such wastes must be excluded from calculations to demonstrate compliance with the credit criteria.

Common materials and reuses

Numerous building materials and components can be recovered or recycled. Common materials and reuses include:

- Bricks and concrete used for clean-fill;
- Timber to be salvaged for new structural or material use; Timber waste ground into mulch or garden compost;
- Crushed concrete and/or clean fill used as road-base/foundations or for land reclamation;
- Plasterboard crushed for soil conditioner or for the manufacture of new plasterboard;
- Steel, aluminium and other metals for reuse in the manufacture of new metal products;
- Foam insulation and packaging for new insulation or soft structural forms;
- Pallets for reuse;
- Clean plastic from packaging for new packaging materials;

Man-7 Waste Management

POINTS
AVAILABLE**3**

- Carpet and ceiling tiles may be taken back for reconditioning/recycling by the manufacturer;
- Light fixtures for cleaning and reuse;
- Furniture for refurbishing and reuse; and
- Crushed tiles for paving or landscape decoration.

BACKGROUND

Traditionally, the bulk of construction waste has gone to landfill, and it has been estimated by the Gauteng Provincial State of the Environment Report (SoER), June 2004, that construction and demolition waste within South Africa makes up approximately one fourth of all waste generated. This occurs despite the fact that much of the waste can be considered as a valuable resource for reuse or recycling.

Waste management on building sites is becoming increasingly common. As the availability of suitable land for landfill diminishes, and concerns about the environmental implications of waste become more widespread, reuse and recycling practices increase.

At the National Waste Summit held in Polokwane in September 2001, the Polokwane Declaration was adopted which commits South Africa to a reduction of 50% in the amount of waste being land filled by 2012 and a plan for zero waste by 2022. Future waste legislation will promote reuse and recycling, and require manufacturers to develop products that do not create waste and that can easily be recycled.

REFERENCES & FURTHER INFORMATION

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<http://soer.deat.gov.za/frontpage.aspx?m=2>

Provincial State of the Environment Reports
<http://soer.deat.gov.za/docport.aspx?m=97&d=5>

Onsite Minimising Construction Waste, Maximising Competitiveness
<http://onsite.rmit.edu.au>

Polokwane Declaration
http://www.environment.gov.za/ProjProg/WasteMgmt/Polokwane_declare.htm

CSIR (2011). 'Municipal waste management - good practices', Edition 1., CSIR, Pretoria.
http://www.csir.co.za/enews/2011_jun/02.html

Man-8 Airtightness Testing

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool

Man-9 Waste and Recycling Management Plan

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool

Man-10 Building Management SystemsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the incorporation of Building Management Systems to actively control and optimise the effectiveness of building services.

CREDIT CRITERIA

One point is awarded where:

- A Building Management System is integrated into the building with functionality to:
 - Monitor and report on energy and water consumption; and
 - Monitor and control building services systems.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. As Built points schedule or As Built drawings 3. Extract(s) from Commissioning Report(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Detailing the scope and functionality of the building management system as contained in the Additional Guidance section;
- Outlining the building services systems that are controlled and monitored, with reference to supporting documentation.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The installation of a Building Management System with functionality to monitor and report on energy and water consumption, and monitor and control building services systems; and,
- The allocation of control points to energy and water meters (where applicable) and building services systems.

Man-10 Building Management SystemsPOINTS
AVAILABLE**1**

As Built point schedule or As Built drawings marked up to show all relevant control points and metering points.

Extract(s) from Commissioning Report(s) demonstrating that a BMS system has been installed, commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

It must be demonstrated that a Building Management System (BMS) is integrated into the building to with the following functionality, at a minimum. Note that where a single BMS system is not appropriate (such as in the case of smaller buildings with simple building services), it is acceptable for the purposes of this credit to have a number of smaller, separate control systems meeting the functionality below, linked to a central location to enable effective monitoring and control by the building facilities management team.

Where certain items of the minimum BMS functionality requirements below are not applicable to the specific system, the project team must clearly justify within the short report why the requirement can be considered not applicable in the case of the specific project.

HVAC System

System	Minimum BMS Functionality as applicable		
	Control	Monitoring	Alarms
Central chilled water and condenser water plant	Chiller, Pump and Cooling Tower stop/start time schedule, Chilled water and condenser water temperature set point	Chiller, pump and cooling tower status, Chilled and condenser water temperatures, outside air dry bulb and wet bulb temperatures	Chiller, pump and cooling tower failure
Air handling units, Fan coil units, VRV systems	Unit Stop/Start time schedule and room temperature setpoint	Status of the unit components and room temperature	Component failure, Dirty filters
Ventilation systems	Fan stop/start time schedule	Fan status	Fan failure
VAV Diffusers, radiant panels	Room temperature setpoint.	Status of the unit components and room temperature	High/low room temperatures

Metering Systems

System	Minimum BMS Functionality as applicable		
	Control	Monitoring	Alarms
Electrical	None	<u>Monthly data</u> <ul style="list-style-type: none"> Month start date and time Energy consumption for the month kWh Peak demand (integrated half hour period) Date and time of peak Corresponding kW, kVAR and power factor at peak 	None

Man-10 Building Management Systems

POINTS AVAILABLE **1**

Water	None	<u>Monthly data</u> <ul style="list-style-type: none"> Month start date and time Water consumption for the month kl 	None
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Electrical System

System	Minimum BMS Functionality as applicable		
	Control	Monitoring	Alarms
Each lighting zone	Lighting on/off time schedule	Lighting status	None
Each Generator	None	Generator status, phase voltage and current, fuel day tank level.	Battery charger fault, battery low voltage, circuit breaker trip, emergency stop, high engine temperature, low oil pressure, not in auto, over speed, over voltage, start failure.

BACKGROUND

Building Management Systems are computer based control systems installed in buildings to control and monitor the building’s mechanical and electrical equipment as well as the water systems. Ideally the BMS, especially on large building projects, is a central integrated system monitoring and controlling the building. However on smaller projects where a single BMS system is not appropriate there is still benefit in installing smaller separate control systems that are linked to a central location to enable effective monitoring and control by the building facilities management team. A BMS consists of software, hardware, sensors, controls, and activators – connected through a communication system, which enables the easy and efficient proactive, rather than reactive, management of service faults (Mustafa & Bansal).

The main benefit associated with a BMS is the real time monitoring of plant status and environmental conditions, which allows for the prevention of energy waste and the reduction of related environmental impacts, as well as the ability to integrate other building systems (reducing costs and increasing productivity) (Mustafa & Bansal).

The results obtained from companies that have adopted such systems are encouraging. A Turkish study into energy savings from the application of BMS in shopping centres demonstrated that the incorporation of a BMS, to monitor and control the heating, ventilation and air-conditioning systems, resulted in average energy savings of 22% (Canbay et al., 2004). There are numerous Australian based case studies for facilities of varying size, which support similar energy savings which also give benefits in monetary terms, with internal rates of return of up to 65% (DEUS, 2008). These real world examples identify BMSs as an essential requirement to the successful management of a business operation in monetary as well as environmental terms.

The South Tweed Bowls Club, in Australia, after installing a BMS (costing AUS\$41,000) to control the club’s air conditioning, achieved a reduction of energy consumption of 25%, which translated into over AUS\$4,500 on savings per month (or 65% rate of return) (DEUS, 2008). The Australian Gas Light Company (AGL) also introduced a BMS into its headquarters in North Sydney to control the air conditioning, lighting and heating systems (DEUS, 2008). AGL

Man-10 Building Management SystemsPOINTS
AVAILABLE**1**

has invested \$88,000 into the system, and is now saving AUS\$33,259 per year (41% rate of return), and helping the environment by reducing its greenhouse gas emissions by 1060 tonnes per annum (DEUS, 2008).

When the Sasol Headquarters in Rosebank, Johannesburg was built in 1988, a BMS system was installed. At the time it cost R500000 but the building has achieved monthly savings of R150,000 on electricity (Business Report, 20 February 2008). A study conducted by Imagine Durban, showed that a BMS system installed in the Lifestyle Home Garden Centre to achieve load limiting cost R500,000 to install and the projected savings on energy costs amount to R770,000 per annum (Imagine Durban, 2009).

Consequently, BMSs can be installed in facilities of all sizes and types, and have become an essential requirement to the successful management of business operations - not only in monetary terms but also environmentally.

REFERENCES & FURTHER INFORMATION

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<http://www.airah.org.au/default.asp>

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Department of Energy Utilities and Sustainability (DEUS) (n.a.), Powering into the Future, Australian Gas Light Company, New South Wales Government Case Study.
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Mustafa, H. T. & Bansal, P.K. (n.a.), Building Management Systems: Beyond Electronics, in Forum Official Journal of AIRAH, Department of Mechanical Engineering, The University of Auckland.
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Imagine Durban (2009.) Saving Electricity Retail Facility Case Studies 2009, Case Study 1: Lifestyle Home Garden Centre.
<http://www.imaginedurban.org/docs/Case%20Studies%20of%20Electricity%20Savings%20in%20the%20Commercial%20Sector.pdf>

Business Report (2008), Eskom to spend R500m on firms.

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Man-11 Green Lease

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool

Man-12 Common Property Management Rules Clauses

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool

Man-13 Learning Resources

POINTS
AVAILABLE

1

AIM OF CREDIT

To encourage and recognise sustainability initiatives implemented in the development as learning resources for building users and visitors.

CREDIT CRITERIA

One point is awarded where:

- Within the building or the broader site, the following ‘Learning Resources’ are provided for building occupants and visitors:
 - A minimum of one sustainability initiative related to a Green Star SA Public Building Energy Credit is described and displayed, and the resulting energy use and greenhouse gas emissions are continuously presented;
 - AND
 - A minimum of one sustainability initiative related to a Green Star SA Public Building Water Credit is described and displayed, and the resulting potable water savings are continuously presented;
 - AND
 - A minimum of one sustainability initiative not related to energy and water is described and displayed, and the resulting benefit(s) are presented.

Further guidance, definitions and examples are provided in the Additional Guidance section.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawings 3. Statement of confirmation

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by:

- Summarising each initiative, including;
 - Stating which Green Star SA – Public & Education Building v1 credit it relates to; and,

Man-13 Learning Resources

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1

- Describing how this initiative is communicated or displayed to educate all building occupants and visitors;
- Describing how data for water and energy initiatives are continuously displayed; and
- Including photographs of the installed learning resources (As Built rating only) where appropriate.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The installation of each learning resource, nominating the location of each initiative and display mechanism (e.g. monitors, visual display, etc.);
- The communication/controls strategy to display/process the water and energy data in real time (where real-time data is displayed); and,
- The content of the material for display (for static displays only).

As Built drawings showing the location of all initiatives and associated displays.

Statement of Confirmation from the building owner indicating that all initiatives and display mechanisms have been installed.

ADDITIONAL GUIDANCE

Sustainability initiative

For the purpose of this credit, a sustainability initiative refers to any design attribute, structural or landscape component, system, service, equipment or strategy rewarded under a Green Star SA credit, and incorporated in the project's Green Star SA submission.

To be eligible to receive the point in this credit, at least one point in each of the Green Star SA – Public & Education Building v1 credits addressing all three sustainability initiatives described above must be achieved.

Learning resources

Sustainability initiatives must be described and displayed as follows:

- Description:
 - A description of a sustainability initiative refers to a clear explanation of what the initiative is, how it works, and what is the expected sustainability benefit resulting from its inclusion in the project scope.
- Display:
 - Display of descriptions of sustainability initiatives to building users includes but is not limited to the use of educational display boards, exhibits, screens, cutaway sections of the building fabric, audio, printed information, etc. Educational display boards used as static display should be a minimum of A1 in size and framed in the display as part of the base building provision.
- Energy and water savings are to be continuously presented as follows:
 - For projects where a Building Management System (BMS) or metering and monitoring system is specified or installed, presentation of data on energy and water savings must be in 'real-time' and include the display of a trend in consumption, savings and (for energy only) reduction of greenhouse gas emissions over a period of time (e.g. weekly, monthly, quarterly or yearly). For the purposes of Green Star SA, 'real-time' means that if a single meter is used, the data should be refreshed at least

Man-13 Learning Resources

POINTS
AVAILABLE

1

every hour on a continuous basis. If a breakdown of uses is displayed, then as a minimum, daily summaries are required to be continuously displayed on screens.

- For projects that do not include a BMS or metering and monitoring, the display provided must make provision for water and energy savings to be presented and regularly updated (period between updates not longer than daily). i.e. screens, signs or educational display boards used should have the functionality for energy and water savings to be displayed and updated on a regular basis.

Location of learning resources

Learning resources, including the display of real-time data (for energy and water) must be permanently located in an area where all building occupants and visitors will be exposed to them. Examples of such areas include, but are not limited to:

- Front desks and receptions;
- Waiting areas;
- Atria;
- Building entrances; and
- Exhibition areas.

The updates (continuous updates for projects with an automated metering and monitoring system e.g. BMS, or regular updates for projects without a BMS installed) on energy and water savings, and the reduction in greenhouse gas emissions, must be displayed as part of, or next to, the learning resource, but can also be displayed in multiple areas of the building for maximum exposure to users.

Learning resources can also be located next to the sustainability initiative (e.g. outside the building next to rainwater collection tanks, photovoltaic panels, co-generation or water treatment plants). When this is the case, signage directing building users to these areas must be provided in locations where all of the building occupants and visitors can see them. Where the initiative is not accessible to building occupants and visitors (e.g. located in the plant room), then the learning resources / information should be located in a central and accessible location such as reception or lobby area.

Learning resources examples

The following are examples of how sustainability initiatives can be described and presented to the public. The energy and water features must present both a description and continuous update of savings as outlined below:

Energy

- Sustainability initiative:
 - The project features a renewable energy source such as photovoltaic panels with the capacity to provide a certain amount of energy to the building, resulting in a significant reduction of greenhouse gas emissions.
- Description:
 - An educational display board is provided explaining what the initiative is, how the photovoltaic panels work, and what the expected sustainability outcome is.
- Location:
 - The educational display board is permanently mounted on a wall in the reception area of the building.
- Display of continuous updates on energy savings:

Man-13 Learning Resources

POINTS
AVAILABLE

1

- The project has a BMS installed, thus 'real-time' data is presented. A screen displaying the energy being produced by the photovoltaic panels, and the equivalent savings in greenhouse gas emissions in real-time is permanently located next to the educational display board.

Water

- Sustainability initiative:
 - The project features a rainwater collection system that distributes rainwater to be used for flushing toilets, cooling towers and irrigation.
- Description:
 - Through the use of one (or several) educational display boards explaining what the rainwater system is, how it works and the expected water savings. The display boards may include drawings or diagrams and other relevant information about the system.
- Location:
 - Educational display boards are placed near rainwater collection tanks, toilets where rainwater is used and clear distribution pipes are installed, showing rainwater being transported. Signs directing occupants and visitors to these features are provided in accessible locations.
- Display of continuous updates on water savings:
 - The project does not have a BMS installed, thus 'real-time' data is not required. A screen displaying potable water savings resulting from the operation of the system is located next to at least one of the educational boards. The screen is linked to a Content Management System that allows water savings to be manually updated on a daily basis. More screens may be located in other visible areas of the building.

Other

- Sustainability initiative:
 - The building in the project incorporates double glazing to some extent. The sustainability initiative of the building enhances the thermal comfort of the occupants and reduces the energy consumption.
- Description:
 - A static display consisting of a cut away section of double glazed window fitting showing the frame and glazing sections together with educational display boards explaining the environmental benefits of the double glazing for the occupants of the building. The educational display board will indicate the effect on occupant thermal comfort due to the double glazing as well as a schematic view and easy to understand workings of solar heat gain, visual transmittance and thermal conductivity and how these properties are tempered by the installation of double glazing resulting in improved environmental performance.
- Location:
 - The static display is in the central foyer or reception area or main recreational area (e.g. canteen) within the building, as such making it visible to all building occupants.

BACKGROUND

Man-13 Learning Resources

POINTS
AVAILABLE

1

This credit has been developed to educate building occupants on how the sustainability initiatives implemented in the building work, and the associated environmental benefits of these initiatives.

Making sustainable building initiatives and features visible and interactive can provide a valuable education and learning opportunity for building users to develop awareness about the building's impacts on the natural environment and resources. By incorporating important concepts such as energy, water and material efficiency, public and education buildings can become interactive learning tools.

REFERENCES & FURTHER INFORMATION

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Man-14 Life Cycle Costing

POINTS
AVAILABLE**1**

AIM OF CREDIT

To recognise and encourage the development of a Life Cycle Cost (LCC) analysis to consider environmentally sustainable attributes in assessing improved design, specification and through-life maintenance and operation.

CREDIT CRITERIA

One point is awarded where:

- A life cycle cost (LCC) analysis has been carried out during the concept design/design development stages covering construction, operations, maintenance, and end of life;
AND
- The LCC analysis is in accordance with the requirements provided in the Additional Guidance and covers at least one of the following building elements;
 - Building structure;
 - Envelope;
 - Services; and/or,
 - Finishes.
 AND
- The LCC analysis considers environmentally preferable alternative options for the building element(s) examined;
AND
- It is demonstrated that the lowest discounted LCC option was considered in the selection criteria, if not incorporated in the design. Where not incorporated, the reasons for the decision to not incorporate the lowest LCC option must be justified.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Life Cycle Cost report 	<ol style="list-style-type: none"> 1. Short report 2. Life Cycle Cost report

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by:

- Providing a brief summary of the building elements covered by the LCC analysis;

Man-14 Life Cycle Costing

POINTS
AVAILABLE

1

- Indicating the environmentally preferable alternative options examined; and
- Confirming that for the building element(s) examined, whether the lowest LCC option was incorporated in the design. If the lowest discounted LCC option was considered but not incorporated in the design, the environmental reasons for the decision must be highlighted.

LCC report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Defining the purpose, scope, key assumptions, limitations, constraints, uncertainties, risks and effects of any sensitivity analysis;
- Confirming that the LCC analysis was carried out in accordance with ISO 15686-5:2008 Building and constructed assets – Service-life planning – Part 5: Life-cycle costing;
- Confirming that the LCC analysis was carried out based on the proposals developed during Concept Design/Design Development Stage, or equivalent;
- Stating the building stages covered and the periods of analysis; and,
- Demonstrating the comparison of options with results for each and clearly indicating the option(s) with the lowest discounted LCC over the period(s) considered.

ADDITIONAL GUIDANCE

LCC analysis and report

The LCC analysis must be carried out in accordance with ISO 15686-5:2008 Building and constructed assets – Service-life planning – Part 5: Life-cycle costing.

The LCC analysis must be carried out based on the proposals developed during Concept Design/Design Development Stage, or equivalent, and must cover the following:

- Building stages to be covered
 - Construction
 - Operation - includes, as a minimum, utilities
 - Maintenance - includes, as a minimum, planned maintenance, replacements and repairs, cleaning, management costs
 - End of life.
- Period of analysis
 - Use a study period of 25 or 30 (as applicable) AND 60 years, shown in real and discounted cash flow terms.

- Comparison of options

The analysis should demonstrate that at least one of the following building elements have been analysed at a strategic and system level (as per figure 6, Different levels of analysis at different stages of the life cycle, ISO 15686-5), and options associated with that building element compared:

- Structure
- Envelope
- Services
- Finishes

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- Selection of option

For the particular building element (i.e. structure, envelope, services and finishes) the option(s) with the lowest discounted LCC over the period is considered, assuming that the selection results in at least one of the following:

- The lowest building energy consumption over the operational life span of the building (compared to other options/alternatives analysed)
- A reduction in maintenance requirement/frequency
- Prolonged replacement intervals of services infrastructure/systems or building fabric
- Dismantling and recycling or reuse of building components.

The results of the LCC analysis should be documented in a report so that users can clearly understand both the outcomes and the implications, including clearly defining the purpose, scope, key assumptions, limitations, constraints, uncertainties, risks and effects of any sensitivity analysis. The report should include:

- An executive summary
- The purpose and scope (including what costs have been included/excluded and the period of analysis)
- A statement of objectives
- The materials under consideration
- Any assumptions made
- Any constraints and risks identified
- Environmentally preferable alternatives considered in the analysis
- A thorough discussion of the interpretation of the results, including risk assumptions and exclusions
- A graphical representation of results (while this is not essential, a graphical representation of results frequently aids understanding and provides a readily comprehensive summary of results)
- A replacement and maintenance plan or profile
- A presentation of the conclusions related to objectives of the study and recommendations for any further work

ISO 15686-5:2008 defines Life Cycle Cost and real and Discounted cost as follows⁴: “Life Cycle Cost analysis: A procurement evaluation technique which determines the total cost of acquisition, operation, maintenance and disposal of the building.

The *strategic level* analysis (looking at issues such as location and external environment, maintainability and internal environment, etc.) and *system level* analysis (looking at issues such as foundations, solid or framed wall and floors, types of energy, ventilation, water capacity, communications, etc.) should be carried out early in the design process to influence the fundamental decisions taken regarding the building without having an adverse effect on either cost or design programme. It is however important that this is revisited as the design develops to ensure that an optimal solution is retained throughout the procurement process.

⁴ From “Man 12 Life Cycle Costing, BREEAM Education 2008”

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AVAILABLE

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Real and discounted cost: *real cost* is the cost expressed as a value at the base date, including estimated changes in price due to forecast changes in efficiency and technology, but excluding general price inflation or deflation. *Discounted cost* is the resulting cost when the real cost is discounted by the real discount rate, or when the nominal cost is discounted by the nominal discount rate. ISO 15686 defines *nominal cost* as the expected price that will be paid when a cost is due to be paid, including estimated changes in price due to, for example, forecast change in efficiency, inflation or deflation and technology.”

BACKGROUND

Building systems / initiatives with the best environmental outcome do not always necessarily reflect the lowest capital expenditure cost. However, when compared in terms of life cycle costs, these sustainable initiatives often perform better than or close to the conventional solutions. Thus by encouraging Life Cycle Costing as a decision making tool, environmentally preferable initiatives are given the opportunity to be considered equitably, avoiding the 'capex' barrier.

Life-cycle cost (LCC) refers to the total cost of ownership over the life of an asset. Also commonly referred to as "cradle to grave" or "womb to tomb" costs. Costs considered include the financial cost which is relatively simple to calculate and also the environmental and social costs which are more difficult to quantify and assign numerical values. Typical areas of expenditure which are included in calculating the whole-life cost include, planning, design, construction and acquisition, operations, maintenance, renewal and rehabilitation, depreciation and cost of finance and replacement or disposal.

During the life of the building, decisions about how to maintain and operate the building need to be taken in context with the effect these activities might have on the residual life of the building and equipment. If by investing 10% more per annum in maintenance costs the equipment life can be doubled, this might be a worthwhile investment.

Other issues which influence the lifecycle costs of a building include:

- Site conditions,
- Historic performance of equipment and materials,
- Effective monitoring techniques,
- Appropriate intervention strategies.

Maintenance expenditure can account for many times the initial cost of the building and equipment. Although a building may be constructed with a design life in excess of 30 years, in reality it will possibly perform well beyond this design life. For such buildings a balanced view between maintenance strategies and renewal/rehabilitation is required. The appropriateness of the maintenance strategy must be questioned, the point of intervention for renewal must be challenged. The process requires proactive assessment which must be based on the performance expected of the plant and equipment and building fabric, the consequences and probabilities of failures occurring, and the level of expenditure in maintenance to keep the service available as was intended in the building design.

REFERENCES & FURTHER INFORMATION

BREEAM Education 2008, Man 12 Life Cycle Costing, BRE Global 2010
<http://www.breeam.org/page.jsp?id=20>

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AVAILABLE

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ISO 15686–5:2008. Buildings and constructed assets – Service-life planning – Part 5: Life-cycle costing

S. Singh, B. R. Bakshi, *Eco-LCA: A Tool for Quantifying the Role of Ecological Resources in LCA*, International Symposium on Sustainable Systems and Technology, 2009, IEEE.

Bobenhausen, C. (2008), 'Sustainable O&M Practices', Whole Building Design Guide, http://www.wbdg.org/resources/sustainableom.php?r=account_spatial.

Crowther, P. (2005), 'Design for Disassembly – Themes and Principles (DES 31)', BEDP Environment Design Guide, www.environmentdesignguide.net.au/.

Dirr, J. & Hicks, R. (2007), 'Designing with the End in Mind: Maximizing Operational Efficiency', School Planning and Management, www.peterli.com/spm/resources/articles/archive.php?article_id=1598.

Man-15 Maintainability

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise building design that facilitates on-going maintenance, and minimises the need for on-going building maintenance throughout a building's lifecycle.

CREDIT CRITERIA

One point is awarded where:

- At both preliminary and final design stages, a design review is completed that:
 - Is undertaken by the person responsible for the facility's maintenance, or a suitably qualified maintenance staff member, or an independent qualified facilities/maintenance manager;
 - AND
 - Each review considers the design with respect to plant access, on-going maintenance and cleaning of building services, internal building surfaces and external building features.

AND

- A Building Maintenance Guide, providing detailed guidance on accessing and maintaining both the building's services and fabric, is developed by the Design Team and made available to the Building Owner or Manager.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Preliminary design review report 3. Building Maintenance Guide 	<ol style="list-style-type: none"> 1. Short report 2. Preliminary design review report 3. Final design review report 4. Building Maintenance Guide

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Detailing author(s) of the design review reports and how they are deemed qualified/experienced to conduct such reviews; and,
- Describing how the recommendations in the preliminary and final design review reports have been incorporated in the building design, noting significant recommendations or changes.

Man-15 MaintainabilityPOINTS
AVAILABLE**1**

Preliminary design review report prepared by the person responsible for the facility's maintenance, or a suitably qualified maintenance staff member, or an independent qualified facilities/maintenance manager, with contents in accordance with the Additional Guidance.

Final design review report prepared by the person responsible for the facility's maintenance, or a suitably qualified maintenance staff member, or an independent qualified facilities/maintenance manager, with contents in accordance with the Additional Guidance.

Building Maintenance Guide in accordance with the Additional Guidance.

ADDITIONAL GUIDANCE**Design reviews**

The preliminary design review must be completed before going to tender and the final design review after tender but before construction commences. Both reports must address each of the following, and specify recommendations as required:

- Access and Configuration:
 - Physical access to building services (e.g. duct work, air handling units, fan-coil units, controllers/sensors and the dimensions of openings and working spaces);
 - Ability to remove/install plant and equipment where necessary with minimal disruption to the building structure or fabric;
 - Configuration/access for cleaning and painting purposes, particularly in space requiring regular cleaning (both internal and external building attributes);
 - Storage facility/space for maintenance and cleaning supplies, tools and equipment; and,
 - Adequate lighting for maintenance tasks.
- Internal and external building fabric (materials and surfaces):
 - Resistance to dirt accumulating on external and internal surfaces;
 - Properties of internal and external surfaces which affect the ability to clean;
 - Chemical use requirements including availability of products for maintenance of surfaces;
 - Renewing/reapplying surface finishes;
 - Reduction of specialised products;
 - Simplicity for product preparation;
 - Ease of clean-up; and
- Modularity and reparability of key building components (HVAC, lighting, control systems, windows, roofing):
 - Reparability of elements (in preference to replacement);
 - Modularity of elements (to facilitate removal and replacement);
 - Standardisation and availability of replacement parts;
 - Provision of fault detection and isolation points for building services;
 - Labelling of components to facilitate repair and maintenance; and
 - Ability of the Building Management and Control System to incorporate additional controls and be re-programmed.

Man-15 Maintainability

POINTS
AVAILABLE

1

Building Maintenance Guide

The Building Maintenance Guide must include the following information:

- A general overview to maintenance of the building and its systems;
- A list of maintenance environmental recommendations;
- Detailed and easy to read guidance on access and maintenance for each of the following, where applicable:
 - External building fabric;
 - Internal building surfaces;
 - Mechanical services;
 - Electrical services;
 - Hydraulic services;
 - Ventilation;
 - Glare control systems;
 - Lighting systems;
 - Opening of windows; and
 - Heating control.

BACKGROUND

Public buildings can be complex structures with a variety of attributes which require a significant amount of maintenance. The design of these types of buildings should reflect the need for such maintenance by providing suitable access to facilities managers.

When designed and managed accordingly, public buildings can minimise maintenance and operational costs, while also minimally impacting their occupants. Such design involves the provision of convenient access to all facilities, in order to perform preventative and corrective maintenance, and involves the upgrade of equipment and building features with minimal use of resources. A well-designed and properly executed operation and maintenance program is critical to the overall success of a sustainably-designed facility (Bobenhausen, 2008).

A vital part of this design process involves the incorporation of suitably qualified facilities management personnel during the preliminary stages of design through to the final stages in order to generate feedback that ensures design efficacy. This collaboration between designers and facility managers aims to provide innovative, yet practical, design solutions that can be maintained with minimal effort and cost.

The South African Facilities Management Association (SAFMA) defines a Facilities Manager as:

“An individual who has not less than 10 years’ experience as a Facility Manager in the built environment with direct on site management experience. The facilities manager is a professional who coordinates the planning, design and management of a facility, including its systems, equipment, and furniture. A facility manager helps an organization meet its long-term strategic and operational objectives while daily maintaining a safe, efficient working environment.”

REFERENCES & FURTHER INFORMATION

South African Facilities Managers Association (SAFMA), www.safma.co.za

Bobenhausen, C. (2008), 'Sustainable O&M Practices', Whole Building Design Guide, http://www.wbdg.org/resources/sustainableom.php?r=account_spatial.

Crowther, P. (2005), 'Design for Disassembly – Themes and Principles (DES 31)', BEDP Environment Design Guide, www.environmentdesignguide.net.au/.

Australian State of the Environment Committee (2006), State of the Environment Report, Commonwealth of Australia, Department of the Environment and Heritage, www.environment.gov.au/soe/.

Dirr, J. & Hicks, R. (2007), 'Designing with the End in Mind: Maximizing Operational Efficiency', School Planning and Management, www.peterli.com/spm/resources/articles/archive.php?article_id=1598.

Chartered Institute of Building Service Engineers, TM31 Building Log Book Toolkit, 2006 <http://www.cibse.org>

Green Building Council Australia, Clean Up Your Business Guide, 2007 <http://www.gbca.org.au/publications/gbca-clean-up-your-business-guide/1417.htm>

New South Wales Department of Environment and Climate Change - National Australian Built Environment Rating System <http://www.nabers.com.au>

Queensland Government - Department of Public Works, Ecologically Sustainable Office Fitout Guideline, 2000 <http://www.build.qld.gov.au/qgao/esd.asp>

State Government of Victoria - Sustainable Energy Authority, Energy and Greenhouse Management Toolkit <http://www.sustainability.vic.gov.au/www/html/1938-energy-and-greenhouse-management-toolkit.asp>

Sydney Harbour Foreshore Authority, Sustainable Development Fitout Guide: Enabling a Sustainable Future, 2008 <http://www.shfa.nsw.gov.au>

Indoor Environment Quality

Each of the credits within the Indoor Environment Quality (IEQ) category of Green Star SA targets the wellbeing of the occupants. The credits address how the heating and cooling systems, lighting, indoor air pollutants and some building attributes contribute to a healthier indoor environment quality.

Comfort factors addressed within this category are thermal comfort and noise levels. Health issues such as minimisation of indoor volatile organic compounds, asbestos and formaldehyde emissions as well as ventilation.

The IEQ category in the Green Star SA rating tool aims to balance other categories. For example, reductions in energy consumption could easily be achieved by avoiding the installation of heating and/or cooling systems, but this would potentially be at the expense of the occupant comfort and wellbeing. The IEQ category in the Green Star SA tool encourages healthy and good indoor environmental quality. The best overall Green Star SA rating is obtained by balancing the requirements for achieving good IEQ while also concentrating on reducing energy usage etc.

The IEQ category in Green Star SA addresses the indoor environment quality and rewards project teams that are designing buildings and homes that provide comfortable and healthy spaces for their occupants.

IEQ-1 VentilationPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise designs that provide ample amounts of good quality outside air to counteract build-up of indoor pollutants.

CREDIT CRITERIA

Up to two points are awarded as follows:

Naturally ventilated spaces

Up to two points are awarded where:

- It is demonstrated that 95% of the Nominated Area is naturally ventilated in accordance with SANS 10400-O:2011;

Mechanically ventilated spaces

Up to two points are awarded where:

- It is demonstrated that for 95% of the Nominated Area, outside air is provided at rates greater than the l/s per person requirements of SANS 10400-O:2011, awarded as follows:
 - 33% improvement for one point;
 - 66% improvement for two points; or

Mixed-mode ventilated spaces

Up to two points are awarded where:

- Both modes of operation individually satisfy the relevant criteria for naturally ventilated spaces and mechanically ventilated spaces. Points awarded are limited to the maximum points awarded under the mechanically ventilated space criteria.

Underfloor displacement ventilated spaces

Up to two points are awarded where:

- It is demonstrated that for 95% of the Nominated Area, outside air is provided at rates greater than the requirements of SANS 10400-O:2011, awarded as follows:
 - 10% improvement for one point;
 - 40% improvement for two points;

IEQ-1 VentilationPOINTS
AVAILABLE**2**

For the purposes of this credit, the 'Nominated Area' is **Occupied Space**.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building PILOT Design	Green Star SA – Public & Education Building PILOT As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) Additionally for mechanically ventilated spaces: <ol style="list-style-type: none"> 3. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) Additionally for mechanically ventilated spaces: <ol style="list-style-type: none"> 3. Extract(s) from Commissioning Report(s)

Short report prepared by a suitably qualified professional demonstrating how the Credit Criteria have been met by:

- Providing a tabulated summary of all occupied spaces within the building, for each indicating their ventilation mode(s) and areas as indicated on the tender/as built drawings;

Additionally for naturally ventilated spaces:

- Providing a tabulated summary of each occupied space, listing its floor area and the area of external openings in that occupied space expressed as a percentage of the occupied space floor area, demonstrating compliance with the 5% minimum requirement in SANS 10400-O:2011; and,

Additionally for mechanically ventilated spaces:

- Providing a tabulated summary of each occupied space, listing the AHU(s) or fan(s) that serve each space and the minimum outside air rate supplied, clearly demonstrating compliance with the credit criteria.

Extract(s) from tender documentation clearly demonstrating the design occupant density and design outside-air rates for each occupied space.

IEQ-1 VentilationPOINTS
AVAILABLE**2**

Tender / As Built drawing(s) clearly marked up to show:

- For naturally ventilated spaces: Architectural floor plans and elevations showing the locations of ventilation openings.
- For mechanically ventilated spaces: Mechanical services drawings, indicating the space served and nominating the outside-air supply rates.

Extract(s) from Commissioning Report(s) demonstrating that the ventilation system(s) have been commissioned and operate as intended by the design, and indicating the minimum outside-air rates supplied by each AHU.

ADDITIONAL GUIDANCE

The systems claimed for this credit must be documented consistently throughout the submission, especially within related credits (e.g. IEQ-3 'Carbon Dioxide Monitoring and Control', IEQ-9 'Thermal Comfort' or Ene-1 'Greenhouse Gas Emissions').

Supplementary outside air systems

Supplementary outside air systems can be incorporated. However, note the following:

- The supplementary system must operate and deliver the air to the occupied space whenever the air conditioning / ventilation system is in operation (as per the Credit Criteria provided). Enabling users to connect to the system will not suffice; and
- The supplementary system must be installed and operated (including energy and maintenance provision) by the base building.

Naturally ventilated spaces

It must be clearly demonstrated that areas nominated as 'naturally ventilated' have opening areas which meet the requirements of SANS 10400-O:2011.

Mechanically ventilated spaces

Projects are required to use the design occupancy, not default occupancy from relevant standards, for all credits that address mechanical ventilation systems.

It must be clearly demonstrated that:

- The documentation shows the minimum outside air rates for each separately served space in the building;
- The HVAC system has been clearly sized to accommodate the increased outside air rates;
- The design ventilation rates represent the required increase on SANS 10400-O:2011 and that these minimum outside air rates are clearly documented in the project design; and

IEQ-1 Ventilation

POINTS
AVAILABLE**2**

- The minimum outside air rate required by the standard is quoted. This will demonstrate to the assessor the percentage improvement for each mechanically ventilated space in the building.

Mixed-mode ventilated spaces

A space or building cannot be considered mixed-mode ventilated unless it independently satisfies the criteria for both naturally ventilated and mechanically ventilated spaces, regardless of the proportion of time the space operates in either mode.

Underfloor displacement ventilated spaces

For the purposes of Green Star SA certification, for an underfloor air distribution system to qualify as a displacement ventilation system, the air velocity at the diffuser may not exceed 0.5m/s (as per ASHRAE PR 949) and return air must be at ceiling level. Supply air must always be provided at a temperature below room air temperature. Note that floor supply of warm air with a ceiling return has a low air change effectiveness (± 0.7). As such, for a system to qualify as displacement ventilation, if heating is provided, it may not be provided at floor level with ceiling return. Should project teams wish to motivate systems with velocities, temperatures or locations for supply / return air that are not in compliance with these parameters, it must be clearly justified how induction of foul air in the room will not take place, and thus that displacement ventilation will occur as opposed to the mixing of foul air and supply air in the room.

The ASHRAE article *LEED and Standard 62.1* from the ASHRAE Journal, (Vol. 47, No. 9, September 2005) notes that “virtually every laboratory and field study has shown that air change effectiveness is always greater than 0.9 when supply air is cooler than room temperature regardless of diffuser location or design.”

Table 6.2 of ASHRAE Standard 62.1 specifies that a system supplying cool air at ceiling level has an air distribution effectiveness of 1.0. Comparatively, a floor supply of cool air and ceiling return, characterised by low velocity displacement ventilation achieving thermal stratification has a typical air distribution effectiveness of 1.2. (Reference: ANSI/ASHRAE Standard 62-2001)

Based on the above rationale, for the purposes of this credit, lower flow rates are permitted for displacement ventilation systems, and are taken to achieve the equivalent air distribution effectiveness with lower resultant flow rates, scaled by a ratio of approximately 1.2.

IEQ-3 ‘Carbon Dioxide Monitoring and Control’

For mechanically ventilated spaces, the submissions between this credit and IEQ-3 ‘Carbon Dioxide Monitoring and Control’ must correlate. If the Carbon Dioxide (CO₂) monitoring system specified or installed (refer to IEQ-3 ‘Carbon Dioxide Monitoring and Control’) is designed to decrease the outside air rates to below those used to achieve this credit, then the points achieved shall be reduced to reflect the minimum ventilation rates set by the CO₂ monitoring and control system. If this credit is claimed, the minimum threshold must correlate to the rate claimed in IEQ-3 ‘Carbon Dioxide Monitoring and Control’. The occupant density referenced for ventilation credits must be consistent with the design occupant density stipulated in the mechanical services specification.

The following reference set points (in parts-per-million) are established within IEQ-3 ‘Carbon Dioxide Monitoring and Control’ to correlate with this credit as follows:

IEQ-1 VentilationPOINTS
AVAILABLE**2**

- 650 PPM for 33% increase; and
- 600 PPM for 66% increase.

REFERENCES & FURTHER INFORMATION

American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S (ASHRAE)
ASHRAE Fundamentals Handbook 1997.

<http://www.ashrae.org>

ASHRAE 62 (2007) Ventilation for Acceptable Air Quality

CIBSE A guide (2006) Environmental Design

<http://www.cibse.org>

SABS (South African Bureau of Standards)

<http://www.sabs.co.za>

IEQ-2 Air Change Effectiveness

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS
AVAILABLE**1**

AIM OF CREDIT

To encourage and recognise the provision of response monitoring of Carbon Dioxide levels to ensure delivery of optimum quantities of outside air.

CREDIT CRITERIA

One point is awarded where:

Naturally ventilated spaces

- No less than 95% of the Nominated Area is naturally ventilated in accordance with SANS 10400-O:2011;

AND

- Carbon Dioxide (CO₂) monitoring is provided for every room or 100 m² (whichever is smaller) to provide an audible or visual alarm if CO₂ levels rise above 900ppm;

AND

- In Nominated Areas, occupants are provided with the ability to control the ventilation rates.

Mechanically ventilated spaces

- A carbon dioxide (CO₂) monitoring and control system is installed that meets the following;
 - Provides a minimum of one CO₂ sensor per zone, to a maximum of 100 m², in 95% of the Nominated Area; and,
 - Facilitates continuous monitoring and adjustment of outside air ventilation rates at each air-handling unit to ensure independent control of ventilation rates to achieve outside air requirements;

OR

- The HVAC system supply air is 100% outside air with no recirculated component.

Mixed-mode ventilated spaces

- Both modes of operation must satisfy the relevant mechanical and natural ventilation criteria.

For the purposes of this credit, '**Nominated Area**' is **Occupied Space**.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS AVAILABLE **1**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
<p>Submit all the evidence and ensure it readily confirms compliance.</p> <ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation <p>Additionally where CO₂ monitoring incorporated:</p> <ol style="list-style-type: none"> 3. Tender drawing(s) 	<p>Submit all the evidence and ensure it readily confirms compliance.</p> <ol style="list-style-type: none"> 1. Short report 2. Extract(s) from Commissioning Report(s) <p>Additionally where CO₂ monitoring incorporated:</p> <ol style="list-style-type: none"> 3. As Built point schedule / As Built Drawings 4. As Built drawing(s)

Short report prepared by a suitably qualified professional demonstrating how the Credit Criteria have been met by:

- Providing a tabulated summary of all occupied spaces within the building, for each indicating their ventilation mode(s) and areas as indicated on the tender/as built drawings;

Additionally for naturally ventilated spaces:

- Confirming that full (2) points are achieved for IEQ-1 Ventilation, OR providing a tabulated summary of each occupied space, listing its floor area and the area of external openings in that occupied space expressed as a percentage of the occupied space floor area, demonstrating compliance with the 5% minimum requirement in SANS 10400-O:2011;
- Providing a tabulated summary of all occupied spaces, indicating the provision of CO₂ monitors and confirming that monitoring is provided for every room or 100m²; and,
- Confirming that the system provides an alarm if CO₂ levels rise above 900ppm, with reference to supporting documentation;

Additionally for mechanically ventilated spaces:

- Providing a tabulated summary of each zone, listing the AHU(s) or fan(s) that serve each zone and the minimum outside air rate supplied; and,
- Confirming the provision of CO₂ sensors to each zone or 100m², to no less than 95% of the Nominated Area, and that the system facilitates the continuous monitoring and adjustment of outside air rates;

OR

IEQ-3 Carbon Dioxide Monitoring & ControlPOINTS
AVAILABLE**1**

- Confirming that the HVAC supply air is 100% outside air with no recirculated component.

Extract(s) from tender documentation clearly demonstrating the inclusion and control strategy of the CO₂ monitoring and control system, and (where applicable), the system's ability to provide an alarm when CO₂ levels rise above acceptable limits.

Tender / As Built drawing(s) marked up to clearly demonstrate the location of all CO₂ monitors.

As Built point schedule / As Built Drawings marked up to clearly indicate the inclusion of all CO₂ monitors within the control system.

Extract(s) from the Commissioning Report(s) demonstrating that the natural ventilation system or mechanical ventilation system has been installed and operates as intended by the design.

ADDITIONAL GUIDANCE

The locations of the carbon dioxide sensors must be clearly shown on drawings.

The audible or visual alarms must be provided in the nominated area served by the CO₂ sensor which has triggered the alarm.

Mechanically ventilated spaces

Systems must have the capability to supply the necessary quantity of outside air at all times.

AHU's may be controlled via variable volume fans, however it must be shown that the control system does not allow the ventilation rate to reduce below the statutory ventilation rate requirements, or where the IEQ-1 credit is targeted, below the ventilation rate claimed in the IEQ-1 credit. This requirement must be clearly stated in the Short Report and shown in the tender documentation (specifications or drawings).

Two types of systems can qualify for the credit:

- 1) Systems where the fan speed is controlled using Carbon Dioxide (CO₂) sensors.

To qualify, the sensors must:

- Be located at all return air points on each floor (usually ducts); location purely within risers does not support the Aim of Credit. Location within return ducts only, or within both return ducts and return risers, is acceptable;

AND

- Be linked to an automated monitoring system (e.g. BMS) or equivalent to ensure continuous adjustment of the outside air rates.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS
AVAILABLE**1**

2) Systems designed to provide 100% outside air with no recirculated component.

To qualify, the following is required:

- The AHU(s) must not have an economy cycle configuration, (i.e. which would allow the building manager to change the mode of operation to recycle air).
- If the AHUs have return air ducting for heat recovery purposes only, the Short Report must clearly confirm that the configuration does not allow for any mixing of supply and return air. Any specifications and drawings submitted must be in accordance with this confirmation (i.e. must not show any allowance for mixing of supply and return air).
- The AHU(s) must be controlled at fixed speed rather than variable volume.

If the Carbon Dioxide (CO₂) monitoring system is designed to decrease the outside air rates to below those used to achieve points in IEQ-1 'Ventilation' then the points achieved in IEQ-1 'Ventilation' shall be reduced to reflect the minimum ventilation rates set by the CO₂ monitoring and control system. If credit is claimed under IEQ-1 'Ventilation', the minimum threshold must correlate to the rate claimed in IEQ-1 'Ventilation'. The occupant density referenced for ventilation credits must be consistent with the design occupant density stipulated in the mechanical services specification.

The following reference set points (in parts-per-million) are established to correlate with IEQ-1 'Ventilation':

- 650 PPM for 33% increase; and
- 600 PPM for 66% increase.

For mechanically air-conditioned and mechanically assisted naturally ventilated spaces, the outside air quantity set points and operational modes must be clearly indicated in the short report.

BACKGROUND

Higher than normal levels of carbon dioxide can be an indicator of inadequate ventilation and impact upon the quality of the breathable air within an enclosed occupied space. This situation can have substantial effects on the wellbeing of the occupants and, subsequently, on their productivity.

The installation of carbon dioxide monitoring systems can detect Indoor Air Quality (IAQ) problems, automatically adjust ventilation supply rates and alert those responsible for building operation before IAQ problems become significant.

IEQ-3 Carbon Dioxide Monitoring & ControlPOINTS
AVAILABLE**1**

REFERENCES & FURTHER INFORMATION

CIBSE Guide H – Building Control Systems

<http://www.cibse.org>

ASHRAE – HVAC Systems & Equipment 2008

ASHRAE 62 (2007) Ventilation for Acceptable Air Quality

<http://www.ashrae.org>

Department of Environment and Water Resources (2001), State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia. Canberra.

<http://www.environment.gov.au/atmosphere/airquality/publications/sok/chapter8.html>

IEQ-4 DaylightPOINTS
AVAILABLE **3****AIM OF CREDIT**

To encourage and recognise designs that provide good levels of daylight for building users.

CREDIT CRITERIA

Up to three points are awarded where:

- A minimum percentage of the nominated area meets a Daylight Factor (DF) of at least 2.0%

OR

- A minimum percentage of the nominal area meets a Daylight Illuminance (DI) of at least 250 lux, as measured at finished floor level (FFL) under a Uniform Design Sky

OR

- A minimum percentage of the nominal area meets a Daylight Illuminance of at least 300 lux based on an annual dynamic simulation model, for 50% of the standard occupied hours (Daylight Autonomy (DA) incremental method).

Points are awarded as follows:

- 30% for one point;
- 60% for two points;
- 90% for three points.

For the purposes of this credit, '**Nominated Area**' is defined as **Occupied Space** with the exception of theatres, cinemas, performance areas (stages), galleries, archives and other spaces that for functional reasons do not allow daylight.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public and Education Building PILOT Design	Green Star SA – Public and Education Building PILOT As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.

IEQ-4 DaylightPOINTS
AVAILABLE **3**

1. Daylight report	1. Daylight report
2. Tender drawing(s)	2. As Built drawing(s)
3. Extract(s) from tender documentation	3. Manufacturer product datasheet(s)

Daylight report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing the methodology and/or modelling software used to calculate the DF, DI or DA;
- Describing the building model(s) including values of reflectance and transmittance used for each relevant material/glazing components and confirm correlation with other related credits;
- Describing how the impacts of window frames and reveals have been considered in the simulation;
- Describing the height(s) above finished floor level used for the calculation plane(s);
- Justifying the inclusion or exclusion of surrounding buildings, with reference to supporting evidence (e.g. aerial image or site plan) and detailing the average reflectance used for surrounding buildings (where applicable);
- For each typical space type, showing outputs from the daylight modelling;
- Providing a summary table that identifies all spaces compliant, identifies the DF, DI values or DA hours within those areas, and providing calculations to confirm that compliant areas jointly contribute to the claimed percentage;
- Where compliance is on the basis of DF, describe the design sky used for the daylight model;
- Where compliance is on the basis of DF, the sky condition used in the analysis;
- Where compliance is on the basis of DI, demonstrating that the analysis grid meets the requirements indicated in the Additional Guidance and demonstrating that the sky illuminance or results represent 85% of the year.; and;
- Where compliance is on the basis of DA, confirming that the analysis was performed for an entire year, demonstrating that the analysis grid meets the requirements indicated in the Additional Guidance, confirming the daily duration that the analysis was undertaken for and the source of the climatic data;

Tender / As Built drawings marked-up to identify;

- The relevant glazing elements within the façade(s) and relevant roof lights within the roof (where applicable);
- The areas modelled.

Extract(s) from tender documentation where all glazing specifications (i.e. visual light transmittance factors) are nominated.

IEQ-4 DaylightPOINTS
AVAILABLE **3**

Manufacturer product datasheet(s) from the glazing manufacturer for each glass type used and indicating the visual light transmittance of each.

ADDITIONAL GUIDANCE**Analysis grid**

All software calculates DF, DI or DA at points on a plan. Some programs calculate results for an almost infinite number of points, providing very accurate results. Other modelling programs request the user to identify a point matrix on the floor plan.

Modelling to calculate the DF, DI or DA must consider the total floor area and be calculated at finished floor level (FFL) for at least 1 analysis point for each 1m² and for all partial square metre segments resulting from the floor plan geometry.

A maximum 1m² grid must be overlaid over the floor plan to determine these points and at all perimeters, the grid must begin within 1 metre of the external façade. Results are then calculated in the centre point for each square in the grid.

Modelling Guidance

Permanent partitions must be included within the modelling of this credit. Temporary partitions can be excluded only if they are shown to be not be in place for most of the occupied hours in the building (for instance, auditorium partitions). Office workstation partitions can be ignored if they are less than 1.5 metres high. All other fitout partitions must be included. Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building. The Daylight Modelling Report must reflect the actual documented design. Representative typical floors and spaces can be modelled instead of modelling the entire building. It must be justified in the daylight modelling report that the typical floors represent the 'worst case' scenario amongst the floors it represents (including overshadowing by adjacent buildings).

Reflectance values

The following reference reflectance values are to be used whenever actual reflectance values are not known. If the actual values substantially differ from these reference values, they must be justified.

- 0.3 for floor (assumes a light-coloured carpet);
- 0.7 for walls (assumes white paint);
- 0.8 for ceilings (assumes white paint); and
- 0.5 for surrounding buildings (discussed below).

The daylight modelling report must reflect the actual documented design. The inputs used for this credit must be used consistently throughout the submission, demonstrating congruity with the building design.

Overshadowing

IEQ-4 DaylightPOINTS
AVAILABLE **3**

Overshadowing must be taken into account in the modelling. A nearby building or structure is defined as overshadowing the proposed building if:

- The overshadowing building or object height is least a third of the height of the proposed building; and
- Where the angle between the nearest point at the top of the overshadowing building and the nearest point at the base of the proposed building is greater than the June 21 (winter) midday altitude of the sun.

Unless otherwise justified within the daylight report with reference to supporting evidence, a nominal reflectance of 0.5 must be used for surrounding buildings.

Typical Floor Plans

The GBCSA recognises that in a multi-storey building (such as a high-rise building) there may be typical floor plans i.e. floor plans that have exactly the same perimeter wall construction, configuration/layout and size.

Submission of typical floor plans is acceptable in place of separate drawings for each floor, provided that compliance with the credit criteria will not vary per floor. Where typical floor plans are used, the following documentation should be submitted:

- A brief description within the Daylight Report motivating that compliance with the credit criteria will not vary per floor represented by the 'typical floor' plan(s).
- 'Typical floor' plan drawing(s) clearly marked and named as such, showing compliance with the documentation requirements for 'Tender / As Built drawings'.

Daylight Factor method

The Daylight Factor (DF) describes the proportion of internal illuminance over external illuminance, expressed as a percentage.

$$\text{Daylight Factor} = \frac{\text{Internal Illuminance (lux)}}{\text{External Horizontal Illuminance (lux)}} \times 100\%$$

The external horizontal illuminance is from a point with an unobstructed hemispherical view of the sky.

The Daylight Factor is a useful method for benchmarking the effectiveness of a design, because it measures the proportion of daylight entering a building and is not climate specific. A typical external horizontal illuminance might be 10,000 lux for many parts of South Africa. A space achieving a daylight factor of 2.5% means that internal light levels average 250 lux at this particular outside lighting level.

Daylight Factor is most commonly calculated using a CIE (Commission International de l'Eclairage) Overcast Sky. However, Green Star SA recommends the use of a Uniform Sky because it allows easier comparison with the Daylight Illuminance method. Calculation using a CIE Overcast Sky is acceptable, but note that this method will usually give lower results than

IEQ-4 Daylight

POINTS
AVAILABLE **3**

that calculated using a Uniform Sky. Note that if software does not have a pre-set option for a Uniform Sky, it can often be set up manually.

With a Uniform Sky, no matter where in the sky you look, the sky has the same illuminance value. The shading effect of the immediate surrounding building and any obstructions still have to be taken into account

Daylight Illuminance method

The Daylight Illuminance (DI) levels must be simulated at 12 noon on the equinox (21st March/September) using a Clear Sky. Light levels above 250 lux can count towards the credit.

The Clear Sky illuminance levels for the particular location used in the simulation, should represent a horizontal illuminance level that is exceeding 85% of the time between the hours of 8am and 6pm throughout the working year. Note that this can be done via either adapting the sky data itself or adjusting the results as a ratio of the sky condition used to what would represent 85%.

Daylight Autonomy

The Daylight Autonomy (DA) at a point of interest in a building is defined as the fraction of the occupied times per year, when the required minimum illuminance level at the point can be maintained by daylight alone.

The Daylight Autonomy model can be done assuming that all shading devices are static, including all blinds. Blinds can be assumed to be open. The climate data, used must be the same as used in Ene-1 'Greenhouse Gas Emissions'. Time intervals must be set at intervals of no more than one hour.

An incremental Daylight Autonomy method is to be used in confirming compliance with this credit. Project teams may not make use of a continuous Daylight Autonomy method to confirm compliance.

There are a number of dynamic simulation software programs that can be used to show compliance with the credit criteria. Daysim, ESP-r, Lightswitch Wizard, and SPOT (> ver 4.0) can be used. Alternative software may be used, after successful submission of a CIR showing that the results are similar to that of the listed software.

Occupied Hours

For the purposes of Daylight Autonomy modelling, all projects other than basic education buildings must choose a 9 hour window between the hours of 7am and 7pm in which the analysis should be applied. Basic education buildings must choose a 7 hour window between the hours of 7am and 4pm in which the analysis should be applied.

CIE Design Sky

Figure IEQ-4.1 illustrates the various CIE design skies that are used for daylight modelling. For the purposes of Green Star SA, the Daylight Factor method must be used with either the Overcast Sky or Uniform Sky, however for the Daylight Illuminance method, a Clear Sky must be used.

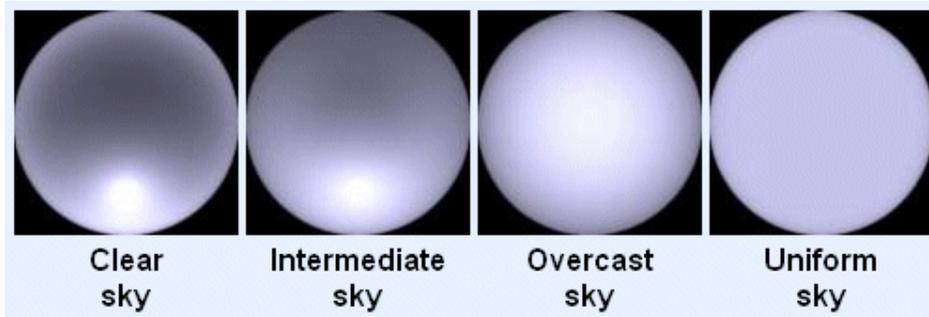
IEQ-4 DaylightPOINTS
AVAILABLE**3**

Figure IEQ-4.1: Illustration of the different CIE design skies.

Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building.

BACKGROUND

The sun has been used for centuries to light building interiors during the day but many buildings today tend to place great emphasis on artificial lighting. However; studies are now starting to show that the increased reliance on artificial lighting is having a detrimental impact on occupant health and wellbeing. A significant body of research has begun to document the impact of natural light in schools and on students.

In educational environments, the research consistently indicates that students in classrooms with access to natural light perform better in all academic fields than students without natural light at the same school. The advantage of using students as a case study is that generally the benchmarks are identical, allowing a reasonable degree of comparison in performance.

International research has also found that students studying in environments with natural light have better attention rates, are less prone to being distracted or disruptive and have better overall health than fellow students in artificially lit rooms.

The impact of circadian rhythms on our productivity and health is well documented. These rhythms are based on the body's understanding of the time of day, which is driven by access to daylight. The natural changes in light that occur over the course of the day drive the circadian rhythms and remind the body that it is not evening.

Whilst most of the current research has been developed for school environments, the general improvements observed are considered relevant to improving the occupant health and wellbeing of residential occupants.

Natural lighting is not without its issues. These include glare, overheating, variability and privacy issues. Effective natural daylighting can be achieved through the strategic placement of skylights and windows and use of intelligent artificial lighting controls which monitor and respond to available daylight levels to maximise natural lighting without compromising day-to-day comfort.

IEQ-4 DaylightPOINTS
AVAILABLE **3**

Daylight Autonomy has been included as an indicator as it provides a more accurate representation of the availability of daylight in a space throughout the year and recent advances in software development is making the extensive simulations required to determine the DA more accessible to projects. In combination with ray tracing software, light bouncing interventions (complex or simple) can now be reflected in a design to a level of accuracy compared to other indicators. This is particularly relevant in predominantly sunny climates like South Africa where energy and indoor environmental quality performance can benefit significantly through optimisation of daylight within buildings.

Per the reference indicated below, the DA method, metric and threshold has been taken from the Daylight Metrics project final report, part of the Public Interest Energy Research (Pier) End-Use Energy Efficiency Program for the California Energy Commission. The report proposes a spatial Daylight Autonomy Metric at 300 lux for 50% of the occupied time on the basis of the percentage of these hours where the 300 lux is exceeded. This is in effect what some software and research considers to be incremental Daylight Autonomy as opposed to continuous Daylight Autonomy which also considers the partial contribution of hours where less than 300lux is achieved. The percentage area achieving this to obtain 1,2 or 3 points for this credit correlates with the existing thresholds in other Green Star SA tools.

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1999), Daylighting and Window Design
<http://www.cibse.org>

Baker, N & Steemers, K 2002, Daylighting Design of Buildings, James & James, London.
Illuminating Engineering Society of Australia (2001), Skylight Availability in Australia – data and their application to design, Dr Nancy Ruck.
<http://www.iesanz.org/>

International Energy Agency (2000), Daylighting in Buildings
<http://www.iea.org/>

British Standard BS 8206: Part 2: 1992, Lighting for Buildings: Code of Practise for Daylighting
<http://www.bsi-global.com>

Public Interest Energy Research (Pier) Program for the California Energy Commission – Daylight Metrics: PIER Daylighting Plus Research Program – February 2012
http://www.h-m-g.com/DaylightPlus/Daylight_Metrics.htm

IEQ-5 Daylight Glare ControlPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise buildings that are designed to reduce the discomfort of glare from natural light.

CREDIT CRITERIA

One point is awarded where:

- It is demonstrated that glare from daylight is reduced through either, or any combination, of the following:
 - Fixed shading devices that shade the working plane at desk height (720mm AFFL), 1.5m in from the centre of glazing, from direct sun for 80% of standard working hours; OR
 - Blinds or screens, fitted as a base building provision, which meet the following criteria:
 - i. Eliminate 95% of all direct sun penetration;
AND
 - ii. Have a visual light transmittance (VLT) of <10%;
AND
 - iii. Can be controlled by occupants.

For the purpose of this credit '**Nominated Area**' is **Occupied Space**.

DOCUMENT REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) Additionally where fixed shading devices used: <ol style="list-style-type: none"> 3. Glare analysis report Additionally where internal blinds/screens used:	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) Additionally where fixed shading devices used: <ol style="list-style-type: none"> 3. Glare analysis report Additionally where internal blinds/screens used:

IEQ-5 Daylight Glare ControlPOINTS
AVAILABLE**1**

4. Extract(s) from tender documentation	4. Statement of confirmation 5. Manufacturer product datasheet(s)
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Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Identifying all spaces within the Nominated Area where glazing elements are provided and glare is to be controlled; and
- Nominating the solution(s) used to minimise glare in each space;

Additionally where internal blinds/screens are used:

- Confirming that the blinds/screens are provided within the scope of the Base Building works, the blinds/screens have compliant VLT and that occupants can control the operation of the blinds/screens.

Tender / As Built drawing(s) marked up to clearly demonstrate:

- All applicable glazing as identified in the short report;
- The glare control solution(s) used for each typical glazing system;

Additionally where fixed external shading devices used;

- Detail drawings indicating all applicable details used within the Glare analysis report.

Glare analysis report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing the methodology and/or modelling software used to complete the glare analysis;
- Describing the building model(s) including key information pertaining to the fixed external shading devices;
- Confirming the height above finished floor level and the distance in from the façade used for the calculation point(s);
- Confirming the hours of analysis used; and,
- Demonstrating that the Credit Criteria is met for each glazing element analysed.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The provision of internal blinds/screens, stipulating a VLT of less than 10%; and that the blinds/screens must have the ability to be controlled by occupants

Statement of confirmation in the form of signed correspondence from the Contractor confirming the type, quantity and location of the glare control devices installed in the building.

Manufacturer product datasheet(s) from the blind/screen manufacturer for each blind/screen product indicating the visual light transmittance (VLT) of each.

IEQ-5 Daylight Glare Control

POINTS
AVAILABLE

1

ADDITIONAL GUIDANCE

The glare control devices must be provided by the Building Owner within the scope of the Base Building works to meet the Credit Criteria. Projects can use a combination of fixed external shading devices and internal blinds, with different systems on each orientation, to achieve this credit.

Fixed shading

The typical glazing system on the façade must be analysed, demonstrating that it shades the stipulated proportion of the Nominated Area for at least 80% of standard working hours throughout the year.

Occupant controlled blinds/screens

The documented blinds/screens must meet all of the following requirements:

- Be provided by the Base Building Owner/Developer;
- Have a VLT of less than 10%; and,
- Can be controlled by occupants.

All base-building fixed external glare control devices must be included in the daylight modelling if IEQ-4 'Daylight' credit is claimed.

As glare can be experienced from any orientation, all facades must meet the Credit Criteria regardless of the orientation.

For Green Star SA credits, viewing facades are defined as any part of the building's façade through which occupants can view the external environment.

Blinds located within the window frame (and between panes) are deemed internal blinds.

Standard working hours are typically from 08:00 until 17:00 weekdays only. These hours should be used by default in the daylight calculations. Should the standard working hours not reflect the reality of the building (i.e. the building has different opening hours), the hours used for this credit can be changed provided they are 9 consecutive hours during which the sun is up.

BACKGROUND

While daylight is generally accepted as beneficial by improving the internal environment and saving on artificial lighting energy, it can also cause significant glare problems. The provision of blinds can overcome this problem by offering occupant control to deal with local glare.

Direct sunlight or patches of sunlight on internal surfaces, including reflections of windows on computer screens, can cause discomfort due to glare. Although a subjective and complex

IEQ-5 Daylight Glare ControlPOINTS
AVAILABLE**1**

phenomenon, much of the research into the physiological basis of glare indicates that there are certain common factors influencing the levels of discomfort and/or visual impairment associated with glare including:

- Contrast between the luminance level of the light source and ambient/background luminance;
- Contrast between ambient/background luminance and the luminance/illuminance of the task;
- Reflections;
- Size and number of glare sources;
- Length of time that the glare source is present; and
- Relative position of the glare source in the field of view.

Shading is essential in preventing glare caused by direct sunlight. Research proves that conventional internal blinds are only marginally effective, and hence this credit requires fixed or automated (with manual override) shading.

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1999), *Daylighting and Window Design*
<http://www.cibse.org>

IESNA (Illuminating Engineering Society of North America) (1993), *Lighting Handbook, 9th edition, Reference & Application*
<http://www.iesna.org>

IEQ-6 High Frequency Ballasts

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-7 Electric Lighting LevelsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise building lighting that is not over designed.

CREDIT CRITERIA

One point is awarded where for 95% of the Nominated Area:

- The lighting design achieves a maximum maintained illuminance level of no more than 80% of the illuminance levels prescribed in SANS 10114-1:2005.

For the purpose of this credit 'Nominated Area' is defined as Occupied Space with the exception of display areas and performance area (stage).

DOCUMENT REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> Short report Extract(s) from tender documentation Tender drawing(s) Illuminance analysis report(s) 	<ol style="list-style-type: none"> Short report As Built drawing(s) <p>Additionally where compliance demonstrated through design implementation:</p> <ol style="list-style-type: none"> Illuminance analysis report(s) <p>Additionally where compliance demonstrated through commissioning measurement:</p> <ol style="list-style-type: none"> Extract(s) from Commissioning Report(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Providing a tabulated summary of all occupied spaces indicating the area of each, the quantity and type of all luminaires within the space, the applicable maintained illuminance level according to SANS 10114-1:2005 and the 80% threshold;

Additionally for Design rating or compliance demonstrated through design implementation (As Built rating):

IEQ-7 Electric Lighting Levels

POINTS
AVAILABLE **1**

- The maximum maintained illuminance level as determined from the illuminance analysis report for each space;
- Confirming that the Credit Criteria are met.

Additionally where compliance demonstrated through commissioning measurement (As Built only):

- Describing the details of measurement method used;
- Providing a tabulated summary of all the measurements taken within each space;
- Indicating on figures within the short report, or on the as built drawings, the location of all measurements; and,
- Confirming that the Credit Criteria are met.

Tender / As Built drawing(s) for each typical ceiling layout, marked up to demonstrate the location and type of all applicable luminaires.

Illuminance analysis report(s) prepared by a suitably qualified professional, for each space type modelled/analysed, clearly indicating:

- The program/software used to complete the modelling/analysis;
- The form and dimensions of the modelled space, and the location of all luminaires;
- The surface reflectance values, the analysis plane height and the calculation grid dimensions;
- The maximum maintained illuminance levels at all calculation points within the space and the maximum maintained illuminance level for the space.

Extract(s) from Commissioning Report(s) demonstrating:

- That the lighting system has been commissioned and operates as intended by the design;
- The values of all measurements taken within each space during commissioning, clearly demonstrating compliance with the credit criteria; and
- Confirming that all measurements were taken at the reference surface area as stipulated in SANS 10114-1:2005.

ADDITIONAL GUIDANCE

It must be clearly demonstrated that the documentation accurately reflects the entire design, even if only typical lighting layouts are documented. In addition to documenting the design, projects can demonstrate compliance through measurements during the commissioning process.

IEQ-7 Electric Lighting Levels

POINTS
AVAILABLE **1**

Where compliance is demonstrated via measurement, all submissions must provide measurements on a grid of no more than 1m x 1m, with all measurements taken at least 0.5m away from a window on a reference surface area as stipulated in SANS10114-1:2005.

Maintained illuminance refers to the average illuminance of a light fitting over its lifetime (dust and other factors taken into account). The eligible maintained illuminance level as per credit criteria is the maximum (at any point), not average (over a floor or space) value for maintained illuminance.

Full lighting capacity (not dimmed) must be included in calculations. Green Star SA assesses the capacity of a building's attributes to reduce its environmental impact; allowing for greater luminance levels does not meet the aim of this credit because tenant operations and/or behaviour can reverse the effort of the commissioning and utilise the full capacity of the design.

Note that it is the project team's responsibility to ensure that and applicable statutory legislation is adhered to. For space types where 80% of the illuminance level prescribed in SANS 10114-1:2005 would result in an illuminance level below that prescribed by the Occupational Health & Safety Act (OHS Act 1993), then the OHS act levels may be used to meet compliance.

BACKGROUND

Lighting luminance levels are an important factor in determining occupant wellbeing and health in public buildings. Lighting that is too dim or too bright can cause discomfort and strain for public building occupants.

A building owner and lighting designer usually provide standard lighting before the space has a tenant and the usage of the space is known. This often results in ceiling mounted light fittings being used to provide an illumination level suitable for reading almost everywhere, even though only about 5–10 percent of the spaces will require this lighting level. There are two main references to design lighting levels in South African standards.

The Occupational Health & Safety Act (OHS Act 1993)

The Occupational Health & Safety Act (OHS Act 1993) sets absolute minimum lighting levels in various spaces in order to ensure the safety of occupants. Table IEQ-7.1 outlines the levels defined for various space types.

It is the project team's responsibility to determine with the local authorities which classification should be used for each space in the building to ensure compliance with the OHS Act.

SANS10114-1:2005 Interior Lighting

Makes reference to the OHS Act, and also makes recommendations for design lighting levels. Note that while compliance with the OHS Act is mandatory, compliance with SANS10114-1 is not.

For the majority of space types found in public buildings there is a difference between the absolute minimum illumination levels, as per OHS Act, and recommended minimum light

IEQ-7 Electric Lighting LevelsPOINTS
AVAILABLE **1**

levels, as per SANS 10114-1:2005, which gives room to design illuminance levels that fall within this band, see Table IEQ-7.1.

Building Type	Space Type	OHS Act	SANS 10114
Educational Building	Classrooms (classroom)	200 lux	300 lux
Court	Court Room (assembly hall)	300 lux	500 lux
Library	General Work Areas	100 lux	300 lux
Office	Reception Areas (reception)	100 lux	200 lux
Office	Conference Rooms / General Offices / Typing and Filing	300 lux	500 lux
Office	Computer and Business Machine Operation	500 lux ¹	500 lux

Table IEQ-7.1: Examples of prescribed illuminance levels in OHS Act 1993 and SANS 10114-2005

Note¹ : See 'International Standards' below

International Standards

Many international standards now recognise that when most occupants in an office are using computers with modern screens, significantly lower light levels than 500 Lux can be comfortable. This then allows significant savings in energy consumption.

CIBSE Lighting Guide 7 (Office Lighting) 2005 recommends light levels of 300 Lux for purely screen based work or 500 Lux for mixed or mainly paper-based tasks. The standard also stresses the importance of reducing glare and the benefits of indirect lighting and illuminating the surfaces of the office (i.e. walls and ceiling) to minimise contrast.

REFERENCES & FURTHER INFORMATION

CIBSE Lighting Guide 7 (Office Lighting) 2005

<http://www.cibse.org>

The Occupational Health & Safety Act (OHS Act 1993)

<http://www.acts.co.za/ohs/index.htm>

SANS10114-1:2005 Interior Lighting

<http://www.sabs.co.za>

IEQ-8 External ViewsPOINTS
AVAILABLE **2****AIM OF CREDIT**

To encourage and recognise designs that provide occupants with a visual connection to the external environment.

CREDIT CRITERIA

Up to two points are awarded where:

- A minimum percentage of the Nominated Area has a direct line of sight to the outdoors or into an adequately sized and day-lit atrium, awarded as follows:
 - 60% for one point;
 - OR
 - 80% for two points.

For the purpose of this credit '**Nominated Area**' is defined as **Occupied Space** with the exception of theatres, cinemas, performance areas (stages), galleries, and other spaces that for functional reasons do not allow daylight.

DOCUMENT REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) Additionally where compliance is achieved through use of atria: <ol style="list-style-type: none"> 3. Daylight report 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) Additionally where compliance is achieved through the use of atria: <ol style="list-style-type: none"> 3. Daylight report

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Providing calculations of the total Nominated Area within eight metres of vision glazing and compliant day lit atrium; and

IEQ-8 External ViewsPOINTS
AVAILABLE **2**

- Providing a summary table demonstrating that compliant nominated area jointly accounts for the stipulated percentage of the nominated area.

Tender / As Built drawings marked-up and including:

- Floor plans marked up to show the location of vision glazing and all Nominated Area within eight metres of vision glazing or daylight atrium and indicating sight lines where relevant;
- Elevation drawings showing the location and dimensions of vision glazing.

Daylight report prepared by a suitably qualified professional, in accordance with the requirements of IEQ-4 Daylight credit, that confirms that the daylight compliance thresholds for the IEQ-4 credit are achieved within the atrium for the claimed percentage of atrium area.

ADDITIONAL GUIDANCE**External views**

Where compliance is achieved through external views, the following must be achieved:

- The view must extend from the perimeter of the building unblocked by solid structures (i.e. there must not be another building within eight metres);
- The area behind any solid portion of the perimeter of the external wall or atrium must be excluded from the calculations; and
- The sight line is to be measured by extending a perpendicular line from the atrium or window; a line at 45 degrees can be used at the corners of atria or windows, as per Diagram IEQ-8.1. Sight lines must take into account thickness of external walls (there must be a clear line of sight to the outside).

IEQ-8 External Views

POINTS
AVAILABLE

2

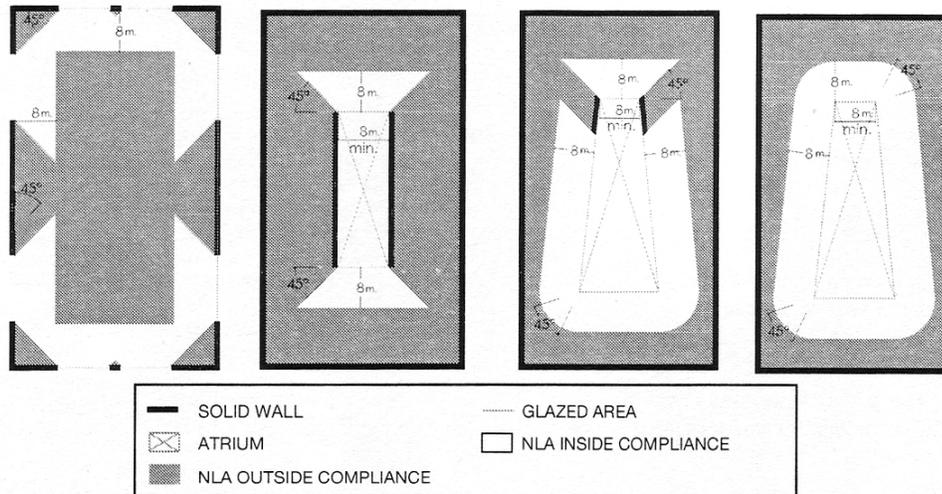


Figure IEQ-8.1: Diagrams illustrating areas that comply with the Credit Criteria given various atria shapes.

Day-lit atrium

Where compliance is achieved through a day-lit atrium, the following must be achieved:

- The atrium must be at least 8 metres wide at any point to which the line of sight is demonstrated;
- The daylight levels within the atrium must be in accordance with the compliance thresholds of the IEQ-4 Daylight credit. See overleaf for details on how to address scenarios where less than 100% of the atrium space is compliant with the IEQ-4 Daylight thresholds.
- If the nominated space opens directly onto the atrium, calculation must be made from the vision glazing or from the internal perimeter of the atrium if no internal glazing is installed;
- The area behind any solid portion of the atrium perimeter must be excluded from the calculations;
- The base of the internal atrium is considered to be at the lowest level of the occupied space (even if the actual base of atrium is several floors lower); and
- The sight line is to be measured by extending a perpendicular line from the atrium/window. A line at 45 degree can be used at the corners of atrium/windows. Sight lines must take into account thickness of external walls (there must be a clear line of site to the outside).

Vision glazing does not include windows below 720mm or above 2400mm AFFL. Skylights are therefore not classed as vision glazing.

IEQ-8 External ViewsPOINTS
AVAILABLE **2**

If the Nominated Area opens directly onto the atrium (i.e. no internal glazing is installed), then the internal perimeter of the atrium may be used for the calculations.

Proportioning of Atrium daylight compliance:

Project Teams may apply a 'proportional-based' method to determining compliant external views claimed from an appropriately sized day-lit atrium. This method correlates the daylight compliant percentage of the horizontal plan area (at the level/floor analysed) of the atrium (at a particular level) with the compliant views claimed.

Where X% of the adequately sized day-lit atrium horizontal plan area is adequately day lit in accordance with the compliance thresholds from the IEQ-4 Daylight credit, then only X% (i.e. the same percentage) of the maximum compliant UA external view for that floor (determined from the atrium perimeter), may be claimed.

For example, a building has three identical floors (680m² nominated area each) with a adequately sized atrium. An analysis of the maximum external view nominated area claimed due to the atria (only) on each floor indicates compliant nominated area of 100m² on each floor. Daylight modelling indicates that on the top level, 94% of the horizontal plan area of the atria achieves the compliance thresholds from the IEQ-4 Daylight credit, and on the middle level this reduces to 68% and on the lower level this reduces to 51%. Using the proportional-based method, the external view nominated area which may be claimed for the top floor is 100 x 94% = 94m², the middle floor 100 x 68% = 68m² and the lower floor 100 x 51% = 51m².

BACKGROUND

There is increasing evidence that eyestrain and related health problems can be significantly reduced in situations where the eyes can be refocused periodically on a distant object. This is easier to achieve where there is a nearby window with a view out. This is especially important where occupants spend significant periods of time in front of computer monitors or closely studying paperwork as in a typical public building.

REFERENCES & FURTHER INFORMATION

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1999), Publications – *Daylighting and Window Design*
<http://www.cibse.org>

Queensland University of Technology (2001), *Modification of Atrium Design to Improve Thermal and Daylighting Performance*

IEQ-8 External Views

POINTS
AVAILABLE **2**

<http://adt.library.qut.edu.au/adt-qut/uploads/approved/adt-QUT20020326.155817/public/01front.pdf>

IEQ-9 Thermal ComfortPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise buildings that achieve a high level of thermal comfort.

CREDIT CRITERIA

Up to two points are awarded where a high level of thermal comfort is achieved for the occupied area on an area-weighted basis:

Mechanically Ventilated Spaces, Mixed Mode and Naturally Ventilated Spaces

Up to two points are awarded where:

- The Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730 using standard clothing and metabolic rate values, are within the following limits for at least 98% of occupied hours:
 - One point for PMV levels between -1 and +1 (inclusive);
 - OR
 - Two points for PMV levels between -0.5 and +0.5 (inclusive).

Naturally Ventilated Spaces

An alternate method to show compliance is available in naturally ventilated spaces.

Up to two points are awarded where:

- Internal operative temperatures are within the *ASHRAE Standard 55-2004 Acceptability Limits* for at least 98% of occupied hours, awarded as follows:
 - One point for meeting the 80% *Acceptability Limits*;
 - OR
 - Two points for meeting the 90% *Acceptability Limits*.

For the purpose of this credit '**Nominated Area**' is defined as **Occupied Space**.

DOCUMENT REQUIREMENTS

Green Star SA – Public and Education Building PILOT Design	Green Star SA – Public and Education Building PILOT As Built
Submit all the evidence and ensure it readily	Submit all the evidence and ensure it readily

IEQ-9 Thermal ComfortPOINTS
AVAILABLE**2**

confirms compliance.	confirms compliance.
<ol style="list-style-type: none"> 1. Thermal comfort report 2. Tender drawing(s) 3. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Thermal comfort report 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s)

Thermal comfort report prepared by a suitably qualified professional that describes how the credit criteria have been met by:

- Describing the HVAC system (where applicable) and passive design strategies used to achieve thermal comfort;
- Confirming which thermal comfort methodology has been used (i.e. ASHRAE 55-2004 Acceptability Limits or ISO7730 PMV values), with justification for the selection based on the Credit Criteria;
- Describing the software package used for determining thermal comfort levels;
- Describing the weather data used and its source, demonstrating that it complies with the weather data requirements of the Additional Guidance;
- Providing marked-up plan drawings clearly showing the zones modelled for thermal comfort and that no perimeter zone exceeds 4m in depth and 100m² in area;
- Providing a tabulated summary of all zones modelled, indicating the area of each and confirming all of the UA has been included in the analysis;
- Confirming the occupancy schedule and total number of hours assessed for thermal comfort;
- Confirming that all modelling inputs are in exact accordance with the modelling presented in Ene-1 Greenhouse Gas Emissions;

Additionally where ASHRAE 55-2004 Acceptability Limits methodology used:

- Confirming all spaces assessed are provided with openable windows, and not provided with mechanical cooling systems;
- Providing a table of the mean monthly outdoor air temperatures and resulting acceptability range;
- Providing a summary table of all zones assessed for thermal comfort and the hours below, within and above the Acceptability Limits of operative temperatures, clearly demonstrating compliance with the Credit Criteria.

Additionally where PMV ISO7730 methodology used:

- Confirming that the CLO and MET values used are in accordance with the

IEQ-9 Thermal ComfortPOINTS
AVAILABLE **2**

- Additional Guidance;
- Demonstrating that the air velocity value selected is justified for the actual system design.
 - Providing a summary table of all zones assessed for thermal comfort and the hours below, within and above the stipulated PMV levels, clearly demonstrating compliance with the Credit Criteria.

Tender / As Built drawings marked-up to clearly demonstrate

- Plans marked up to indicate all zones assessed for thermal comfort;
- Façade, roof and, wherever relevant, section drawings showing the materials in the design; and
- For naturally ventilated spaces, indicating and dimensioning all ventilation openings, inlets and outlets.

Extract(s) from tender documentation where the thermal properties of all materials that are used as inputs for demonstrating compliance are nominated.

Extract(s) from Commissioning Report(s) demonstrating that the HVAC system of the building has been commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

All inputs into the modelling or calculations (e.g. building form, materials and air conditioning system(s) etc.) must be referenced consistently throughout the rest of the submission (i.e. in related credits such as Ene-1 'Greenhouse Gas Emissions' or IEQ-1 'Ventilation Rates') and be clearly justified by the documented design (for Green Star SA –Public Building Design assessment) or by the as built evidence (for Green Star SA – Public Building As Built assessment).

On-site thermal comfort measurement is not an acceptable way to demonstrate compliance with the Credit Criteria.

ASHRAE 55-2004 Adaptive Comfort Temperatures

The ASHRAE guide defines a range of temperatures which are deemed comfortable for a naturally ventilated space, where occupants have control over openings. These depend on the mean monthly outside air temperature, based on the fact that people living in warmer areas can tolerate higher internal temperatures than those living in cold areas. An approximate summary of the data is as follows:

Mean monthly outdoor temp °C	Min temp (80% acceptability) °C	internal (80% acceptability)	Min temp (90% acceptability) °C	internal (90% acceptability)	Max temp (90% acceptability) °C	internal (90% acceptability)	Max temp (80% acceptability) °C	internal (80% acceptability)
10	17.5		18.5		23.5		24.5	
15	19		20		25		26	
20	20.5		21.5		26.5		27.5	
25	22		23		28		29	
30	23.5		24.5		29.5		30.5	

Table IEQ-9.1: Adaptive Comfort Temperatures as defined in ASHRAE 55-2004

These internal temperatures are 'operative' internal temperatures, defined in ASHRAE Fundamentals 2001. For occupants not sitting in direct sunlight, this can be approximated as the mean of the air temperature and the mean radiant temperature.

ISO7730

The purpose of the ISO 7730 standard is to present a method for predicting the thermal sensation and the degree of discomfort (thermal dissatisfaction) of people exposed to moderate thermal environments and to specify acceptable environmental conditions for

IEQ-9 Thermal ComfortPOINTS
AVAILABLE **2**

comfort. It applies to healthy men and women and was originally based on studies of North American and European subjects but agrees also well with recent studies of Japanese subjects and is expected to apply with good approximation in most parts of the world. It applies to people exposed to indoor environments where the aim is to attain thermal comfort, or indoor environments where moderate deviations from comfort occur.

The Predicted Mean Vote (PMV) is an index that predicts the mean value of the votes of a large group of persons on the following 7-point thermal scale:

PMV (Predicted Mean Vote)	PPD (Predicted Percentage Dissatisfied)	Thermal Scale
+3		hot
+2	70%	warm
+1	25%	slightly warm
0	5%	neutral
- 1	25%	slightly cool
- 2	70%	cool
- 3		cold

Table IEQ-9.2: PMV index

The PMV index can be determined when the activity (metabolic rate) and the clothing (thermal resistance) are estimated, and the following environmental parameters are measured:

- Air temperature;
- Mean radiant temperature;
- Relative air velocity; and
- Humidity.

A PMV of between –1 and +1 corresponds to a Predicted Percent Dissatisfied (PPD) of no more than 25% (i.e. 25% of people are dissatisfied or uncomfortable). A PMV of between –0.5 and +0.5 corresponds to a PPD of no more than 10%. Note that when the PMV is zero, there are still 5% of occupants dissatisfied or uncomfortable, which illustrates the point that it is impossible to have ‘perfect’ comfort conditions since different people have different preferences.

Building properties

Building properties shall be assigned in the model as defined in the Green Star SA – Public Building PILOT Energy Calculator.

Model zoning

IEQ-9 Thermal ComfortPOINTS
AVAILABLE **2**

Perimeter zones of four meters or less from the façade shall be modelled independently to prevent averaging of heat fluxes and temperatures from invalidating the results. No perimeter zone may be larger than 100m².

Operating schedules

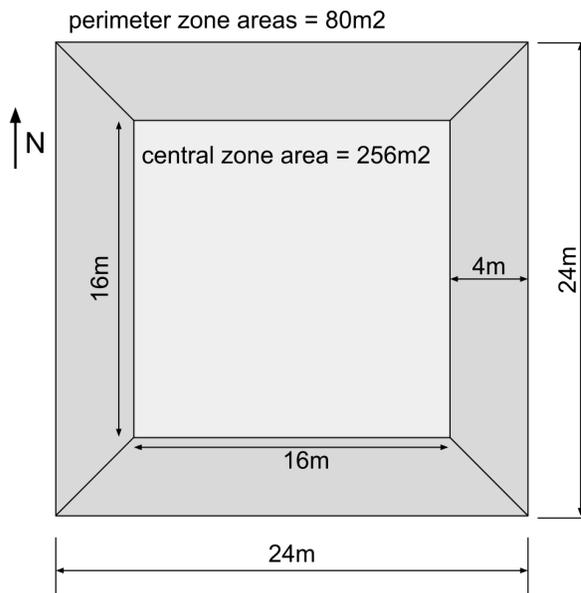
Should operating schedules of HVAC equipment be used as part of the energy performance or thermal comfort strategy (e.g. night flushing of the building), the actual HVAC plant operating schedules for the related equipment as supported by tender documentation (Design) or commissioning data (As Built) may be used for the thermal comfort model. Please note that if any overrides over timer-based controls are included in the system (e.g. CO₂ or temperature overrides) these should be accounted for accurately or assumptions conservatively justified – alternatively the HVAC plant operating schedules in the Energy Modelling Protocol should be used.

IEQ-9 Thermal Comfort

POINTS AVAILABLE **2**

Area weighting

Area weighting is to be done as a post process whereby resultant compliant and non-compliant hour totals for each zone are to be weighted based on their floor area. An example of this is included, based on the single-floor building shown below:



Below is an example of a building that meets the credit criteria for this credit:

Zone	Area	Hours below PMV = -0.5 (using CLO= 0.95)	Hours within PMV -0.5 to 0.5	Hours above PMV = 0.5 (using CLO= 0.6)	Percentage hours within PMV thresholds	Area weighted hours within PMV thresholds
Central zone	256	7	3180	13	99.4%	1 413
North perimeter	80	24	3161	15	98.8%	439
South perimeter	80	87	3113	0	97.3%	432
East perimeter	80	9	3158	33	98.7%	439
West perimeter	80	13	3132	55	97.9%	435
TOTAL	576					3 158
TOTAL WEIGHTED RESULT						98.7%
Total hours in schedule	3200	Compliant with credit criteria?				Yes

Below is an example of a building that does not meet the credit criteria for this credit:

Zone	Area (m ²)	Hours below PMV = -0.5 (using CLO 0.95)	Hours within PMV -0.5 to 0.5	Hours above PMV = 0.5 (using CLO 0.6)	Percentage hours within PMV -0.5 to 0.5 (%)	Area weighted hours within PMV limits
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IEQ-9 Thermal ComfortPOINTS
AVAILABLE**2**

Central zone	256	17	3143	40	98.22%	1 397
North perimeter	80	106	3007	87	93.97%	418
South perimeter	80	139	3044	17	95.13%	423
East perimeter	80	42	2997	161	93.66%	416
West perimeter	80	31	2982	187	93.19%	414
TOTAL	576					3 068
TOTAL WEIGHTED RESULT						95.87%
Total hours in schedule	3200		Compliant with credit criteria?			No

Weather data

A Test Reference Year's (TRY) worth of weather data must be used to calculate hourly thermal comfort values for each location where one is available. Where no TRY is available, the applicant will be expected to demonstrate that the weather data is typical of that locality.

Standard variables

Standard Hours of Occupancy are defined in the Green Star SA – Public Building PILOT Energy Calculator.

When using the Predicted Mean Vote thermal comfort model:

Variable	Value	Notes
Warm condition CLO	0.6	For determining frequency of PMV > 0.5 or PMV > 1
Cold condition CLO	0.95	For determining frequency of PMV < -0.5 or PMV < 1
Met	1.2	1 Met = 58.2W/m ² [ISO 7730, p. 3]
Air velocity	0.14 m/s	Typical value representative of an artificially ventilated space. [ASHRAE-55 p.8]

Using alternative air velocities

If a non-standard air velocity is used (such as in the case of natural ventilation or the implementation of ceiling fans), it must be justified with supporting documentation.

IEQ-9 Thermal ComfortPOINTS
AVAILABLE **2****BACKGROUND**

Most buildings are designed using air-temperature design conditions. Whilst this metric is the most easy to measure for the determination of comfort, it is often a poor indicator of how comfortable spaces actually are. This is because the sensation of comfort is based on a wide range of parameters, which include air temperature, mean radiant temperature, humidity, air movement, clothing levels and metabolic rates.

Some examples of where one might feel uncomfortable, despite ambient conditions of 21-24°C include:

- Feeling too hot in direct sun on a 22°C day;
- Feeling cold from the draught in an air conditioned office; and
- Feeling hot in an air conditioned car on a very hot day.

This credit aims to encourage projects to design for comfort, rather than temperature. To assist, there is an international standard (ISO7730) that was developed to measure thermal comfort, rather than temperature, to assess the comfort of building occupants.

REFERENCES & FURTHER INFORMATION

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) (2004),
ASHRAE 55P – *Thermal Environmental Conditions for Human Occupancy*
<http://www.ashrae.org/publications>

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) (1997),
ASHRAE Fundamentals Handbook 1997
<http://www.ashrae.org/publications>

CIBSE (Chartered Institution of Building Services Engineers, U.K.) (1992), Standard 55-1992 -
Thermal environmental conditions
<http://www.cibse.org>

ISO (International Organisation for Standardisation). ISO7730: *Moderate thermal environments – Determination of the PMV and PDD indices and specification of the conditions for thermal comfort*
<http://www.iso.org/iso/en/ISOOnline.frontpage>

IEQ-10 Individual Comfort Control

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise actions taken to reduce health risks to occupants from the presence of hazardous materials.

CREDIT CRITERIA

One point is awarded where:

- A comprehensive hazardous material survey has been carried out on the project site, as defined by the South African Occupational Health and Safety (OH&S) Act;
- AND
- Wherever asbestos, lead or polychlorinated biphenyls (PCBs) were found, they have been removed in accordance with the standards listed under Table IEQ-11.1.

Where no buildings or structures existed at the time of site purchase, or for refurbishments or redevelopments where none of the above hazardous materials were found, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Indoor Environment Quality Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Hazardous materials survey report Additionally where applicable hazardous materials were found: <ol style="list-style-type: none"> 2. Hazardous materials survey report <u>OR</u> 3. Extract(s) from contract Where no existing buildings or structures were present: <ol style="list-style-type: none"> 4. Short report 	<ol style="list-style-type: none"> 1. Hazardous materials survey report Additionally where applicable hazardous materials were found: <ol style="list-style-type: none"> 2. Hazardous materials survey report <u>OR</u> 3. Disposal receipts Where no existing buildings or structures were present: <ol style="list-style-type: none"> 4. Short report

IEQ-11 Hazardous Materials

POINTS
AVAILABLE **1**

Hazardous materials survey report prepared by a suitably qualified professional demonstrating how the Credit Criteria have been met by:

- Describing the hazardous material survey scope (i.e. what buildings or structures are included);

Where survey completed and hazardous materials identified:

- Detailing in a tabulated summary, all hazardous materials identified as present within all existing buildings and/or structures on the project site;

Where survey completed and no hazardous materials identified:

- Confirming that no asbestos, lead and/or PCBs were identified in any existing buildings and/or structures on the project site.

Additionally where post-decontamination hazardous material survey completed:

- Confirming there is no longer any asbestos, lead and/or polychlorinated biphenyls present within the project site; and
- Confirming that all hazardous materials identified in the initial 'Hazardous Material Survey Report' have been removed and disposed of in accordance with standards listed under Table IEQ-11.1.

Short report prepared by a relevant project team member describing how the credit is not applicable with reference to supporting evidence (e.g. aerial survey, site plan etc.).

Extract(s) from contract between the Building Owner and Contractor (or Sub-Contractor) clearly stipulating the removal of the hazardous materials identified in 'Hazardous Materials Survey Report'.

Disposal receipts from the recipient of the hazardous waste confirming the disposal of the identified hazardous materials.

ADDITIONAL GUIDANCE

This credit considers only those hazardous materials which may be present in existing buildings or structures within the project site. Hazardous materials or contaminants present in soil or sub-surface materials are considered in Eco-3 Reclaimed Contaminated Land within the Land Use & Ecology category.

In addition to redevelopments (where existing buildings and/or structures are to be retained within the new development), the IEQ-11 Hazardous Materials credit and compliance criteria is applicable where existing buildings and/or structures located on the project site are to be demolished within the scope of either the main contract, or as a separate demolition contract, for the project. In such cases, the comprehensive hazardous materials survey must be carried out on the project site prior to any demolition works commencing, and where hazardous materials are identified in buildings or structures proposed for demolition, the materials must be removed in accordance with the applicable standards. The above requirement does not

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1**

apply to demolition works that commenced more than two years prior to construction commencement.

The credit can only be deemed 'Not Applicable' whereby it is demonstrated via a hazardous materials survey that no asbestos, lead or PCBs are present in existing buildings or structures within the project site, or where no existing buildings or structures were present at the time of site purchase.

It must be clear from the submitted documentation that the hazardous materials within the scope of the credit will be or have been removed as per the relevant standards or legislation as detailed in Table IEQ-11.1.

Hazardous Materials	Relevant Standards or Legislation
Asbestos	South African National Occupational Health and Safety Act, 1993, National Environmental Management: Waste Act, 2008 and associated regulations.
Lead	South African National Occupational Health and Safety Act, 1993, National Environmental Management: Waste Act, 2008 and associated regulations.
PCBs	South African National Occupational Health and Safety Act, 1993, National Environmental Management: Waste Act, 2008 and associated regulations

Table IEQ-11.1: List of relevant legislation and standards

The disposal receipts must account for all hazardous materials in all locations as identified in 'Hazardous Materials Survey Report'. Where disposal receipts do not account for all hazardous materials in all locations identified, the credit will not be rewarded.

The contract must be counter-signed and demonstrate a contractual obligation by the Contractor or Sub-Contractor to remove the hazardous materials in accordance with the standards and legislation listed in Table IEQ-11.1.

The documentation requirement 'Hazardous materials survey report' may consist of two individual reports; an initial survey report and a post-decontamination report, with the latter referencing the former.

BACKGROUND

Asbestos

Although asbestos is now rarely used in construction, many asbestos-containing products and materials may still be found in existing buildings. These include vinyl asbestos tiles, laboratory table tops, roofing felts, suspended ceiling tiles, and asbestos cement products (including

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1**

pipes, roof and wall cladding). These types of materials do not present a significant health risk unless they are tooled, cut, drilled, sanded or otherwise abraded or machined so as to release asbestos dust.

Sprayed insulation materials containing asbestos may occur throughout buildings and other structures, especially those built from the 1950s to the mid-1980s. Such buildings will often have asbestos used in sprayed-on fireproofing/soundproofing/thermal insulation, and acoustic plaster soundproofing.

Asbestos is composed of many very small fibres. Because they are very fine, when they become airborne the fibres are easily inhaled or swallowed. When they are inhaled, the lung's defence cells try but cannot break down or destroy the fibres, which results in the asbestos fibres permanently remaining in the lungs causing scarring and inflammation for decades. This can further cause various lung-based diseases (mesothelioma, asbestosis, lung cancer) which can take up to 40 years to develop.

Asbestos was used extensively in structures such as buildings, processing plants, ships, trains and motor vehicles in the 1950s, 1960s and early 1970s. The known adverse health consequences of asbestos exposure dictate that some control is required.

Polychlorinated Biphenyl (PCBs)

Polychlorinated biphenyls (PCBs) are covered by the Stockholm Convention on Persistent Organic Pollutants (POPs). The convention provides measures to eliminate or reduce the presence of these materials in the environment.

The convention identified the main PCB uses in industry being within heat exchange fluids; electric transformers and capacitors; and as additives in paint, carbonless copy paper, sealants and plastics. PCBs are most commonly found in the ballasts of fluorescent light fixtures.

A broad range of health problems is associated with exposure to PCBs. These health effects increase with the amount of PCBs and the length of exposure. PCBs accumulate in the body with repeated exposure and are stored in fat tissue and body organs including the liver, kidneys, lungs and brain. PCB exposure can cause:

- Chloracne (a severe, persistent acne-like rash) is the most commonly observed symptom in people exposed to high levels;
- Liver damage;
- Respiratory disorders;
- Thyroid gland disorders;
- Muscle and joint pain, headaches, loss of appetite, nausea, vomiting and abdominal pain;
- Cancer - PCBs are classed as Carcinogen Class 2 (probable human carcinogen); and
- Reproductive problems in animals. These include increased spontaneous miscarriage rates, still births, underweight births and decreased post-natal survival.

When PCBs are exposed to extreme heat they may form dioxins, which are highly toxic.

IEQ-11 Hazardous MaterialsPOINTS
AVAILABLE**1****Lead (Pb)**

Large amounts of lead in the body can cause pain in joints and muscles. Other symptoms of lead exposure include anaemia, nausea headaches, high blood pressure and gastric, sleep and concentration problems. In children, the symptoms of lead exposure can be poor development of motor abilities and memory, reduced attention span, and colic and gastric problems.

Lead is absorbed if dust or fumes that contain lead are swallowed or breathed in. Although small amounts of lead do not cause any specific symptoms, as much as 10% of the lead that enters an adult's body stays there, and so even small amounts can gradually build up in the body.

Lead was also used in paint products. Paints containing as much as 50% lead were used on the inside and outside of houses built before 1950. Until the late 1960s, paint with more than 1% lead was still being used. By 1970, the lead content of paint was limited to 1%. Thus the disturbance or removal of old paint can still create a health hazard to both humans and surrounding soil.

Any amount of lead can be a health risk for pregnant woman because the unborn baby is exposed to lead in the mother's blood. A large amount of lead in the mother's body can cause premature birth, low birth weight, or even miscarriage or stillbirth.

Lead was used for centuries in water pipes, water jugs, and bullets because it is easy to mould into different shapes. However, its use is restricted to products that are not used for food or drink.

REFERENCES and FURTHER INFORMATION

Stockholm Intervention on Persistent Pollutants

<http://www.pops.int>

South African National *Occupational Health and Safety Act*, 1993: various chapters.

<http://www.acts.co.za/ohs/index.htm>

Regulations for the prohibition of the use, manufacturing, import and export of asbestos and asbestos containing materials

<http://www.environment.gov.za/HotIssues/2007/asbestos/asbestos.html>

Sustainable Home Design, Chemical products

<http://www.sustainablehomedesign.co.za/>

National Environmental Management: Waste Act, 2008.

<http://www.info.gov.za/view/DownloadFileAction?id=97351>

Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Department of Water Affairs and Forestry, Republic of South Africa, 1998

http://www.dwaf.gov.za/Dir_WQM/docs/Pol_Hazardous.pdf

IEQ-11 Hazardous Materials

POINTS
AVAILABLE **1**

ANZECC Guidelines Polychlorinated Biphenyls Management Plan
<http://www.environment.gov.au/settlements/publications/chemicals/scheduled-waste/pubs/biphenyls.pdf>

IEQ-12 Internal Noise LevelsPOINTS
AVAILABLE **3****AIM OF CREDIT**

To encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level.

CREDIT CRITERIA

Up to three points are awarded as follows:

Building Services Design

One point is awarded where:

- For a minimum of 95% of the Nominated Area, noise from the building services does not exceed the design equivalent continuous rating levels as set out in SANS 10103:2008.

Overall Building

One point is awarded where:

- For a minimum of 95% of the Nominated Area, the ambient sound level does not exceed the design equivalent continuous rating levels as set out in SANS 10103:2008.

Note: For spaces where a maximum ambient sound level is not provided in SANS 10103:2008, a maximum sound level of 45 dB(a)eq shall apply.

Educational Spaces (only)

An additional point is awarded where:

- Two points (above) are achieved;

AND

- For all classrooms and lecture theatres provided within the building:
 - The total surface area finished with a material with a Noise Reduction Coefficient (NRC) of 0.70 or higher, equals or exceeds the total ceiling area (excluding lights, diffusers and grilles);

OR

- The reverberation time in each space, measured in accordance with (BS EN) ISO 140-4:1998 does not exceed the following values:
 - Classrooms: 0.8 seconds

IEQ-12 Internal Noise LevelsPOINTS
AVAILABLE **3**

- Small lecture theatres (< 50 people): 0.8 seconds
- Large lecture theatres (≥ 50 people): 1.0 seconds

Where no classrooms or lecture theatres are provided within in the building, the additional point is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category score.

For the purpose of this credit '**Nominated Area**' is defined as **Occupied Space**.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Acoustic report 2. Tender drawing(s) 3. Extract(s) from tender documentation Where third point claimed 'Not Applicable': <ol style="list-style-type: none"> 4. Short report 	<ol style="list-style-type: none"> 1. Acoustic report Additionally where confirming noise levels by design implementation: Survey of internal noise levels <ol style="list-style-type: none"> 2. As Built drawing(s) Where third point claimed 'Not Applicable': <ol style="list-style-type: none"> 3. Short report

Acoustic report prepared by a qualified Acoustic Consultant that describes how the Credit Criteria have been met by:

Where compliance demonstrated by design implementation (first & second points):

- Providing a summary of the applicable requirements of SANS 10103:2008 pertaining to equivalent continuous rating levels;
- Describing all relevant internal noise sources and quantified levels from building services, or confirming lack thereof;
- Describing the supporting external noise level measurements and measurement methodology, or justification why external noise level measurements were not required (second point only);
- Describing the noise control features required to achieve the Credit Criteria, with references to relevant supporting documentation;

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- Providing a tabulated summary of Nominated Areas indicating where noise control features are included and compliance with the Credit Criteria is achieved;
- Providing comment on low frequency noise, confirming that this has been considered in the design (if applicable); and,
- Providing a conclusion that supports compliance with the Credit Criteria.

Where compliance demonstrated by design implementation (third point):

- Demonstrating the provision of compliant products to the required surface areas in accordance with the Credit Criteria, with reference to supporting documentation; OR
- Demonstrating through calculation that the reverberation time is in compliance with the Credit Criteria.

Where compliance demonstrated by noise level measurement (As Built only; first & second points):

- Providing a summary table of the Nominated Areas tested and the measured internal noise levels in each space, clearly indicating compliance with the credit criteria;
- Confirming the test methodology used, the conditions under which the testing was done, including the time of testing and confirming that the spaces tested are representative and 'worst case';
- Proving architectural floor plans indicating the location of test points;
- Confirming that all plant and equipment was operating during the test (if applicable), and that the testing was conducted at a time appropriate to the external noise environment;
- Confirming that 95% of the Nominated Area is compliant with the Credit Criteria.

Where compliance demonstrated by noise level measurement (As Built only; third point):

- Providing a tabulated summary of all results of testing with regards to reverberation time, demonstrating compliance with the Credit Criteria; or
- Confirming the products used and areas applied, demonstrating compliance with the Credit Criteria, with reference to supporting documentation.

Tender / As Built drawing(s) clearly marked-up to show, for all Nominated Area, relevant wall and floor constructions and other relevant acoustic details, demonstrating that the noise control features have been incorporated as per the Acoustic report (where required).

Extract(s) from tender documentation clearly demonstrating the contractual requirement:

- For the incorporation/installation of noise control products/features as referenced in the Acoustic Report, with performance requirements, as nominated in supporting documentation.

Short report prepared by a relevant project team member, confirming that the building is not provided with classrooms or lecture theatres.

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AVAILABLE **3****ADDITIONAL GUIDANCE****Acoustic Reports**

The GBCSA offers the following additional guidance for acoustic reports:

- The acoustic consultant must reach a conclusion that supports compliance with the Credit Criteria.
- The data provided in the report must clearly justify the conclusion and account for all constant noise sources (hydraulic and mechanical systems that are both internal and external to the space).
- In most cases, it is in the interest of the project to provide a tabulated summary listing the noise levels in all relevant spaces and comparing them to the values prescribed in the Credit Criteria.

Naturally ventilated spaces

In naturally ventilated buildings it is assumed that mechanical ventilation will not be an issue - therefore, in this instance the Building Services Design point refers to hydraulic services only.

All calculations must be carried out with ventilation openings open and any extract fans running as required for normal operation of the building.

Low frequency noise

For noise from mechanical systems with excessive low frequency energy due to turbulence (rumble), significant annoyance can arise even when the A-weighted sound pressure level is below the recommended value.

Internal noise level measurements

Measurements must be carried out by a suitably qualified acoustic consultant to the applicable sections of SANS 10103:2004 'The measurement and rating of environmental noise with respect to land use, health, annoyance and speech communication'. These measurements must be taken when the building is unoccupied, but with all the building services running as for normal operation of the building.

For the internal noise level measurements of an As Built submission, it is permissible to test a representative floor of a multi-story building with repetitive, identical floor plates and layouts, as long as the worst case of the repetitive floors is tested. The Project Team must clearly demonstrate and justify that the floor tested is "worst case". Any floor with a different floor plan and layout must be tested separately.

Occupants and equipment

Noise from occupants and non-base building services equipment must not be included in the analysis or measurements.

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AVAILABLE **3****External noise level measurements**

For the purposes of this credit, where the second point is claimed, it is expected that external noise level measurements will be carried out during the hours of occupancy of the building when the most significant external noise levels are likely to be experienced (typically during peak traffic hours). It is however at the acoustic consultant's discretion whether an external noise level survey is required for the specific project. Where deemed to not be required, it should however be clearly justified within the Acoustic report as to how the calculations for the second point have been accurately or conservatively addressed without surveyed external noise levels. Where deemed necessary and conducted, external noise levels must be measured on the actual project site and not on a neighbouring site, in order to accurately reflect true conditions. The period of measurement is also at the discretion of the qualified Acoustic Consultant, however must be selected such that all potential sources of noise (of concern) are measured.

Noise reduction materials

Reverberation time requirements can generally be met through the use of sound absorbent materials and other surface. The area specified for the application of the noise reduction material has been defined as the surface area of the ceiling minus lights, diffusers and grilles. The most common application of sound absorbing materials is as in-lay ceiling panels, but the use of sound absorbing panels elsewhere in the room is allowed as long as it meets the area requirements.

BACKGROUND

Internal noise is a significant factor in terms of occupant satisfaction and wellbeing. It can have a major influence on productivity in the workplace and is recognised as a health hazard by the World Health Organisation.

Sound is measured in terms of pressure levels to which the human ear is extremely sensitive. The measure used is the decibel (dB). On this scale 0dB corresponds to the lowest possible audible sound and 140dB to the level at which pain will occur. The scale is not linear and an increase of 3dB corresponds to a doubling of the sound intensity whilst an increase of 10dB is perceived as an approximate doubling of the loudness of the sound.

The level of ambient sound may affect speech communication or, in extreme conditions, the effectiveness of a public address system. Control of the ambient sound level and limiting reverberation times are required to achieve good communications. On the other hand, spaces such as offices and restaurants may benefit from some continuous ambient sound, which may assist in providing privacy between adjacent groups of people or in reducing distraction where people are concentrating on some particular task.

Noise level usually lies in the range between 30dB(A) and around 100dB(A) with levels above 85dB(A) capable of causing some permanent loss of hearing. Noise levels fluctuate and a number of scales are used to represent this. These scales are referred to as dB L scales.

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- LAeq – This scale measures the average energy of the noise level. It is the equivalent steady state level of a fluctuating noise level. When considered over a period of time T, this is represented by the scale dB LAeqT.
- LA90 – This scale measure the level that is exceeded for 90% of the time.
- LA10 – This scale measures the level that is exceeded for 10% of the time i.e. the louder end of the noise range only.

Ambient noise level is a measure of 'background sound' that tends to be of low intensity and is present for most of the time. In a building, it can be defined as the noise level in a space caused by a composite of sounds from HVAC, equipment, lighting systems, computers, activity noises and the like, but excluding specific sources of interest, such as a person talking in an adjacent space. Excessive amounts of ambient sound can cause stress, which can impede an individual's ability to work well or to be comfortable.

REFERENCES & FURTHER INFORMATION

ASHRAE HVAC Applications Volume (2007) – Chapter 47: Sound and Vibration Control

CIBSE Guide A – Environmental Design (2006) – 1.9 Acoustic Environment
CIBSE Guide B (2002) – B5 Noise and Vibration Control for HVAC

Jones, R (1984) – Noise & Vibration Control in Buildings, McGraw-Hill

Lord, P and Templeton, D (1986) – Detailing for Acoustics, 2nd Ed., Applied Science Publishers

British Standard BS8233: 1999 Sound insulation and noise reduction for buildings - code of practice

British Standard BS EN ISO 140-4:1998 Acoustics – Measurement of sound insulation in buildings and of building elements – Part 4: Field measurements of airborne sound insulation between rooms

British Standard BS EN ISO 717-1: 1997 Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation

SANS 10103:2004 - The measurement and rating of environmental noise with respect to land use, health, annoyance and speech communication.

SANS 10103:2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication.

SANS 11690-2:1996 – Acoustics – Recommended practice for the design of low noise workplaces containing machinery.

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Department for Education and Skills: Building Bulletin 93; Acoustic design of schools – a design guide.

IEQ-13 Volatile Organic Compounds

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AIM OF CREDIT

To encourage and recognise specification of interior finishes that minimise the contribution and levels of Volatile Organic Compounds in buildings.

CREDIT CRITERIA

Up to three points are awarded independently as follows:

Paints

One point is awarded where:

- At least 95% of all painted surfaces within the Nominated Area meet the TVOC Content Limits outlined in Table IEQ-13.1 and must not contain any added lead in the form of driers or pigments;

OR

- No paint is used within the Nominated Area.

Adhesives and Sealants

One point is awarded where:

- At least 95% of all adhesives and sealants within the Nominated Area meet the TVOC Content Limits outlined in Table IEQ-13.2;

OR

- No adhesives or sealants are used within the Nominated Area.

Carpets and Floor Coverings

One point is awarded where:

- At least 95% of all carpets and floor coverings within the Nominated Area meet the TVOC emissions limits outlined in Table IEQ-13.3.

Where no carpet or floor covering is installed in the Nominated Area, the carpet and floor coverings point is 'Not Applicable' and is excluded from the Points Available, used to calculate the IEQ category score.

For the purpose of this credit, 'nominated areas' are all internal habitable areas. Refer to Additional Guidance for further information

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DOCUMENTATION REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> Short report Extract(s) from tender documentation Additionally where proprietary products specified: <ol style="list-style-type: none"> Manufacturer product datasheet(s) 	<ol style="list-style-type: none"> Contractor compliance report Manufacturer product datasheet(s) Statement(s) of confirmation

Short report prepared by a suitably qualified professional that describes how the applicable Credit Criteria have been met by:

- Listing all the products proposed within the project that are in the scope of the selected Credit Criteria (i.e. product categories);
- Listing all proprietary products specified in the extract(s) from tender documentation and indicating their compliance with the Credit Criteria, with reference to supporting documentation (where applicable);
- Where the extract(s) from tender documentation demonstrates a requirement of less than 100% compliance (e.g. all paints must comply), demonstration via calculation (of areas) that the 95% threshold of each applicable product category is met;

Where third point claimed 'Not Applicable':

- Confirming that Nominated Area does not incorporate any carpets or floor coverings.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The products to meet the stipulated TVOC limits (by explicit mention) and lead content limits (where applicable) for each applicable product within the Nominated Area;
- The Contractor/Sub-Contractor to obtain approval of the design team or client before substituting the applicable products and requiring that at the end of construction works, the contractor undertakes a final audit to ensure that the correct products have been used; and,
- That where the project includes no finishes from a particular product category, it is clearly stated that no finishes are to be used for the particular application in the project.

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Manufacturer product datasheet(s) must be official manufacturer product datasheets, be provided for each compliant product, and:

- Clearly indicates the compliant TVOC level as referenced in the short report;
- States the calculation method used to determine the TVOC level; and
- For paint finishes only; states that the paint product does not contain added lead.

Statement(s) of confirmation from supplier(s) in the form of signed correspondence stating the quantity of applicable product(s) supplied to the Contractor/Sub-Contractor for the project, and that the product(s) are compliant with the Credit Criteria (for each applicable product).

Contractor compliance report signed off by the Contractor that describes how the Credit Criteria have been met by:

- Listing all the products used within the project, their application, their suppliers and inclusion or exclusion in the scope of the Credit Criteria;
- The actual TVOC limits of each product with reference to the appropriate manufacturer product datasheet(s) and nominating compliance with the Credit Criteria;
- Demonstrating that all applicable products within the scope of the Credit Criteria are compliant;

Where third point claimed 'Not Applicable':

- Confirming that no carpet or flooring was installed in the Nominated Area;

ADDITIONAL GUIDANCE

For the purpose of this credit nominated area includes all internal habitable areas. Non-habitable rooms that open directly to outside or into internal car parking areas may be excluded from the IEQ-13 credit and thus are not required to comply with the credit criteria. Non-habitable rooms that open directly into internal spaces other than internal car parking areas must however be included in the scope of the credit. Examples of non-habitable rooms that may be excluded include store rooms and plant rooms opening directly to outside or into internal car parking areas. Rooms such as security offices, workshops and rooms dedicated for manual waste sorting are however considered habitable and must be included under the credit criteria. See SANS 10400 definition for 'habitable room' for further guidance.

It must be clear that all finishes of a product category have been addressed by the documentation. If points are claimed for not using a product type, it must be clearly stated within the documentation.

The specifications given to contractors must explicitly list all the appropriate low-VOC content or emissions (depending on the product category) next to each product used. A general clause that stipulates that compliance is required with Green Star SA – Public & Education Building V1 Technical Manual, is not acceptable for the documentation requirements.

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Manufacturer product datasheets

For the purposes of the IEQ-13 Volatile Organic Compounds credits, a 'Manufacturer product datasheet' is defined as:

- Compliance certificate or report– Where products have been certified by a third party certification that complies with the same testing methodology and TVOC content limits required by the IEQ-13 credit, certificates and or reports must be provided from the third party certification scheme which confirms the certification of the specific product specified in the project. If not stated on the certificate or report, supporting documents must also be submitted that state the testing method and demonstrate that the TVOC content limits required by the certification body are in line with those set out in the IEQ-13 credit in the Green Star SA Office v1 Technical Manual. For carpets, as the testing method and TVOC limits referenced in the IEQ-13 credit have been based on the Carpet and Rug Institute Green Label (U.S.), for products that are Green Label or Green Label Plus certified, only the compliance certificate need be provided as the testing method and TVOC limits are known to be in line with the requirements of the Green Star SA – Office v1 Technical Manual.

OR

- Laboratory test reports or test certificates – Product TVOC test reports/certificates must be issued by an ISO/IEC 17025 certified testing laboratory and must state the product name, TVOC result and the testing method used. Refer to the Additional Guidance section of the Green Star SA VOC credit for lists of compliant test methods.

OR

- Material Safety Data Sheets (MSDS) – Where a product MSDS includes TVOC information, it must include the numerical result expressed in g/litre of product and the test method used to obtain the results. Refer to the Additional Guidance section of the Green Star SA VOC credit for lists of compliant test methods.

OR

- Manufacturer product data sheet(s) – Official manufacturer datasheets must be provided for each compliant product and must clearly indicate the compliant TVOC levels and state the calculation method used to determine the TVOC levels. The product data sheets must demonstrate that TVOC is based on theoretical calculations of the subtotal of the known VOC values of the product's raw material components.

Where the TVOC content of individual components is not known, it must be determined experimentally by one of the appropriate test methods listed in the Additional Guidance section of this credit. The manufacturer prepared VOC datasheets must contain the following:

- Numerical TVOC results expressed in g/litre of product (the total VOC content or sum, not the itemized calculation);
- Manufacturer's statement that the results have been obtained based on the subtotal of the known VOC values of the product's raw material components.

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Alternatively, project teams must submit a signed letter from the manufacturer containing the above requirements. Screen captures of website information is not an acceptable form of documentation to demonstrate a product's compliance with the Credit Criteria.

Paints

Paints are defined as a liquid solution of pigment in a suitable vehicle of oil, organic solvent, or water; liquid when applied but dries to form an adherent, protective, and decorative coating.

The scope of the credit criteria is applicable to those paints applied within the nominated areas. Any paint used in an internal application, and applied on site, must meet the TVOC Content Limits outlined in Table IEQ-13.1. Paints used in exterior applications do not require documentation and are excluded from this credit. All internal applications must meet the Credit Criteria, whether they are exposed or concealed, and whether the paint applied internally is classified for internal or external applications.

For demonstrating compliance with the credit criteria, the metric to be used is net surface area painted, regardless of the number of coats applied to a particular surface. Green Star SA always tries to use metrics and methodologies in use by building practitioners. The metric used by quantity surveyors for paint is painted surface area and as such this is the metric used.

Calculations must be made based on whole paint (water and tints included) by grams of VOC per litre used (VOCs by content). This method is an internationally accepted proxy to measure the total impact on indoor environmental air quality from use of a product containing VOCs. From an industry-practice approach it has been identified as the most intuitive method because architectural coatings are used on a square metre per litre (of whole paint) basis.

Values must reflect the final product as mixed and ready to use, inclusive of tints and irrespective of the number of coatings.

VOCs are to comply with the grams per litre (g/L) content limits set out in the table below which have been adopted using a combination of the Good Environmental Choice Australia (GECA) standard number GECA-23-2005 version 1.0 Australian Voluntary Environmental Labelling Standard Architectural and Protective Coatings and The Maximum TVOC Content Limits Values for Paints and Varnishes as stated in Annex II, Table A of Directive 2004/42/CE of the European Parliament and Council of 21 April 2004.

The TVOC content of the 'ready-to-use' paint shall be theoretically calculated as the sum total of the VOCs of each of the raw material components comprising the paint.

Where the TVOC content of individual components is not known, it must be determined experimentally by one of the following testing methods as appropriate:

- ISO Method 17895 (2005), for a material with a presumed VOC content < 1%;
- ISO Method 11890-2 (2006), for a material with a presumed VOC < 15%;
- ISO Method 11890-1 (2007), for a material with a presumed VOC content > 15%;

OR

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- ASTM D3960, which is comprised of four individual testing procedures that measures TVOC (D2369) as well as density (D1475), water content (D4017), but not excluding exempt compounds (D4457).

Paints, varnishes, and protective coatings must comply with the TVOC limits as outlined in Table IEQ-13.1.

Product Type/Sub Category	Max TVOC content (g/L of ready-to-use product)
Ceilings - interior flat	14
Walls and ceilings – int. flat washable, low sheen, semi-gloss	16
Walls and ceilings – interior gloss	75
Trim - gloss, semi-gloss, satin, varnishes and wood stains	75
Timber and binding primers	30
Latex primer for galvanized iron and zincalume	60
Interior latex undercoat	65
Interior sealer + general wall & ceiling primer	65
One and two pack performance coatings for floors	140
Any solvent-based coatings whose purpose is not covered in table	200

* *EU Directive 2004/42/CE, Annex II, Table A*

Table IEQ-13.1: *Maximum TVOC Content Limits for Paints, Varnishes and Protective Coatings*

For the purposes of this credit, epoxy wall and/or floor coverings, are considered paints, not sealants, and must not exceed 200g/L TVOC content as per the sub-category 'solvent-based coatings'. General primers are included in the 'Interior Sealer' category of Table IEQ-13.1. Binding primers are included in the 'Timber and binding primers' category. The maximum TVOC content of ready-to-use paint for walls and ceilings, interior gloss is 75 g/l.

Adhesives and Sealants

Adhesives are defined as substances capable of holding materials together by bonding the surfaces that are in contact. Sealants are materials or devices used to prevent the passage of liquid or gas across a joint or opening.

Any adhesive and sealant product(s) used in an internal application as detailed below, and applied on site, must meet the TVOC Content Limits outlined in Table IEQ-13.2. Adhesives and sealants used in internal car parks or exterior applications do not require documentation and are excluded from this credit. All internal applications shown below must meet the Credit

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Criteria, whether they are exposed or concealed. This includes exterior-grade and solvent-based sealants and adhesives, should they be employed in internal applications.

The following uses for sealants and adhesives are considered to represent the most significant portion of these products within buildings and are included within the scope of this credit:

- Floor coverings – including carpet and tile adhesives
- Wall coverings – including wallpaper and tile adhesives
- Ceiling and soffit coverings – including adhesives for laminated ceiling tiles or bonded insulation, and
- Skirting board applications.

Adhesive and sealant applications specified for use in/on miscellaneous applications OTHER than those listed above are EXCLUDED from the IEQ-13 Volatile Organic Compound credit scope and are not required to comply with the credit criteria. These include, but are not limited to, piping glues/sealants, window and/or expansion joint sealant.

For compliance with the credit criteria, project teams must demonstrate that 95% of adhesive and sealant products used to fix floor, wall, ceiling and soffit coverings and skirting boards (measured in surface area of use), meet the VOC levels in Table IEQ-13.2: Maximum TVOC Content Limits for Adhesives & Sealants

Acoustic Sealants must be categorised under the Product Type 'Architectural Sealants' (with a Max VOC Content limit of 250 g/Litre). Adhesives and mastics that are used for temporary formwork are not required to comply with Green Star SA VOC credit criteria. Such materials are not commonly used within indoor spaces, and as such, the impact on the indoor environment quality of the completed project is negligible. Waterproofing membranes are included in the 'Architectural Sealant' category of table IEQ-13.2.

VOCs are to be in conformance with the grams per litre (g/L) content limits set out in the table below which have been adopted from South Coast Air Quality Management District (California, U.S.) – Rule 1168.

Compliance Testing: Refer to South Coast Air Quality Management District Rule 1168 for testing methods. Exempt compounds must not be subtracted in the calculation of VOC content. Values must reflect the final product as mixed.

The TVOC content of the 'ready-to-use' product may also be calculated theoretically as the sum total of the VOCs of each of the raw material components comprising the product.

Where the TVOC content of individual components is not known, it must be determined experimentally by ASTM D3960, which is comprised of 4 individual testing procedures that measures TVOC (D2369) as well as density (D1475), water content (D4017) but not excluding exempt compounds (D4457).

Product Type	Max TVOC content* (g/litre of product)
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Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Resilient flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry Wall and Panel adhesive	50
Multipurpose construction adhesive*	70
Structural glazing adhesive	100
Architectural sealants*	250

* Sealants used to enhance the fire and water-proofing properties are included.

Table IEQ-13.2: Maximum TVOC limits for Adhesives and Sealants

Multipurpose construction adhesives includes, but not limited to, mastics, glues, epoxies, neoprene-based, acrylic, vinyl-emulsions, vinyl acetate, and any solvent-based adhesives. Architectural sealant includes, but not limited to, caulks and gap fillers, silicone, acrylic, polyurethane, latex, hybrids and any solvent-based sealants.

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those adhesives and sealants applied within the nominated areas.

Floor Coverings

In addition to broadloom carpet, examples of floor coverings include, but not limited to, vinyl sheet, vinyl composite tiles (VCT), rubber, linoleum, cork, carpet tiles.

Compliance Testing Carpets: - Refer to Carpet and Rug Institute Green Label (USA), OR American Society for Testing and Materials (ASTM) D5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products (24 hour test).

Compliance Testing Flooring (other than carpet): - Refer to the American Society for Testing and Materials (ASTM) D5116 Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products (24 hour test), OR the ISO 16000 – part 9, 10 and 11 test protocol, also known as the EN 13419 test protocol.

Timber flooring and hard surfaces (e.g. exposed concrete floor, stone, ceramic and concrete tile, etc.) are excluded from this aspect of the credit however the sealers or protective coatings applied to such products must comply with the criteria for 'Interior sealer' in Table IEQ-13.1.

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If carpet has an underlay or carpet pad, the underlay or pad must also be included in the carpet product VOC calculations for this credit. Carpet underlay products are to comply with the emission limits stated in Table IEQ-13.3.

Flooring product(s) must comply with TVOC emissions limits as outlined in Table IEQ-13.3 (below). Please note two different test protocols are acceptable.

ASTM D5116 (Carpets and other flooring products):

Total VOC limit	0.5 mg/m ² per hour
4-PC (4-Phenylcyclohexene) limit	0.05mg/m ² per hour

ISO 16000 (Flooring products other than carpet):

TVOC at 3 days	5mg/m ² /h
TVOC at 28 days	0.5mg/m ² /h

Table IEQ-13.3: Maximum TVOC limits for Flooring

Regardless of delivery type (i.e. Conventional, Integrated or Shell & Core), the scope of the credit criteria is applicable to those carpets and flooring installed within the nominated areas.

General

Reused items/products are not addressed by this credit and do not need to demonstrate compliance with the Credit Criteria.

For the purposes of Green Star SA, calculations for TVOC must include the exempt compounds (based on ASTM D3960 as well as SCAQMD Rule 1168), in the TVOC calculations.

The exemption for those compounds in the Standards is based on the impact that they have on air pollution, not indoor environment quality (i.e. if the VOC compound did not participate in air pollution reactions, it was exempted from the VOC content).

A practice in the industry exists to replace non-exempt compounds (e.g. methyl ethyl ketone) with 'exempt compounds' (e.g. acetone) in formulations of paints, coatings and adhesives. While this lowers the TVOC content of the product, it will still have an indoor environment impact. For this reason exempt compounds must be included in TVOC calculations submitted.

Adhesive tapes are excluded from the Credit Criteria for all applications.

BACKGROUND

'VOC' is the term used to describe the several hundred organic chemicals which have a boiling point range falling below 250°C. These consist primarily of petrochemical solvent-type compounds e.g. aliphatic and aromatic hydrocarbons, alkenes, halogenated hydrocarbons, ketones, aldehydes and esters.

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The South African usage of the concept of VOC follows a European definition in that VOCs are defined as organic solvents with a boiling point less than 250°C at 101.3kPa or a vapour pressure of 0.01kPa at 293.15 degrees Kelvin (20°C).

We spend over 90% of our lives indoors and our exposure to air pollutants can be far greater through breathing indoor air than outdoor air. It is commonly found for most air pollutants that indoor air concentrations are far in excess of those outdoors. Consequently there is considerable research underway concerning:

- The elimination or control of sources of indoor pollutants; and
- Ensuring that building ventilation rates are sufficient to remove pollutants for which source control is limited (refer IEQ-1 Ventilation).

The health implications of exposure to VOCs are consistent with 'sick building syndrome' effects including eye, nose and skin irritation, headache and lethargy.

Measurement standards

For Green Star SA purposes, the two primary and internationally-accepted ways to measure the impacts of TVOCs on indoor environment quality include:

- Measurement by 'rate' of emission – typically reported in g or mg/m²/hr; and
- Measurement by content – reported by 'concentration' in grams of VOC per litre of product.

Lead in paint

Lead is added to paint mainly as a pigment (PbCrO₄ 'Chrome yellow' or PbCO₃ 'white lead') or to increase drying speed. Lead is known to increase paint durability and resist moisture. However lead is highly toxic and leads to nervous system damage especially in young children. It was believed that lead was primarily absorbed by children from chewing on painted surfaces, but the predominant exposure comes from ingestion of lead dust resulting from deteriorating lead paint or from renovation activities.

In 1921 the International Labor Organisation introduced the 'Convention Concerning the Use of White Lead in Painting' restricting the use of white lead in paints, which was however not ratified by all countries. Added lead in paint has been outlawed in the UK ('UK Lead Paint Regulation' in 1927 which was superseded by the 'Control of Lead at Work Regulation' in 1998), European Union (Marketing and Use Directive 76/769/EEC (1988)), Australia and the USA.

The Paint industry in South Africa subscribed to a voluntary agreement prohibiting the use of lead in paint. Nonetheless the practice of using lead in pigments and as driers still persists.

There is no current legal requirement for paint manufacturers to declare lead content in paint. The declaration required by the GBCSA that no lead has been added to the paint is deliberately more stringent than the proposed South African legislation which limits lead to a maximum of 600ppm.

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AVAILABLE**3****REFERENCES & FURTHER INFORMATION**

Australian Safety and Compensation Council (1994), *Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace* [NOHSC:3017(1994)]. Commonwealth of Australia, Canberra.

Australian Safety and Compensation (1995), *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008(1995)] 3rd Edition. Commonwealth of Australia, Canberra

South African National Occupational Health and Safety Act, 1993: various chapters.
<http://www.acts.co.za/ohs/index.htm>

Australia Green Procurement database (search for low-VOC paints, carpets and adhesives).
<http://www.greenprocurement.org/database/main.jsf>

Carpet and Rug Institute, Green Label Testing Program.
<http://carpet-rug.com>

Ecospecifier, Products and Materials database search for low-VOC paints, carpets and adhesives.
<http://www.ecospecifier.org>

Nordic Swan Ecolabelling, Ecolabelling of Panels for the Building, Decorating and Furniture Industry.
<http://www.svanen.nu/Eng/>

South Coast Air Quality Management District (U.S.), Rules and regulations.
<http://www.aqmd.gov/rules/rulesreg.html>

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the specification of products with low formaldehyde emission levels.

CREDIT CRITERIA

One point is awarded where:

- All composite wood products used within the Nominated Area, either:
 - Comply with the formaldehyde emission limits in Table IEQ-14.1;
 - OR
 - Contain zero formaldehyde.

Where no composite wood products are used within the Nominated Area, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Indoor Environment Quality category score.

For the purpose of this credit, 'nominated areas' are all internal habitable areas. Refer to Additional Guidance for further information.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation Additionally where specific proprietary products are specified: <ol style="list-style-type: none"> 3. Manufacturer product datasheet(s) 	<ol style="list-style-type: none"> 1. Contractor compliance report 2. Manufacturer product datasheet(s) 3. Statement(s) of confirmation Where credit is claimed as 'Not Applicable': <ol style="list-style-type: none"> 4. Contractor compliance report

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Listing all the applications of composite wood products proposed within the project (that are in the scope of the Credit Criteria);
- Demonstrating that the Credit Criteria requirement for all (i.e. 100%) composite wood products (within the scope of the Credit Criteria) to be compliant is met for the project, with reference to supporting documentation; and,

Where credit claimed 'Not applicable':

- Confirmation that no composite wood products are to be used in the project, with reference to supporting documentation.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- The applicable products within the design to meet the formaldehyde standards (explicitly stipulated);
- The Contractor/Sub-Contractor to obtain approval of the design team or client before substituting the applicable products and requiring that at the end of construction works, the contractor undertakes a final audit to ensure that the correct (i.e. compliant) products have been used;

Where credit claimed 'Not Applicable':

- An explicit statement confirming that no composite wood products (excepting excluded applications) are to be used in the project.

Manufacturer product datasheet(s) must be official manufacturer product datasheets or Testing Laboratory Report naming the tested product, be provided for every compliant product and clearly indicate:

- The compliant formaldehyde emission level of the product as referenced in the short report; and,
- The test method to which the stated emission limit(s) and/or emission rate(s) have been determined.

Contractor compliance report signed off by the Contractor that describes how Credit Criteria have been met by:

- Listing all the composite wood products used within the project, their application, their suppliers and inclusion or exclusion in the scope of the Credit Criteria;
- The actual formaldehyde emission limits of each product with reference to the appropriate manufacturer product datasheet(s) and nominating compliance with the Credit Criteria;
- Demonstrating that all composite wood products within the scope of the Credit Criteria are compliant;

Where credit claimed 'Not Applicable':

- Confirming that no composite wood products have been used in the project (except for applications excluded from the Credit Criteria);

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1**

Statement(s) of confirmation from supplier(s) in the form of signed correspondence stating the quantity of applicable product(s) supplied to the Contractor/Sub-Contractor for the project, and that the product(s) are compliant with the Credit Criteria (for each applicable product).

ADDITIONAL GUIDANCE

The scope of the Credit Criteria is applicable to all composite wood product applications within the Nominated Area, irrespective of exposed or concealed applications, and irrespective of the delivery type (i.e. Conventional, Integrated or Shell & Core).

For the purpose of this credit nominated area includes all internal habitable areas, excluding carparks, basements and plantrooms where formaldehyde emissions are not affecting any occupants (and heavy duty finishes may be required for safety or durability reasons). Applicable common areas include, but are not limited to, internal corridors and passages, internal lobbies, internal stairwells (fire escape or otherwise), internal spaces used for common activities (e.g. reception, meeting rooms, gyms, libraries, theatre rooms, media rooms etc.), facility management offices or other similar spaces. Corridors or passages which are covered, but largely open to the outside through the use of permanent openings, balustrades or fixed louvers, are considered as 'external' and excluded from the scope of the Credit Criteria. Common areas excluded from the scope of the Credit Criteria include, but are not limited to, car parking areas, storage areas, plant and equipment areas, lift shafts, garbage and recycling waste storage areas, bicycle storage areas etc. Finishes applied to all external spaces or surfaces are excluded from the scope of the Credit Criteria.

Composite wood products include, but are not limited to, particleboard, plywood, timber veneer, medium density fibreboard (MDF), laminated veneer lumber (LVL), glulam timber, high-pressure laminates, compact laminates, laminate flooring and decorative overlaid wood panels. The GBCSA also considers products made from other natural products such as wheat or rice straw fibres as composite wood products and are included in the scope of the Credit Criteria.

It must be clearly demonstrated that all composite wood products (including both 'raw' unfinished and finished products) used in the project (except excluded applications) have low formaldehyde emissions or contain no formaldehyde.

For a Design rating, the applicable formaldehyde limits must be explicitly contained within the tender documentation. A general clause that stipulates that compliance is required with Green Star SA – Public & Education Building V1 Technical Manual, is not acceptable for the documentation requirements.

The following applications of composite wood products are excluded from this credit:

- Any composite wood products used in exterior applications;
- Formwork;
- Reused composite wood products; and,
- Timber (i.e. non-composite products).

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1****Emission requirements**

The emission levels must be established by a NATA or ISO/IEC17025 registered laboratory as per the testing methodologies provided in Table IEQ-14.1.

Test Protocol	Emission limit/ Unit of measurements
AS/NZS 2269:2004, testing procedure AS/NZS 2098.11:2005 method 10 for Plywood	≤ 1.0 mg/L
AS/NZS 1859.1:2004 - Particle Board, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	≤ 1.0 mg/L
AS/NZS 4357.4 – Laminated Veneer Lumber (LVL)	≤ 1.0 mg/L
Japanese Agricultural Standard MAFF Notification No.701 Appendix Clause 3 (11) - LVL	≤ 1.0 mg/L
JIS A 5908:2003- Particle Board and Plywood, with use of testing procedure JIS A 1460	≤ 1.0 mg/L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	≤ 1.0 mg/L
JIS A1901 (not applicable to Plywood)	≤ 1.0 mg/L
ASTM D5116	≤ 0.1 (+/- 0.0005) mg/m ² hr*
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	≤ 0.1 (+/- 0.0005) mg/m ² hr (at 3 days)
ASTM D6007	≤ 0.1 (+/- 0.0005) mg/m ² hr (at 3 days)
ASTM E1333	≤ 0.12mg/m ³ **
EN 717-1 (also known as DIN EN 717-1)	≤ 0.12 mg/m ³ ***
EN 717-2 (also known as DIN EN 717-2)	≤ 3.5mg/m ² hr*
JAS 233 for Plywood	≤ 0.12mg/L
EN 120 for particle board and MDF	≤ 9mg/(100g)
For plywood	≤ 6mg/(100g)

* mg/m²hr may also be represented as mg/m²/hr

** The test report must confirm that the conditions of Table 1 comply for the particular wood product type, the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.

*** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.

Note, test methods and limits applicable to glulam timber, HPL and compact laminates are JIS A 1901, ASTM D5116 and ISO16000 part 9, 10 and 11. EN717-1 and EN717-2 are also applicable to glulam timber.

Table IEQ-14.1: Formaldehyde emission limit values for different testing methods

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1****BACKGROUND**

Formaldehyde is a widely used industrial chemical (generally as a solution in water) and is a gas at room temperature, thus also a harmful VOC. Formaldehyde resins are used to bond the constituent parts together in some particleboards and all fibreboards, and have been reported to:

- Be an irritant at low levels to eyes, mucous membranes, nose and throat;
- Lead to sensitise skin (dermatitis) and respiratory system (asthma and rhinitis);
- Cause an increased risk of cancer;
- Lead to reproductive hazards with the ability to damage a foetus; and
- Emit vapour even after it has hardened, in the case of formaldehyde resin.

There is on-going debate within the industry regarding the approach of testing for formaldehyde emissions in products, with the principal approaches being either 'Industrial Production Testing' or 'Performance Testing'. The distinction between these two approaches is based on how formaldehyde emissions are considered in green building situations and addresses two key issues; the indoor environmental quality and the toxicity of materials.

Industrial Production Testing reports on the content of formaldehyde as an ingredient in a product (a materials/toxicity issue). It is usually tested by 'concentration-based' methods and might be deemed to better reflect the proof of best-practice minimisation of formaldehyde in a product. The logic associated with support of this method overlaps on indoor environmental quality implications because, in theory, minimal inclusion of formaldehyde (stipulated at < 1 mg/L) will deliver a low rate of formaldehyde emission into the indoor environment.

Performance Testing uses 'rate-based' testing methods to report the 'rate' of formaldehyde emitted over the lifetime of a finished product which might be deemed to be a better reflection of realistic calculable net best air quality for human exposure. It is typically reported by mg/m²/h.

The GBCSA recognises the merits of both the 'rate-based' and 'concentration-based' testing methodologies. There is sufficient consensus from a range of internationally-accepted standards, which define both low formaldehyde 'rate' and 'concentration' emission limit values, to warrant recognition in Green Star SA rating tools of both methodologies. The emission limit values prescribed in the 'Additional Guidance' section is adopted from Good Environmental Choice Australia's (GECA) Guidance Note on Formaldehyde Testing v1.0. The acceptable emission levels quoted in this document are founded on independent comparability research of inter-laboratory formaldehyde emission testing undertaken by GECA. The limit values have also passed through an industry stakeholder engagement process, which is required by the GECA standards development protocol and are referenced in the Emissions Requirement sections of two GECA standards.

The GBCSA supports recognition of internationally accepted test methods as a means to remove technical barriers to trade, thereby ensuring that both imported and domestically produced products have equally accessible opportunities for recognition in Green Star SA

IEQ-14 Formaldehyde MinimisationPOINTS
AVAILABLE**1**

rating tools, provided that the products can demonstrate compliance with emission levels as per one of the respective testing methods provided in Table IEQ-14.1.

REFERENCES & FURTHER INFORMATION

Australian Safety and Compensation Council (1994), Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace [NOHSC: 3017(1994). Commonwealth of Australia, Canberra.

Australian Safety and Compensation (1995), Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC: 3008 (1995)] 3rd Edition. Commonwealth of Australia, Canberra.

Good Environmental Choice Australia (2007), Good Environmental Choice Australia Standard No: GECA 04-2007 Panel Boards section 3.2.1.5 Emissions Requirements.

South African National Occupational Health and Safety Act, 1993: various chapters.
<http://www.acts.co.za/ohs/index.htm>

Japanese Standard (2003), JIS A 5905:2003: Fiberboards. The official translated version (into English) is available from Standards Australia. Australia Green Procurement database (search for low-VOC paints, carpets and adhesives).
<http://www.greenprocurement.org/database/main.jsf> (Accessed November 2007).

Ecospecifier, Materials database search for low formaldehyde engineered wood products.
<http://www.ecospecifier.org>

Nordic Swan Ecolabelling, Ecolabelling of Panels for the Building, Decorating and Furniture Industry.
<http://www.svanen.nu/en>

Alternative Resin Binders for Particleboard, MDF and Wheatboard, Global Health and Safety Initiative.
<http://www.healthybuilding.net/healthcare/Alternative%20Resin%20Binders.pdf>

IEQ-15 Mould PreventionPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the design of services that eliminate the risk of mould growth and its associated detrimental impact on occupant health.

CREDIT CRITERIA

One point is awarded where:

- It is demonstrated that for no less than 95% of the Nominated Area, the HVAC system maintains humidity levels at;
 - No more than 60% RH (Relative Humidity) in the space;
 - AND
 - No more than 80% RH in the supply ductwork;

OR

- It is demonstrated that for no less than 95% of the Nominated Area, the spaces are naturally ventilated in accordance with SANS 10400-O:2011.

For the purposes of this credit, 'nominated area' is defined as Occupied Space.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report Additionally for air conditioned spaces: 2. Tender drawing(s) 3. Extract(s) from tender documentation	1. Short report Additionally for air conditioned spaces: 2. As Built drawing(s) 3. As Built point schedule / As Built drawings 4. Extract(s) from Commissioning Report(s)

IEQ-15 Mould PreventionPOINTS
AVAILABLE**1**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

Where building naturally ventilated:

- Confirming that no less than 95% of the Nominated Area is naturally ventilated in accordance with SANS 10400-O:2011, as demonstrated by three points in IEQ-1;

Where building air conditioned:

- Describing the humidity control system and its operation; and,
- Confirming that the Credit Criteria are met both within the space and within the ducts.

Tender / As Built drawing(s) marked-up to clearly demonstrate the location of all humidity sensors.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for humidity control within the HVAC design, stipulating the design parameters in terms of design conditions and humidity control parameters.

As Built Point Schedule / As Built Drawings marked-up to clearly demonstrate the integration of the humidity sensors within the control system.

Extract(s) from Commissioning Report(s) demonstrating that the HVAC system, specifically the humidity control, has been commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

Systems that rely on humidity monitoring only or humidity control by virtue of coil selection only do not satisfy the Credit Criteria.

Naturally ventilated spaces

The areas nominated as naturally ventilated must be designed to meet the requirements of SANS10400-O:2011.

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation' by meeting the requirements for 'Naturally Ventilated Spaces' this credit is automatically achieved and no additional documentation is required. Where the project does not achieve full points for IEQ-1 'Ventilation', the point will not be awarded for this credit through this deemed-to-satisfy route.

Mechanically air-conditioned spaces

Humidity sensors must be provided in the ductwork and linked to the BMS to ensure that humidity control can be maintained both during and after commissioning.

It must be clear from the documentation that an active humidity control system has been incorporated in the project. Extracts from the Commissioning Records will be needed, showing measured humidity levels in the ductwork and in the occupied space for all modes of operation.

IEQ-15 Mould Prevention

POINTS
AVAILABLE

1

Mixed-mode ventilated space

Mixed-mode ventilated spaces must comply with the criteria for mechanically air conditioned spaces.

BACKGROUND

ASHRAE Standard 62-2001 recommends maintaining indoor relative humidity levels between 30% and 60%. Humidity levels less than 30% trigger respiratory discomfort in some people while humidity levels over 70 percent near surfaces for extended periods of time promote the growth of some forms of mould and fungi.

This can be achieved through specific HVAC system design and by including dehumidifying components such as desiccants.

Controlling indoor moisture levels is one way to control propagation of fungi and dust mites inside buildings: in the carpets, wall coverings, and furnishings, as well as within the HVAC system itself.

The ducts must also be constructed from a material which is not susceptible to mould growth. Internal duct linings must be avoided or else selected with regard to avoiding mould growth and with provision for easy access for maintenance.

Mould is a type of fungus. There are numerous naturally occurring species present outdoors and inside buildings. Typically they pose no hazard to people however problems may arise when quantities of mould grow beyond usual limits or when particular species are introduced into a building. In these situations, mould can cause irritation, allergic responses and infections particularly in the eyes and respiratory system. Also of concern are mould toxins, which can potentially affect the skin immune system, respiratory system and nervous system.

Ultra-violet systems located in ductwork just after cooling coils can reduce the risk of mould growth but do not eliminate the risk.

Excessive moisture in various building materials and systems can provide a place for mould to grow. Controlling humidity and moisture problems is the main way to prevent unhealthy mould growth and build up. This must be combined with an effective maintenance programme.

Recently, litigation for mould related illnesses has increased substantially in the US. Most insurance firms now specifically exclude mould from policies covering building owners and building industry practitioners. Alexander Robertson, Erin Brockovich's attorney, commented in 2001 that 'mould is where asbestos was thirty years ago'.

IEQ-15 Mould Prevention

POINTS
AVAILABLE

1

REFERENCES & FURTHER INFORMATION

ASHRAE – Minimizing Indoor Mold Problems Through Management of Moisture in Building Systems
<http://tc112.ashraetcs.org/content.html>

ASHRAE - The ASHRAE Guide for Buildings in Hot and Humid Climates 2008
<http://www.ashrae.org/publications/>

IEQ-16 Dedicated Exhaust RiserPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise the design of buildings with a dedicated exhaust riser that is used to remove indoor pollutants from printing and photocopy rooms.

CREDIT CRITERIA

One point is awarded where:

- Dedicated print/photocopy room(s) are provided;
- AND
- All print/photocopy room(s) are exhausted to a dedicated exhaust riser which meets the following requirements:
 - Provides at least 3 air changes per hour for each print/photocopy room(s);
- AND
- The exhaust system is not recycled and is discharged outside of the building.

Where no dedicated print/photocopy area(s) (whether separate enclosed rooms or not) are provided in the building, this credit is 'Not Applicable' and is excluded from the points available used to calculate the IEQ category score.

DOCUMENT REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing how the dedicated exhaust riser is controlled and operated;
- Demonstrating that the riser has the capacity to serve all printing/photocopy rooms as required by the Credit Criteria; and,

IEQ-16 Dedicated Exhaust RiserPOINTS
AVAILABLE**1**

- Describing how it meets the requirements of the credit and referring to the supporting documentation.
- In the case where this credit is claimed as 'N/A', a clarification with reference to the fitout drawings is required to support the claim that no printing or photocopy equipment will be installed in the building.

Tender / As Built drawing(s) marked-up to clearly show the location of the dedicated exhaust risers and the exhaust system provided to each printing/copy room.

ADDITIONAL GUIDANCE

It is a requirement of this credit that the exhaust facility is a dedicated exhaust facility and that air exhausted cannot be recycled to other enclosures. In addition, the dedicated exhaust riser must NOT serve the kitchenette or tearoom areas.

If providing an exhaust riser, the exhaust fans must be installed as part of the base building – provision for future installation (e.g. by the tenant) does not meet the Credit Criteria.

It must be clear that the project's exhaust riser is externally exhausted, meets the air change requirement and the requirements for all printing/photocopy rooms.

If the nominated area consists of 1000 m² or more of the following spaces (combined), then this credit cannot be claimed as 'Not Applicable' as print and photocopy equipment will be expected to be present.

- Cellular office
- Open plan office
- Reception
- Laboratory
- Consulting room
- High density IT work space
- IT equipment

BACKGROUND

We spend over 90% of our lives indoors and our exposure to air pollutants is far greater from breathing indoor air than outdoor air. It is commonly found for most air pollutants that indoor air concentrations are far in excess of those outdoors. Consequently there is considerable research underway concerning:

- Eliminating or controlling sources of indoor pollutants; and

IEQ-16 Dedicated Exhaust RiserPOINTS
AVAILABLE **1**

- Ensuring building ventilation rates are sufficient to remove pollutants for which source control is limited.

This credit (along with IEQ-1 'Ventilation') addresses copying/printing equipment ventilation concerns. A dedicated print/photocopy room with dedicated exhaust riser can assist in removing pollutants from the building environment.

The typical copying/printing process can produce emissions such as volatile organic compounds (VOCs), ozone and particulates, particularly as the machines age. Volatile organic compounds are produced when toner is baked onto the paper during photocopying, whilst the black pigment is generally the source of particulate pollution from these machines.

Toner dust may irritate the respiratory tract, resulting in coughing and sneezing. Some toners contain carcinogenic chemicals. Copier pollutants have been known to be the cause of headache; mucous membrane irritation; and dryness of eyes, nose and throat.

Ozone is an unstable form of oxygen, which may be formed during the printing or photocopying. Ozone is a reactive, unstable gas with a half-life of six minutes in office environments. It is a highly toxic gas and is the most serious health risk from photocopiers. Ozone is also produced by ultraviolet emission from the photocopier lamp.

Ozone has a sweet smell and can be detected at concentrations of 0.01 to 0.02 parts per million (ppm). The permissible exposure level currently accepted in Australia for ozone is 0.1 ppm as a time-weighted average over the working day. Prolonged inhalation of ozone levels of a few parts per million is known to damage the lungs. Some authorities suggest that a concentration of 0.1 ppm might cause premature ageing and shortened life span.

Some photocopiers and printers use a drum impregnated with selenium and cadmium sulphide. The gas these chemicals emit, especially when hot, can cause throat irritation and sensitisation to exposed workers.

Nitrogen oxide gas may be produced when there is a spark in electrostatic photocopiers. Carbon monoxide is produced when toner (containing Carbon Black) is heated in an inadequate air supply. In an insufficiently ventilated environment this can induce headaches, drowsiness, faintness and increased pulse rate and carbon monoxide can cross the placenta and affect the foetus.

REFERENCES & FURTHER INFORMATION

Australian Safety and Compensation Council (1994), *Guidance Note for the Assessment of Health Risks Arising from Hazardous Substances in the Workplace* [NOHSC:3017(1994). Commonwealth of Australia, Canberra.

Australian Safety and Compensation (1995), *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008(1995)] 3rd Edition. Commonwealth of Australia, Canberra.

London Hazards Centre (2002). *Photocopier and Laser Printer Hazards*.
<http://www.lhc.org.uk/members/pubs/factsht/76fact.pdf>

IEQ-16 Dedicated Exhaust Riser

POINTS
AVAILABLE **1**

The Union for People in Transport & Travel (UK).
<http://www.tssa.org.uk>

Workers Health Centre, Photocopiers,
<http://www.workershealth.com.au/facts011.html>

IEQ-17 Environmental Tobacco Smoke Avoid.

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-18 Places of Respite and Connection to Nature

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-19 Private Outdoor Space

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-20 Kitchen Extract

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-21 Carbon Monoxide Monitoring & Control

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-22 Universal Access

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

IEQ-23 StairsPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise designs that promotes the wellbeing of occupants by encouraging the use of stairs as an alternative to vertical transportation by lift.

CREDIT CRITERIA

One point is awarded where:

Internal stairs are provided and are:

- Available for use by the building users and, where relevant, the public;
AND
- Highly visible (i.e. not visually blocked behind doors or other visual obstructions);
AND
- Located within 5m of the primary set of lifts OR within 20m of a main entrance;
AND
- At least one of the following requirements are met:
 - 25% of the stairwell wall area is exterior glazing;
OR
 - Each level within the stairwell is sufficiently day-lit in accordance with the IEQ-4 Daylight credit compliance thresholds for 90% of the area at finished floor level (FFL);
OR
 - The stair is fully open to the interior on at least one side over the entire span of the stairwell.

Where the building is single storey or does not have a passenger or goods lift (dedicated disabled persons lift can be excluded), then this credit is 'Not Applicable' and is excluded from the points available used to calculate the IEQ score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public and Education Building v1 Design	Green Star SA – Public and Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) Additionally where daylight modelling completed: <ol style="list-style-type: none"> 3. Daylight report Where credit claimed 'Not Applicable': <ol style="list-style-type: none"> 4. Short report 5. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) Additionally where daylight modelling completed: <ol style="list-style-type: none"> 3. Daylight report Where credit claimed 'Not Applicable': <ol style="list-style-type: none"> 4. Short report 5. As Built drawing(s)

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by:

- Identifying the relevant stairwell within the building
- Summarising how the Credit Criteria have been met for access, visibility and location;
- Where the project is demonstrating compliance by external glazing, calculations demonstrating 25% of the stairwell wall has exterior glazing.

Where credit claimed 'Not Applicable':

- Confirming that the building is single storey, or does not have a passenger or goods lift (dedicated disabled persons lift can be excluded).

Tender / As Built drawings marked-up to clearly demonstrate

- The location of all internal stairs within each typical floor plate;
- Details of the tread steps including colouring;
- Details of the hand rails;
- The distance of the stairwell to either the primary set of lifts or main entrance;
- Public access to the stairs;
- Elevation drawings showing and detailing glazing of external and/or fully opened interior of the stairwell. This must correlate with the tender drawings provided.

IEQ-23 StairsPOINTS
AVAILABLE **1**

- Section drawing clearly showing that the stair is fully open to the interior on at least one side over the entire span of the stairwell.

Where credit claimed 'Not Applicable':

- Demonstrating that the building is single storey, or does not have a passenger or goods lift (dedicated disabled persons lift can be excluded).

Daylight report prepared by a suitably qualified professional, in accordance with the requirements of IEQ-4 Daylight credit, that confirms that the daylight compliance thresholds for the IEQ-4 credit are achieved for 90% of the floor area at each level of the stairwell.

ADDITIONAL GUIDANCE

Please note that the criteria for this credit applies to a minimum of one main stairwell in the building (i.e. within the required proximity to the primary set of lifts or the main entrance). If additional emergency staircases are provided, these do not need to comply with the credit criteria.

BACKGROUND

Lifts in multi storey buildings is often the main form of vertical transport. This can largely be attributed to the fact that stairs are 'hidden' away and used for emergencies only. By making stairs more prominent their use could be more attractive with added health benefits as a result. A Swiss study, carried out for 6 months in 2009, shows that encouraging stair use in a work environment can improve, amongst others, fitness levels and blood pressure.

Provision of attractive stairs promotes the use of stairs and thereby giving occupants the option to improve their physical well-being. Taking the stairs is one way to be more physically active. Choosing stairs is a quick way for people to add physical activity to their day.

Stair Use and Link to Health Benefits

The University of Geneva carried out research and found that taking stairs instead of the lift at work could prolong your life. They did a study with 69 participants who were leading a "sedentary lifestyle" (less than 2 hours of exercise a week and climbed fewer than 10 flights of stairs each day). Over a period of 3 months the volunteers were asked to use the stairs exclusively. After the research period the volunteers showed better lung capacity, blood pressure and cholesterol measurements. The research concluded suggesting that stair climbing can have major public health implications.

Features that increase the use of Stairs

Gayle Nicoll (2006) carried out a research for Georgia Institute of Technology, titled "Taking the stairs: Environmental features that predict stair use in 3 to 4 story academic workplace buildings". Her research objective was to identify features of building that may influence stair use. She made the following recommendations for stairs:

- i. Locate stairs directly along the main paths of circulation or linking stairs to the principal entrance of the building
- ii. Locate stairs so that their point of entry is visible from the elevator

IEQ-23 StairsPOINTS
AVAILABLE**1**

- iii. Locate stairs so they are in close proximity and highly visible
- iv. Orient the stair so it is visible from the largest area where people travel
- v. Orient the stair so it requires fewest turns in direction to enter the stairs
- vi. Provide sufficient stair with to accommodate people traveling by stairs in groups
- vii. Locate stairs within the public area of the building
- viii. Increase visibility of a stair by providing open stairs

In addition to the above, one reason why occupants may not use the stairs is because they perceive them as unattractive and/or unsafe. CDC Division of Nutrition and Physical Activity conducted a research study to relate the attractiveness of the stairs to the frequency of stair use by occupants.

Their data suggest that physical improvements, motivational signs and music can increase stairwell use among building occupants. Making the stairs more attractive through use of daylight, light paints, artwork etc will increase the use of the stairs.

Another reason why occupants may not use stairs is because they are hidden and visually unattractive. Often stairs are hidden away as fire escapes and are not open for people to use. By placing the stairs in a prominent place at the entrance of the building and people are given an option, they are more likely to take the stairs.

REFERENCES & FURTHER INFORMATION

Taking the stairs: Environmental features that predict stair use in 3 to 4 story academic workplace buildings - Gayle Nicoll, Thesis for Doctor of Philosophy in the College of Architecture.

http://herg.gatech.edu/Files/nicoll_taking_the_stairs.pdf

StairWell to Health - Centers for Disease Control

<http://www.welcoa.org/freeresources/pdf/stairwell.pdf>

Climbing Stairs can prolong life - University of Geneva

<http://news.bbc.co.uk/2/hi/7591311.stm>

Stairs instead of elevators at workplace: cardioprotective effects of a pragmatic intervention – University of Geneva

<http://cpr.sagepub.com/content/17/5/569.abstract>

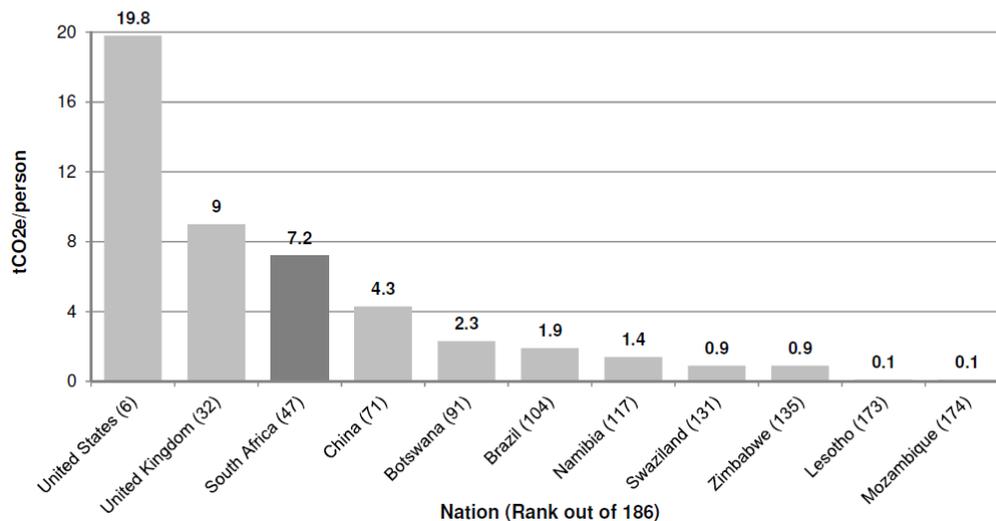
Energy

The credits within the Energy Category target an overall reduction in energy consumption and a reduction of greenhouse gas (GHG) emissions associated with energy generation from fossil fuels. Within public and education developments, reductions in energy consumption can be achieved through increased energy efficiency of heating, cooling, lighting and hot water systems. The use of site energy resources through the installation of renewable energy systems can also reduce greenhouse gas emissions by reducing the demand for conventional energy sources.

Current research indicates that buildings consume 40% of the world's end-use energy, with nearly 60% of the world's electricity being consumed by residential and commercial buildings. This places buildings as one of the largest single contributors to global greenhouse gas emissions, currently accounting for one third of greenhouse gas emissions and projected to continue to account for this proportion in 2030⁵.

In 2005, South Africa's national greenhouse gas emissions were 336.5 MtCO₂e (million tonnes of carbon dioxide equivalent), which placed the nation 19th out of 186 nations in terms of annual greenhouse gas emissions. Although significantly smaller than the two largest emitters (United States 5,842 MtCO₂e & China 5,590.9 MtCO₂e), South Africa's contribution is much greater than other African nations with large economies (Nigeria 98.5 MtCO₂e - 39th, & Egypt 169.6 MtCO₂e - 28th). The figure below displays the 2005 greenhouse gas emissions for several of South Africa's neighbouring nations, and several developed nations, on a per capita basis⁶.

Per Capita GHG Emissions (2005)
(excludes land use change)



⁵ UNEP, 2011 'Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication', www.unep.org/greeneconomy

⁶ Climate Analysis Indicators Tool (CAIT), World Resources Institute, <http://cait.wri.org/>

Energy

It is evident that the per capita greenhouse gas emissions of South Africa are much higher than its neighbours. This, however, is not simply due to South Africa's larger economy; the emissions in relation to GDP are also higher at 1.89 tCO₂e per US\$1,000 GDP, compared to Botswana (0.51 tCO₂e), Namibia (0.50 tCO₂e), Swaziland (0.56 tCO₂e), and Mozambique (0.24 tCO₂e)⁷.

Concerns surrounding increasing national greenhouse gas emissions are exacerbated by the growing energy demands of an increasing South African population. To allow for this natural population increase, without causing a correlated increase in greenhouse gas emissions, it is critical to reduce energy demands, which is best achieved at the planning and design stages. With the current shortfall in electrical generation capacity in South Africa, reducing buildings' electrical energy demand has the added benefit of reducing strain on the generation and distribution infrastructure, minimising the future need for load shedding.

⁷ *Climate Analysis Indicators Tool (CAIT), World Resources Institute, <http://cait.wri.org/>*

Ene-0 Conditional Requirement

POINTS
AVAILABLE **0**

AIM OF CREDIT

To encourage and recognise designs that minimise the greenhouse gas emissions associated with operational energy consumption.

CONDITIONAL REQUIREMENT CRITERIA

To meet the Ene-0 Conditional Requirement, the Project must demonstrate compliance using one of the three compliance routes described below:

NOTE: *Projects are required to select Compliance Route 1, Compliance Route 2 OR Compliance Route 3. Projects are NOT required to demonstrate compliance to all routes.*

Compliance Route 1 - Energy Modelling

The predicted greenhouse gas emissions of the 'Actual Building' are less than or equal to the predicted greenhouse gas emissions of the 'Notional Building' in the same location, when modelled in accordance with the Green Star SA - Public & Education Building - Energy Calculator & Modelling Protocol Guide v1.

Compliance Route 2 - ASHRAE Deemed-to-Satisfy (DTS)

The building fabric and building services design fully comply with the ASHRAE *Advanced Energy Design Guide for Small Office Buildings*. Refer to Green Star SA – Public & Education Building – Energy Calculator & Modelling Protocol Guide v1 for additional guidance.

Compliance Route 3 – SANS 204:2011 Deemed-to-Comply (DTC)

The design complies with all of the SANS 204:2011 Energy Efficiency in Buildings 'Deemed-to-Comply' clauses regarding building fabric and building services. Refer to Green Star SA – Public & Education Building – Energy Calculator & Modelling Protocol Guide v1 for additional guidance.

DOCUMENTATION REQUIREMENTS

Documentation is not required to be submitted for this Conditional Requirement. It must be clear from the documentation submitted for Ene-1 Greenhouse Gas Emissions that the applicable minimum requirements have been achieved.

Ene-0 Conditional Requirement

POINTS
AVAILABLE **0**

ADDITIONAL GUIDANCE

This Conditional Requirement must be met in addition to the other Conditional Requirement's within the rating tool for the Project to be eligible for a Green Star SA Public & Education Building v1 certification. For further details, please refer to the Green Star SA Public & Education Building - Energy Calculator & Modelling Protocol Guide v1.

BACKGROUND

Please refer to Refer to Ene-1 Greenhouse Gas Emissions for further background information.

REFERENCES & FURTHER INFORMATION

Please refer to Refer to Ene-1 Greenhouse Gas Emissions for references and further information.

Ene-1 Greenhouse Gas Emissions

POINTS
AVAILABLE **20**

AIM OF CREDIT

To encourage and recognise designs that minimise greenhouse gas emissions associated with operational energy consumption.

CREDIT CRITERIA

Up to 20 points are awarded where it is demonstrated that the building's predicted greenhouse gas emissions have been reduced.

NOTE: *Projects are required to select Compliance Route 1, Compliance Route 2 OR Compliance Route 3. Projects are NOT required to demonstrate compliance to all routes.*

Compliance Route 1 - Energy Modelling

The building is to be modelled in accordance with the Green Star SA - Public & Education Building - Energy Calculator & Modelling Protocol Guide v1. The predicted greenhouse gas emissions determined for the 'Actual Building' must be compared with those determined for the 'Notional Building' at the same location. Whilst the 'Actual Building' represents the intended building design, the 'Notional Building', however, is modelled based on fabric and services performance characteristics as per the Green Star SA - Public & Education Building - Energy Calculator & Modelling Protocol Guide v1.

Compliance Route 2 - ASHRAE Deemed-to-Satisfy (DTS)

As an alternative to the energy modelling route the building fabric and building services need to comply with the relevant clauses in ASHRAE Advanced Energy Design Guide for Small Office Buildings. The reduction in HVAC energy consumption of the building is assumed to be 20% and no energy modelling is required. Refer to Green Star SA - Public & Education Building - Energy Calculator & Modelling Protocol Guide v1 for additional guidance.

Compliance Route 3 – SANS 204:2011 Deemed-to-Comply (DTC)

The design complies with all of the SANS 204:2011 Energy Efficiency in Buildings 'Deemed-to-Comply' clauses regarding building fabric and building services. The notional and actual buildings are assumed to be air conditioned and the HVAC energy consumption of both buildings is assumed to be the same. Refer to Green Star SA - Public & Education Building - Energy Calculator & Modelling Protocol Guide v1 for additional guidance.

Ene-1 Greenhouse Gas EmissionsPOINTS
AVAILABLE **20**

For all Compliance Routes points are awarded on a linear scale with 0 points for the notional building and 20 points for a net zero operating emissions building. One point is awarded for every 5% saving below the notional building level.

The points are determined by the Green Star SA - Public & Education v1 Energy Calculator.

DOCUMENTATION REQUIREMENTS

NOTE: *Project Teams must select Compliance Route 1, Compliance Route 2 OR Compliance Route 3. Project Teams are NOT required to demonstrate compliance to all routes.*

Compliance Route 1 – Energy Modelling

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Energy modelling report 2. Calculator extract Additionally for naturally ventilated buildings: <ol style="list-style-type: none"> 3. Statement of confirmation 	<ol style="list-style-type: none"> 1. Energy modelling report 2. Calculator extract 3. Extract(s) from Commissioning Report(s) Additionally for naturally ventilated buildings: <ol style="list-style-type: none"> 4. Statement of confirmation

Energy modelling report prepared by a suitably qualified professional in accordance with the Green Star SA – Public & Education Building v1 Energy Modelling Protocol Guide, describing how the Credit Criteria are met by:

- Describing the software package used, confirming it is in accordance with the requirements of the Green Star SA – Public & Education Building - Energy Modelling Protocol Guide v1;
- Describing the weather data used and how it is applicable to the project site;
- Providing a general description of the servicing strategy (where applicable);
- Providing a tabulated summary of the space types modelled and the servicing strategies in each space;
- Clearly identifying all occupant and other loads as per the Green Star SA Public & Education Building - Energy Modelling Protocol Guide v1;

Ene-1 Greenhouse Gas Emissions

POINTS
AVAILABLE **20**

- Clearly identifying all of the design-driven inputs (where assumptions are used, they must be justified);
- Extracts of applicable documentation (as appendices) justifying the design-driven inputs (e.g. specifications, drawings, manufacturer product datasheets etc.) as requested in the 'Documentation' column of the tables contained in the Green Star SA – Public & Education Building – Energy Calculator & Modelling Protocol Guide v1;
- Providing marked-up drawings identifying the zones used for energy modelling;
- Confirming that the energy modelling report has been compiled in accordance with Appendix D of the Green Star SA – Public & Education Building - Energy Calculator & Modelling Protocol Guide v1.

Calculator extract from the Green Star SA Public & Education Building v1 Energy Calculator that demonstrates what energy values have been entered for the 'Actual Building' and 'Notional Building' and the calculator's output result.

Extract(s) from Commissioning Report(s) demonstrating that the building services have been commissioned and operate as intended by the design.

Statement of confirmation in the form of signed correspondence from a relevant project team member confirming that for spaces claimed as naturally ventilated where no heating and/or cooling systems are provided, that the space achieved full points within IEQ-9 Thermal Comfort.

Compliance Route 2 - ASHRAE Deemed-to-Satisfy (DTS)

Green Star SA – Public & Education Building Design	Green Star SA – Public & Education Building As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. Tender drawing(s) 4. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. As Built drawing(s) 4. Extract(s) from Commissioning Report(s) 5. Statement of confirmation

Short report prepared by a suitably qualified professional, written in the same format as the *ASHRAE Advanced Energy Design Guide for Small Office Buildings Climate Zone X*

Ene-1 Greenhouse Gas EmissionsPOINTS
AVAILABLE **20**

Recommendation Table detailing each component (e.g. roof insulation), the ASHRAE recommendation, and the achieved performance level in the design.

Calculator extract from the Green Star SA Public & Education Building v1 Energy Calculator that demonstrates what energy values have been entered for the 'Actual Building' and 'Notional Building' and the calculator's output result.

Tender / As Built drawing(s) (plans, elevations and typical details) marked up to clearly demonstrate that the wall, roof and window constructions meet the thermal insulation and solar performance as described in the ASHRAE Advanced Energy Design Guide for Small Office Buildings.

Extract(s) from tender documentation clearly demonstrating the contractual requirement that applicable mechanical and electrical services meet the requirements of the ASHRAE Advanced Energy Design Guide for Small Office Buildings.

Extract(s) from Commissioning Report(s) demonstrating that the building services have been commissioned and operate as intended by the design.

Statement of confirmation(s) in the form of signed correspondence from the Contractor, confirming that;

- The insulation, glazing and other thermal envelope components supplied to the project are as per the specification and achieve compliance with the ASHRAE Advanced Energy Design Guide for Small Office Buildings; and,
- The applicable HVAC and electrical services are as per the specification and achieve compliance with the ASHRAE Advanced Energy Design Guide for Small Office Buildings.

Compliance Route 3 – SANS 204:2011 Deemed-to-Comply (DTC)

Green Star SA – Public & Education Building Design	Green Star SA – Public & Education Building As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. Tender drawing(s) 4. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. As Built drawing(s) 4. Extract(s) from Commissioning Report(s) 5. Statement of confirmation

Ene-1 Greenhouse Gas Emissions

POINTS
AVAILABLE **20**

Short report prepared by a suitably qualified professional that describes how the SANS 204:2011 deemed to comply clauses have been complied with, clearly demonstrating that:

- Glazing areas and performance satisfy the minimum requirements of SANS 204:2011;
- Insulation levels satisfy the minimum requirements of SANS 204:2011; and
- Applicable services comply with the minimum requirements of SANS 204:2011.

Calculator extract from the Green Star SA Public & Education Building v1 Energy Calculator that demonstrates what energy values have been entered for the 'Actual Building' and 'Notional Building' and the calculator's output result.

Tender / As Built drawing(s) (plans, elevations and typical details) marked up to clearly demonstrate that the wall/roof constructions and glazing elements within the design.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for all design initiatives that comply with of SANS 204:2011, including;

- Minimum fabric performance requirements (e.g. insulation type(s) and R-value(s)); and,
- Glazing performance requirements (e.g. U-values and SHGC).

Extract(s) from Commissioning Report(s) demonstrating that the building services have been commissioned and operate as intended by the design.

Statement of confirmation(s) in the form of signed correspondence from the Contractor, confirming that;

- The insulation, glazing and other thermal envelope components supplied to the project are as per the specification and achieve compliance with SANS 204:2011; and,
- The applicable HVAC and electrical services are as per the specification and achieve compliance with SANS 204:2011.

ADDITIONAL GUIDANCE

Please refer to the Green Star SA – Public & Education Building Calculator & Modelling Protocol Guide v1 for additional guidance.

BACKGROUND

As noted in the introduction to this Energy chapter, emissions from buildings total 20% of global greenhouse gas emissions. At the same time, a Working Group of the

Ene-1 Greenhouse Gas Emissions

POINTS
AVAILABLE **20**

Intergovernmental Panel on Climate Change (IPCC) in 2007 noted that the built environment provides a significant amount of cost-effective greenhouse gas mitigation potential; more than any other industry.

Building shell performance has a large impact on the heating, cooling and illumination requirements for commercial buildings. Improvements in the thermal, daylight and natural ventilation performance of commercial building shells will reduce greenhouse gas emissions. Increasing the efficiency of artificial lighting will reduce emissions directly by lowering energy consumption (refer to Energy credit Ene-2 'Energy Sub-metering'), and indirectly through lower cooling requirements.

Commercial & Public Services account for around 7% of overall energy usage in South Africa, but around 14% of electrical use (data from 2005 source IEA at <http://www.iea.org>).

In 2005, 93% of South African electricity was generated from coal, which is one of the most polluting forms of electrical generation in terms of carbon, sulphur (SO_x) and nitrous oxide (NO_x) emissions. Only approximately 2% came from renewable sources such as hydroelectric and solar.

The South African Government has targeted a final energy demand reduction of 15% by 2015 for the commercial and public building sector.

In addition to operational greenhouse gas emissions, the overall reduction in a building's contribution to climate change depends on the efficiency and embodied energy of its systems (although embodied energy is not addressed in this conditional requirement). When effectively designed and operated, centralised energy systems can deliver such a reduction and optimise energy, resource and maintenance efficiency.

REFERENCES & FURTHER INFORMATION

ASHRAE Advanced Energy Design Guide for Small Office Buildings, 2004

ANSI-ASHRAE 104:2004 Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs

CIBSE TM33:2006 Tests for Software Accreditation and Verification
Energy Efficiency Strategy of the Republic of South Africa – Department of Minerals and Energy, March 2005

ASHRAE 90.1-2004 Energy Standard for Buildings Except Low-Rise Residential Buildings
<http://www.ashrae.org>

SANS 204:2008 Energy Efficiency in Buildings
<http://www.sabs.co.za>

International Energy Conservation Code, 2006 edition
<http://www.iccsafe.org>

Ene-1 Greenhouse Gas Emissions

POINTS
AVAILABLE **20**

Dept of Minerals & Energy (DME), Energy Efficiency Strategy of the Republic of South Africa, 2005

<http://www.dme.gov.za>

Southern African Association for Energy Efficiency (SAEE)

<http://www.sae.org.za>

International Energy Agency

<http://www.iea.org>

Council for Scientific & Industrial Research (CSIR)

http://www.csir.co.za/Built_environment

Carbon Dioxide Information Analysis Center

<http://cdiac.ornl.gov>

UN Millennium Development Goals Indicators

<http://mdgs.un.org/unsd/mdg/Default.aspx>

Promoting Renewable Energy in Africa (PREA)

<http://prea.ises.org>

Sustainable Energy Society of Southern Africa

<http://www.sessa.org.za>

South African Cities Network

<http://www.sacities.co.za>

Ene-2 Energy Sub-metering

POINTS
AVAILABLE **3**

AIM OF CREDIT

To encourage and recognise the installation of energy sub-metering to facilitate on-going management of energy consumption.

CREDIT CRITERIA

Up to three points are awarded as follows:

One point is awarded where:

- Electrical sub-metering is provided for:
 - All substantive electrical energy uses within the building;AND
- An effective monitoring system is installed to monitor all sub-meters and an automated metering strategy is prepared;

One point is awarded where:

- Thermal sub-metering is provided for:
 - All substantive thermal energy uses within the building;AND
- An effective monitoring system is installed to monitor all sub-meters and an automated metering strategy is prepared.

If centralised space heating or cooling reticulation systems are not included within the base-building, the thermal sub-metering point is 'Not Applicable' and is excluded from the points available used to calculate the Energy Category Score. Type 'na' in the No. of Points Achieved column in the rating tool.

An additional point is awarded where:

- One point above is achieved;
- AND
- Electrical sub-metering is provided separately for lighting and separately for power for 95% of the building;
- AND
- An effective monitoring system is installed to monitor all sub-meters and an automated metering strategy is prepared.

Ene-2 Energy Sub-meteringPOINTS
AVAILABLE **3**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Tender schematic drawing(s) 4. Tender point schedule / Tender Drawings 5. Automated metering strategy 	<ol style="list-style-type: none"> 1. Short report 2. As Built schematic drawing(s) 3. Tender point schedule / Tender Drawings 4. Automated metering strategy 5. Extract(s) from Commissioning Report(s) 6. Manufacturer product datasheet(s)

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Describing the effective monitoring system

Additionally where first and/or second point claimed:

- Providing a summary table of all separately sub-metered spaces and substantive loads in the building, or justifying their exclusion through calculations;

Additionally where additional point claimed:

- Providing a summary table of all separately sub-metered lighting and power groups for the building;

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- Energy sub-meters for all substantive energy and lighting/general power demands (where applicable) within the building as referenced in the short report; and
- An effective monitoring system, detailing that all sub meters are to be connected to this system (E.g. where a BMS is specified, the BMS specification and BMS point schedule);

Tender / As Built drawing(s) (schematic) marked-up to clearly demonstrate the inclusion of all sub-meters and the loads of all substantive energy demands as referenced in the short report.

Ene-2 Energy Sub-metering

POINTS
AVAILABLE **3**

Tender / As Built Point Schedule / Drawings showing inputs from the sub-meters

Automated metering strategy document in accordance with the Additional Guidance.

Extract(s) of Commissioning Report(s) demonstrating that the sub-meters and effective monitoring system have been installed and that all systems operate as intended by the design.

Manufacturer product datasheet(s) of the installed sub-meters, indicating their ability for automatic monitoring.

ADDITIONAL GUIDANCE

The documentation must account for all of the substantive electrical and thermal demands in the development, and clearly identify the location, number and respective loads of all sub-meters.

Effective monitoring system

There must be an 'effective' system for collecting, recording and monitoring data from all sub-meters. In most cases, the requirement for an effective system will lead to the inclusion of automated monitoring systems.

There must be an effective system for collecting, recording and monitoring data from the sub-meters, and for alerting the facility management of any change in electrical / thermal energy consumption trends during the building's operation. In most cases, the requirement for an effective system will lead to the design of automated monitoring systems, such as Building Management Systems (BMS). Manual monitoring of sub-meters is not acceptable to meet the Credit Criteria.

Wherever such systems are present to monitor the energy consumption data, the electrical and thermal energy sub-meters must be linked to them. If there is a monitoring system / BMS that can provide a breakdown of the energy use by building system and location, this will also comply with the Credit Criteria. However, relevant details of the monitoring system and data must be provided to confirm the energy metering monitoring capability of the system.

Substantive electrical loads

Substantive electrical loads are those where electrical sub-metering is deemed sensible and beneficial for energy saving and monitoring by a suitable qualified professional. For a typical public building, the following electrical loads must be sub-metered:

- Car park ventilation and lights;
- Chillers;
- Hot water plants for space heating;
- Air handling fans;

Ene-2 Energy Sub-metering

POINTS
AVAILABLE**3**

- Lifts/escalators;
- Domestic hot water plants with a combined storage of 1000 litres or more;
- All tenancies individually; and
- Any additional item that carries an energy use greater than 100kVA.

Whenever lifts, individually or collectively, carry an energy use greater than 100kVA, they must be sub-metered. If individual lifts carry an energy use under 100kVA, they can be sub-metered individually or as a group; if individually they carry an energy use greater than 100kVA, they must be sub-metered separately unless they are monitored by an intelligent control system.

Domestic hot water plants installed within tenanted areas and for use by the tenants can be excluded from the metering requirements as it is already metered through the tenant's meter.

The Project Team must justify the exclusion of any load based on the context of the building and calculation of the estimated annual energy consumption, or that the loads are not deemed substantive, demonstrated through calculation.

Sub-metering must measure energy in kWh and need not measure kVA or other electrical parameters.

Note that supplementary equipment can also be installed on the same measured circuit as the substantive energy use item. However, the supplementary equipment must not contribute more than 10kVA of the total metered kVA on that circuit.

Substantive thermal loads

The design and documentation must account for all thermal energy provision to substantive thermal energy uses, which must include:

- all tenancies that have a 10kW peak thermal requirement or greater
- all spaces where thermal energy is provided (these can be grouped into one meter if practically possible, but can also be in the form of multiple meters)

The thermal energy referred to above is chilled or hot water from a central thermal plant (excluding domestic hot water). All meters must be clearly identified on drawings (through highlighting or similar means).

It must be clear that the sub-metering is provided by the base building owner/developer.

Sub-metering must measure supply and return temperatures and mass flow.

Tenancy meters

Meters must be installed to all tenancies in the Public / Education Building to be awarded this credit.

Automated metering strategy

The automated metering strategy for sub-metering must describe;

Ene-2 Energy Sub-metering

POINTS
AVAILABLE **3**

- The frequency of meter readings, data collection and storage, and reporting method; and,
- How metering errors are to be identified and provide guidance on future calibration or verification requirements (where applicable).

This document must be based on what the actual methodology will be that the development will adopt for sub-metering. The strategy document need not be exhaustive and must be written in easy-to-read language for a non-technical reader.

BACKGROUND

In successfully managing energy consumption it is important that sufficient data is available to building managers to allow them to monitor consumption and compare historical records. Sub-metering allows building managers to fine tune operational procedures to minimise consumption and to detect any operational problems early.

Where thermal energy is provided to tenancies from a large central plant, metering of the plant does not provide sufficient sub-metering detail to identify uncharacteristic energy use and address any problems. Thermal metering of the HVAC heating and cooling energy within tenancies provides building managers with a method for managing the energy use of large central plants at a tenancy level.

Measuring the electrical and thermal energy used by all tenants within a public building can highlight differences in energy use and allow facility charges to be linked to levels of energy consumption, thus providing a financial incentive for organisations to reduce energy consumption.

REFERENCES & FURTHER INFORMATION

CIBSE TM39:2006 Building Energy Metering – A Guide to Energy Sub-metering in Non-domestic Buildings

International Performance Measurement & Verification Protocol
<http://www.ipmvp.org>

Ene-3 Lighting Power Density

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

Ene-4 Lighting ZoningPOINTS
AVAILABLE **2****AIM OF CREDIT**

To encourage and recognise lighting design practices that offer greater flexibility for light switching, making it easier to light only occupied areas.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- All individual or enclosed spaces are individually switched;
AND
- The size of individually switched lighting zones does not exceed 100m² for 95% of the nominated area;
AND
- Switching is clearly labelled and easily accessible by building occupants.

An additional point is awarded where:

- The point above is achieved;
AND
- An individually addressable lighting system is provided for 90% of the nominated area.

For the purpose of this credit, 'nominated area' is defined as Occupied Space.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Extract(s) from Commissioning

Ene-4 Lighting ZoningPOINTS
AVAILABLE**2**

	Report(s)
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Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Providing a summary table that lists all separately switched zones and their area, and,
- Demonstrating that compliant areas jointly account for the stipulated proportion of the nominated area.

Additionally where additional point claimed:

- Describing the individually addressable lighting system and confirming that it is provided to the compliant nominated area of the building;

As Built drawing(s) clearly indicating the location of the switches, each individually switched lighting zone and its area.

Extract(s) from tender documentation where the requirements for switching and zoning are stipulated, and the required location for switches and the required area for each individually switched lighting zone are clearly stipulated. Where Tender Drawings are provided for this purpose, the location of switches as well as the areas of individual lighting zones should be clearly shown.

Extract(s) from Commissioning Report(s) demonstrating that the lighting system has been commissioned and operates as intended by the design.

ADDITIONAL GUIDANCE

In order to be deemed 'easily accessible', switching (wired for each zone of 100m² or any part thereof) must be located as follows:

- Within the 100m² zone AND an override switch for all 100m² zones at the entrance to that floor/building at every entry (one switch can be provided which overrides all 100m² zones in that floor / tenancy). These override switches per floor / tenancy entrance are not required where all 100m² zones in the floor / tenancy are controlled by presence detectors;

OR

- At the entry point to the tenancy or floor (whichever is smaller) if the area controlled by the switching does not exceed 500m².

To be considered 'individually addressable', the lighting fixtures must be able to be readdressed/regrouped without rewiring.

Ene-4 Lighting Zoning

POINTS
AVAILABLE **2**

Controlling alternate rows by separate switches in a lighting zone that exceeds 100m² does not meet the intent of the credit to minimise energy consumption necessary for performing a task in a specific area, as it is likely that both switches will be on simultaneously to provide the desired lighting level.

Motion occupancy sensors (presence/absence detection)

Motion occupancy sensors are treated the same way as manual switching, thus zones controlled by occupancy sensors that do not exceed 100 m² may contribute to the compliant nominated area provided the occupancy sensor is located within the 100 m² zone that it controls.

Daylight sensors

Daylight sensing linked to automatic dimming of lighting is to be encouraged, but these controls cannot be treated as manual switches when claiming this credit. Daylight sensing and presence/absence detection can be incorporated in the energy modelling which will result in reduced cooling load on the HVAC systems and hence energy savings in the Ene-1 credit.

BACKGROUND

Lighting expenditures within a building can represent two-thirds of total energy costs. Decreasing the size of lighting zones allows for greater control over lighting, giving building managers the ability to reduce energy consumption and costs by only lighting those areas or zones that are occupied. Within buildings with great occupancy fluctuations, the impact of properly managing lighting can result in a significant reduction in electricity wastage due to lights being left on when not required.

Most buildings are dynamic and over their lifetime will have changes made to the internal layout. Addressable lighting systems assist building managers to easily change lighting zones and link them to additional energy saving systems such as occupancy and daylight sensors.

REFERENCES & FURTHER INFORMATION

SANS 10400 *Application of the National Building Regulations – Part O – Lighting & Ventilation*

SANS 10114-1:2005 *Interior Lighting – Part1: Artificial Lighting of Interiors*

SANS 10142-1:2003. *Code of Practice: The Wiring of Premises*

SANS 204:2008 *Energy Efficiency in Buildings*

Occupational Health & Safety Act (OHS) 1993

Ene-5 Maximum Electrical Demand ReductionPOINTS
AVAILABLE**3****AIM OF CREDIT**

To encourage and recognise designs that reduce the maximum demand on the electrical supply infrastructure.

CREDIT CRITERIA

Up to three points are awarded where it is demonstrated that the building has reduced its peak electrical demand load on electricity infrastructure as follows:

One point is awarded where:

- Peak electrical demand is actively reduced by 10%;
- OR
- The difference between the peak and average demand does not exceed 40%.

Two points are awarded where:

- Peak electrical demand is actively reduced by 20%;
- OR
- The difference between the peak and average demand does not exceed 30%.

Three points are awarded where:

- Peak electrical demand is actively reduced by 30%;
- OR
- The difference between the peak and average demand does not exceed 20%.

Ene-5 Maximum Electrical Demand ReductionPOINTS
AVAILABLE**3**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

Where reduction of peak electrical demand claimed:

- Justifying, with supporting calculations/modelled results, the building's peak demand value;
- Detailing, with supporting calculations/modelled results, the design, operation, and sufficient capacity of the intended system;
- Appropriately referencing drawings and SANS 10142; and
- Clearly identifying what active mechanisms will ensure that the demand on the infrastructure will at no point exceed the stipulated percentage of the building's demand.

Where flatter electrical demand curve claimed:

- Describing building attributes that result in a flatter overall electrical demand curve; and
- Providing calculations/modelled results supporting compliance with the Credit Criteria.

Extract(s) from tender documentation where the proposed solution(s) are described and specified.

Extract(s) from Commissioning Report(s) demonstrating that the solution(s) have been commissioned and operate as intended by the design.

Ene-5 Maximum Electrical Demand ReductionPOINTS
AVAILABLE**3****ADDITIONAL GUIDANCE**

The peak demand is expected to occur during standard hours of occupancy.

Mixed-mode ventilated buildings must provide calculations for the mechanically air conditioned mode.

Passive design can be claimed to meet the Credit Criteria for the flatter overall electrical demand curve (i.e. the difference between the peak and average demand), but not for active peak energy demand reduction.

The following is required to claim the points:

- Active peak electrical demand reduction (refer to Green Star SA – Public & Education Building Energy Calculator & Modelling Protocol Guide for details):
 - Peak electrical demand must be calculated for the actual building (including active peak demand reduction measures e.g. ice storage); and
 - Peak electrical demand must be calculated for a the actual building without the peak energy demand measures
 - The difference between the two peak demands is used to motivate compliance (10% / 20% / 30% reduction).
- Flatter electrical demand curve
 - Peak electrical demand must be calculated for the actual building; and
 - Average electrical demand must be calculated for the actual building.

The proposed system must be incorporated accurately and consistently throughout the submission wherever it may affect compliance with other claimed credits (e.g. Ene-1 'Greenhouse Gas Emissions').

Compliance may NOT be achieved by 'load lopping' using the Building Management System (BMS) or equivalent. 'Load Lopping' is when chillers or other large pieces of equipment are turned off automatically if the building exceeds a certain power usage. This is excluded since it will affect the comfort of the occupants and is easy to reset or override.

Peak electrical energy demand calculations

Peak energy demand is the predicted annual peak to be calculated as the sum of all loads (to include all miscellaneous loads) relevant to the base building in electrical schematics.

Peak energy demand must be calculated as follows:

- In accordance with SANS 10142;
- As the absolute design capacity of the system, after the application of diversity factors but prior to the application of contingency factors as required for utility agreements;
- Mixed-mode ventilated buildings must be calculated as per the mechanically air conditioned mode; and

Ene-5 Maximum Electrical Demand ReductionPOINTS
AVAILABLE**3**

- Everything except tenant lights and power must be included in assessing peak demand.
- Projects must look at the peak energy demand over the 24 hour demand curve, not just the occupied hours.

The energy models of the actual building used under Ene-1 may be used to do these calculations.

The graphs below illustrate the two Credit Criteria options given.

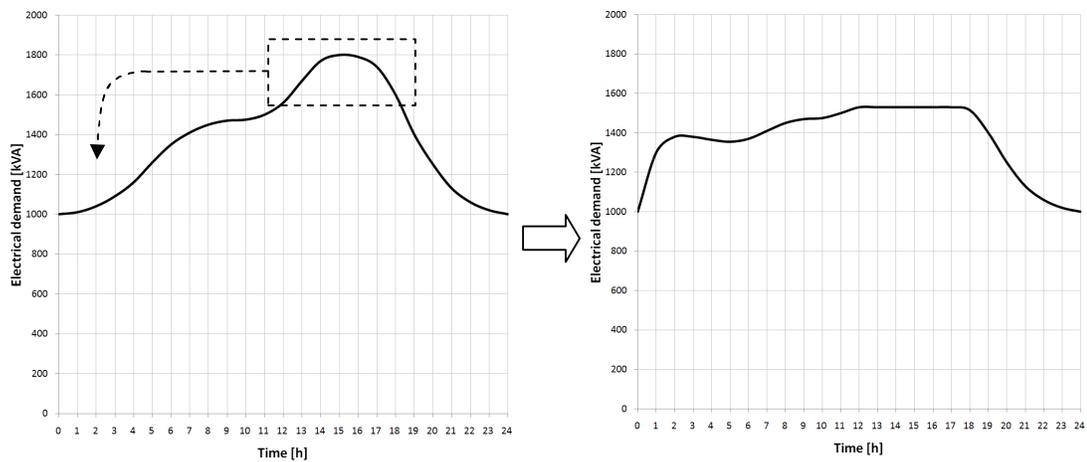
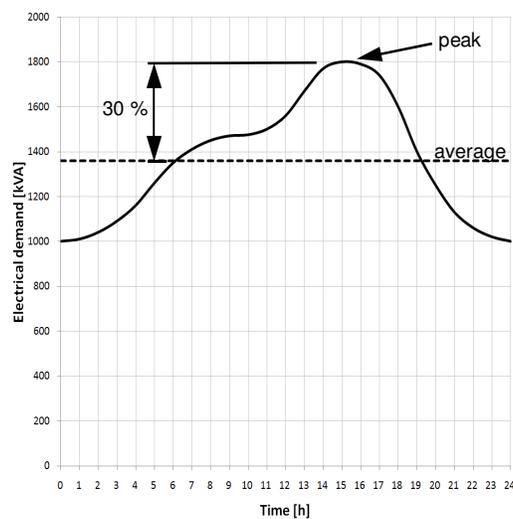


Figure Ene-5.1 Graphs indicating how the peak demand can be shifted into another period of the day to result in a reduced overall peak



Ene-5 Maximum Electrical Demand ReductionPOINTS
AVAILABLE**3**

Figure Ene-5.2 Graph indicating the percentage difference between the peak and the average of the annual demand curve.

Design strategies

Peak energy demand reduction systems that could comply with the credit's requirements include, but are not limited to:

- Distributed energy systems;
- Cogeneration;
- Micro-turbines;
- Photovoltaics (note that battery storage may be required);
- Fuel cells;
- Energy and thermal storage systems;
- Batteries;
- Ice storage; and
- Phase change materials.

Passive designs can claim the credit for the flatter overall demand curve, but not for the active peak energy demand reduction. This credit deals with active reduction of peak electrical demand of the as-designed building, or achievement of a flatter electrical demand curve. Decreased demand through efficient design is rewarded in Ene-1 Greenhouse Gas Emissions.

Energy storage systems may also be useful in combination with intermittent energy sources, a common trait of many renewable energy sources. The most common example of this is a system that utilises the excess electricity from a photovoltaic array to charge a battery during daylight hours, then drawing off the battery during the night.

Unless they are designed and integrated into the base building for the purpose of peak energy demand reduction and can be activated automatically and without causing a blackout, stand-by generators do not qualify for this credit.

BACKGROUND

Lessening the peak demand is one strategy for reducing the energy infrastructure required to meet the needs of buildings and industry.

The electrical generation capacity in South Africa has been unable to meet peak demands at times, leading to regular load shedding and disruption. Reducing peak loads will reduce the pressure on the utility to provide short-term solutions (often involving older 'dirtier' plant and carbon intensive generation) and allow the utility to concentrate on longer-term cleaner forms of electrical energy generation.

Ene-5 Maximum Electrical Demand Reduction

POINTS
AVAILABLE

3

REFERENCES & FURTHER INFORMATION

SANS 10142-1:2003 Code of Practice: The Wiring of Premises
ESKOM Annual Report 2007
<http://www.eskom.co.za>

National Response To South Africa's Electricity Shortage (Jan 2008)
http://www.info.gov.za/otherdocs/2008/nationalresponse_sa_electricity1.pdf

Eskom Demand Side Management
<http://www.eskomdsm.co.za/>

CSIRO, Demand-Side Response and the Electricity Network
http://www.det.csiro.au/science/de_s/de_dsm.htm

Ene-6 Thermal Energy Sub-metering

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

Ene-7 Hot Water Energy Usage

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

Ene-8 Common Property Services Energy Use

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

Ene-9 Renewable Energy Generation Use

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

Ene-10 Energy Efficient Appliances

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

Ene-11 Unoccupied Spaces

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise designs that minimise or eliminate energy use for spaces when unoccupied.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- A minimum of 60% of the Nominated Area achieves the Unoccupied Space criteria detailed below.

OR

Two points are awarded where:

- A minimum of 90% of the Nominated Area achieves the Unoccupied Space criteria detailed below.

The Unoccupied Space criteria for Credit Criteria compliance are:

- The space is naturally ventilated in accordance with SANS 10400-O:2011;

OR

- The air-conditioning system in each separate enclosed space is:
 - Designed for automatic shut down after a set unoccupied period;
 - OR
 - Designed with a “set-back” control band (i.e. wider temperature control band) which commences after a set unoccupied period.

For the purpose of this credit ‘**Nominated Area**’ is **Occupied Space**.

Ene-11 Unoccupied SpacesPOINTS
AVAILABLE**2**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report Additionally for air-conditioned spaces: <ol style="list-style-type: none"> 2. Extract(s) from tender documentation 3. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report Additionally for air-conditioned spaces: <ol style="list-style-type: none"> 2. As Built drawing(s) 3. Extract(s) from Commissioning Report(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

Where spaces air-conditioned:

- Providing a schedule of spaces within the building, indicating their ventilation mode(s); and
- Detailing the air-conditioning system and its occupancy control and setback mechanism;

Where spaces naturally ventilated:

- Listing each naturally ventilated space, its floor area and the area of external openings (openable windows/external doors) in that occupied space. The schedule must include the openings area expressed as a percentage of the occupied space floor area, to demonstrate compliance with the 5% minimum requirement in SANS 10400-O: 2011.

Tender / As Built drawing(s) of each typical space indicating floor area, air conditioning system and key control elements of the air conditioning system.

Extract(s) from tender documentation clearly demonstrating the control strategies used to achieve the set-back or automatic shut off that meet the Credit Criteria.

Extract(s) from Commissioning Report(s) demonstrating that the solution(s) have been commissioned and operate as intended by the design.

Ene-11 Unoccupied Spaces

POINTS
AVAILABLE**2**

ADDITIONAL GUIDANCE

Set-back requirements

The set-back control strategy must allow a minimum of an additional 2° in each direction is required (e.g. if the band allowed for an occupied room is 20° to 24°C then the band for an unoccupied room must be 18° to 26°C).

BACKGROUND

Depending on the climate of the location, HVAC systems use between 10% and 30% of the total electricity used in buildings (NREL, 1998). By reducing the amount of energy spent on heating and cooling in a building, users can reduce both greenhouse gas emissions and operational costs significantly. Buildings that are purely mechanically ventilated or air-conditioned can suffer from a number of problems, including: high energy consumption; poor indoor air quality; and thermal discomfort (IHEA, 2004).

Most HVAC systems are generally programmed to maintain a constant indoor temperature of 22° to 24°C and a relative humidity of 50% (Computrols, 2008). By increasing the thermostat to 26°C and relative humidity to 55%, it is possible to reduce energy consumption by up to 15% (Computrols, 2008; Green 2008). These are still comfortable environmental conditions. Similarly, many HVAC systems run continuously, even when there is no-one using the building. In 2006, a college of Harvard University saved nearly US\$9,000 on their utilities bill by installing sensors to shut down the HVAC system in unoccupied areas (HGCI, 2007). The Idaho Falls School District saved US\$20,000 during one holiday period by implementing similar shutdown measures (IOER, 2001).

REFERENCES & FURTHER INFORMATION

National Renewable Energy Laboratory (1998), 'New Design Tool Can Help Cut Building Energy Use by up to 50%: Energy Efficient Buildings Can Substantially Reduce Global Warming', in News, www.nrel.gov/news/press/1998/01en10.html, accessed August, 2008.

Institute of Hospital Engineering Australia (IHEA) (2004), Application Notes for Energy Saving: Mixed Mode/Natural Ventilation, IHEA National Office, Melbourne, Australia.

Computrols (2008), Energy Savings: HVAC, www.computrols.com/hvac-savings, accessed August, 2008.

Green, B. (2008), 'School's Energy Savings Inspire Town', in The Independent, 22 May, 2008,

Ene-11 Unoccupied Spaces

POINTS
AVAILABLE **2**

New York, USA.

Harvard Green Campus Initiative (HGCI) (2007), Green Building Resource: HVAC – Controls, www.greencampus.harvard.edu/theresource/tech-prod/hvac-controls, accessed August, 2008.

Idaho Office of Energy Resources (IOER) (2001), Idaho Falls School District #91: Holiday

Shut-Down Results in Big Savings for Idaho School District, IOER, Boise, USA.

Transport

All credits within the Transport category have the same underlying principle; to reward the reduction in automotive commuting by simultaneously discouraging it and encouraging use of alternative transportation.

Motor vehicles in general, and private cars in particular, are responsible for many forms of pollution. Climate change is impacted by motor vehicle use indirectly due to the high amounts of energy (and therefore emissions) required to manufacture cars and build supporting infrastructure and services, as well directly as the transport fuels combusted lead to greenhouse gas emissions within exhaust fumes. Car exhaust fumes also increase the levels of polluting particles in the air, which are a contributing cause of asthma and other respiratory illnesses.

There is a need to maximise alternative transport options if the use and environmental impact of car commuting is to be reduced. Options available may include trains, buses, minibus taxis, light rail and trams, as well as pedestrian and cycling opportunities. Of all of these alternatives, walking is the most 'sustainable', with no associated embodied energy or pollutants; cycling similarly does not pollute the environment.

The proportion of transport's contribution to regional and global carbon emissions varies by country and region, but the Western Cape energy profile for 2004 shows that transport accounts for 34.9% of total energy consumption by all economic sectors⁸. This translates into more than 22% of carbon emissions for the province, which is a higher proportion than some other countries, such as Australia where the transport sector accounted for 13.5% of greenhouse gas emissions in 2004⁹.

Reducing dependency on motor vehicles and private car use is an important means of reducing overall greenhouse gas emissions. Switching to transport modes that have low or zero carbon emissions can help support South Africa's long-term mitigation scenario for climate change, published in 2007 by the Department of Environment Affairs and Tourism¹⁰. Many commuters are in a position to make such a switch, particularly where development's design, facilities and location deliberately support alternative transport modes.

⁸ http://www.capecapegateway.gov.za/Text/2010/7/white_paper_-_sustainable_energy_western_cape.pdf

⁹ <http://www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006-report.pdf>

¹⁰ [www.environment.gov.za/HotIssues/2008/LTMS/A LTMS Scenarios for SA.pdf](http://www.environment.gov.za/HotIssues/2008/LTMS/A_LTMS_Scenarios_for_SA.pdf)

Tra-1 Provision of Car Parking

POINTS
AVAILABLE**2**

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of alternative modes of transport for staff and visitors/students travelling to public or education buildings.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where the number of car parking spaces provided is:

- At least 25% lower than the maximum local planning allowances applicable to the project;
OR
- Does not exceed;
 - The local planning minimum allowance by more than 10%;
OR
 - Where there is no minimum local planning allowance; the minimum Department of Transport (DoT) guidelines by more than 10%.

OR

Two points are awarded where the number of car parking spaces provided is:

- At least 50% lower than the maximum local planning allowances applicable to the project;
OR
- Does not exceed;
 - The local planning minimum allowance;
OR
 - Where there is no minimum local planning allowance; the minimum Department of Transport (DoT) guidelines.

Where car parking is not permitted in the local planning scheme, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Transport Category Score.

Tra-1 Provision of Car ParkingPOINTS
AVAILABLE**2**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Planning allowances extract(s) 3. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. Planning allowances extract(s) 3. As Built drawing(s)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Including a comparison between the total number of car parking spaces provided by the project against the total maximum or minimum number of car parking spaces allowed, with reference to supporting documentation.
- Where the credit is claimed as not applicable, referencing local planning extracts or the development approval certificate from the relevant authorities stating that no car parking is permitted in the project.

Planning allowances extract(s) from the local, provincial or national authority that clearly demonstrates the parking allowances for the project site and whether they are mandatory or otherwise.

Tender / As Built drawing(s) marked-up to show all car parking spaces in the development.

ADDITIONAL GUIDANCE

This credit is applicable regardless of the location of the project or the presence of local planning allowances, as neither of those factors lessens the environmental impact of automotive commuting.

Only mandatory local, provincial or national planning allowances can be used. This includes car parking requirements within the planning allowances or Development Approval requirements for the project. A number of South African municipalities do not have their own parking requirements, and defer to Department of Transport standards. Most that do have standards specify a minimum number of spaces.

Tra-1 Provision of Car Parking

POINTS
AVAILABLE**2**

The City of Cape Town in 2006 issued parking standards under the new Integrated Zoning Scheme that reduced the minimum parking ratios, but did not specify a maximum. The City of Johannesburg in 2007 prepared a set of parking maximums.

Car parking spaces dedicated for use by disabled users can be excluded from the total number of car parking spaces provided by the project. All other car parking that forms part of the development must be included.

External car parks

If any part of the car parking provisions for the building occupants are met through external means (e.g. car park spaces are leased in another building), then it is necessary to:

- Include them in the number of parking spaces provided for the project; and
- Ensure that energy modelling addresses the external car parks in accordance with the relevant methodology (refer to Ene-1 'Greenhouse Gas Emissions').

Dedicated parking areas

The portion of the building that will not be for the use of the public or education building usage may be excluded from the calculations for car parking spaces if it can be demonstrated in the submission that the building occupants and visitors can not park in the parking area(s) dedicated to the other usage(s). Where this cannot be demonstrated all building areas and car parking spaces should be included in the calculations.

BACKGROUND

The proportion of a country's greenhouse gas emissions that can be attributed to transport activity varies from country to country. According to the South African State of the Environment Report 2006, vehicles contributed 21.3% to the total greenhouse gas emissions in the country. The majority of the transport emissions come from road transport, including cars, trucks and buses (DEAT, 2006).

Between 2000 and 2006 the number of vehicles has increased by 14%; furthermore vehicle emissions are predicted to increase by 27% and up by 44% by 2011 (base year 2002). The estimated car ownership rate for South Africa is about 129 vehicles per 1,000 people, which is marginally higher than the world average of 120 vehicles per 1,000 people (DEAT, 2006).

Atmospheric emissions are derived from a wide variety of anthropogenic and natural sources, and have effects on both human health and the environment. Fossil fuel combustion, particularly by motor vehicles, has been identified as the single largest contributor to air pollutants.

Reducing the number of car parking spaces will not only encourage building occupants to use mass transport but also to car-share, walk or cycle to work.

Tra-1 Provision of Car ParkingPOINTS
AVAILABLE**2**

REFERENCES AND FURTHER INFORMATION

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment
<http://soer.deat.gov.za/frontpage.aspx?m=2>

Western Cape Sustainable Energy Policy
<http://www.wcapeenergy.net>

National Greenhouse Gas Emissions Profile
<http://soer.deat.gov.za/themes.aspx?m=172>

City of Johannesburg Transportation Dept Parking Policy, October 2007

Australian Greenhouse Office, Sustainable Transport
<http://www.greenhouse.gov.au/transport>

Department of Transport and Regional Services (DOTARS), Motor Vehicles and the Environment
http://www.dotars.gov.au/department/statements/2005_2006/paes/part_c.aspx,

Nature Conservation Council, Smogbusters
<http://www.nccnsw.org.au>

Travel Smart Schemes:

Queensland - **<http://www.transport.qld.gov.au/travelsmart>**

South Australia - **<http://www.transport.sa.gov.au/environment/travelsmartsa>**

Victoria - **<http://www.travelsmart.vic.gov.au>**

Western Australia - **<http://www.dpi.wa.gov.au/travelsmart>**

Tra-2 Fuel-Efficient TransportPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise developments that facilitate the use of more fuel efficient vehicles for staff and visitors/students travelling to public or education buildings.

CREDIT CRITERIA

Two points are awarded where:

- For every 20 car parking spaces provided, a minimum of 1 parking space (or 5 parking spaces in total, whichever is the greater) is provided for mopeds/scooters/motorbikes;
AND
- A minimum of 5% of all car parking spaces (or 5 parking spaces in total, whichever is the greater) are dedicated solely for use by hybrid or other alternative fuel vehicles;
AND
- A minimum of 3% (or 1 parking space in total, whichever is greater) of staff car parking spaces are dedicated solely for use by car-pool and car-share vehicles, with appropriate supporting programs as per Additional Guidance;
AND
- All of parking spaces required above must be in preferred parking locations and be designed and labelled for the intended vehicles.

Where staff car parking is less than 30% of all car parking spaces, the third criterion is void. Where no parking spaces are to be provided, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Transport category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s)

Tra-2 Fuel-Efficient TransportPOINTS
AVAILABLE**2**

<p>3. Extract(s) from tender documentation</p> <p>Additionally where car pool vehicle parking spaces claimed:</p> <p>4. Green Travel Plan</p> <p>Additionally where car-share program claimed:</p> <p>5. Extract(s) from contract</p>	<p>3. Statement of confirmation</p> <p>Additionally where car pool vehicle parking spaces claimed:</p> <p>4. Green Travel Plan</p> <p>Additionally where car-share program claimed:</p> <p>5. Extract(s) from contract</p>
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Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Indicating the number and preferred location of car-pool, car-share, motorbike/moped/scooter, hybrid (or other alternative fuel) vehicles, and total number of parking spaces being provided; and,
- Demonstrating the share of staff parking of all parking spaces, and where the share of staff parking is greater than 30%, indicating the number and preferred location of staff parking dedicated solely for the use by car-pool and car-share vehicles.

Tender / As Built drawing(s) marked-up to clearly demonstrate the total number (or lack thereof, if the credit is claimed as 'Not Applicable') and preferred location of designated parking spaces required to meet the Credit Criteria.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the dedicated use parking to be clearly signed and marked.

Green Travel Plan prepared by a suitably qualified professional that:

- Adequately describes how the car-pool system is to work, including where parties register their interest as passenger/driver; and,
- Details the allocation of responsibility for implementation of the programme.

Extract(s) from contract for car share-service signed by both the Building Owner and the service provider, clearly indicating:

- The number of car-share vehicles to be accommodated on the site; and,
- The time period that the contract is valid for.

Statement of confirmation from the Contractor in the form of signed correspondence stating that all dedicated use car parking spaces are clearly signed and marked.

ADDITIONAL GUIDANCE

This credit is applicable regardless of location or presence of local planning allowances, as neither of those factors lessens the environmental impact of automotive commuting.

Tra-2 Fuel-Efficient Transport

POINTS
AVAILABLE**2**

For the purpose of this credit, car parking spaces dedicated for use by disabled users can be excluded from the total number of car parking spaces.

Preferred parking spaces

Preferred parking spaces are defined as those located closest to the facility entrance or lift core (aside from parking spaces for disabled users). These spots must be clearly signposted and marked with a separate colour from other spots. They must not be double or tandem spaces. Double parking, in this context, is defined as two vehicles parking side by side, or in parallel, in such a way that the inner vehicle is blocked and unable to leave by the outer vehicle. Tandem parking is similar but in this case the vehicles are parked nose to tail hence blocking the inner vehicle.

Parking space sizes

The number of moped/scooter/motorbike spaces must be at least 5 or 1 for every 20 vehicle spaces on the site (whichever is greater). The size of the 'parking space' is equal to the size of a moped/scooter/motorbike parking space. For example, a site with 190 car parking spaces and 10 motorbike spaces would qualify, however, 9 motorbike spaces would not qualify (in the calculation decimals greater or equal to 0.5 need to be rounded up). A site with only 15 car parking spaces would be required to provide 5 motorbike spaces to qualify.

Carpooling

In South Africa, there is no existing process for car pool participants to be registered as part of a carpooling programme, for which documentary evidence or preparatory registration must be submitted. Therefore the requirement for this credit is to demonstrate commitment to a green travel plan that is supported by an employee of the building owner (or tenant) or the body corporate in the case of a multi-building development with independent owners. The percentage only applies to staff bays.

Car sharing

The concept of car sharing is that individuals can hire cars from a pool that is distributed throughout a city, on an hourly basis rather than daily, making them a more cost-effective and efficient form of transport than owning a vehicle or renting on a daily basis. (ZipCar is a North American example, and there are others in Europe.) This credit allows for the possibility that building owners or tenants may set up formal car-sharing arrangements for the use of the building tenants and potentially for other workers in the vicinity. To claim credit for such an arrangement, it must be shown that parking space(s) is provided. The percentage only applies to staff parking bays.

BACKGROUND

Over the last decade new private vehicle sales showed an average increase of 9.5% per annum up until 2008 worldwide (KPMG, 2008). During the same period petrol sales have increased by 14% and diesel sales by 50% (Mabusela & Mamakoko, 2006). While the 2001 South African Census shows that private vehicles account for 19% of all journeys taken, one can expect that this trend will increase, especially in the urban environment. In Johannesburg, for example, private car travel accounts for almost 50% of commuter trips with minibus travel being responsible for a further ~30% of trips (DEAT, 2006).

Tra-2 Fuel-Efficient Transport

POINTS
AVAILABLE**2**

Increases in the extent of single occupancy vehicles, and increases in the number of cars per capita have been quoted in cities like Cape Town as proof of the growth in vehicle activity rates (Cape Town State of Environment Report, 2003).

The greenhouse gas emissions from the typical petrol based passenger vehicle are approximately 60% greater than the emissions from a motorcycle. Choosing a two-wheeled vehicle can help to reduce air pollution, as well as minimise greenhouse gas emissions.

REFERENCES AND FURTHER INFORMATION

Department of Environmental Affairs and Tourism (DEAT) & Department of Minerals and Energy (DME) (2003) Joint Implementation Strategy for the Control of Exhaust Emissions from Road-going Vehicles in the Republic of South Africa

Moving South Africa: A Transport Strategy for 2020

<http://www.transport.gov.za/projects/msa/msa.html>

Australian Greenhouse Office, *Fuel Consumption Guide*

www.greenhouse.gov.au/fuelguide

Greenhouse Gas Emissions Calculator

www.greenhouse.gov.au/fuelguide/environment.html

Department of Transport and Regional Services (DOTARS), *Motor Vehicles and the Environment*

www.dotars.gov.au/department/statements/2005_2006/paes/part_c.aspx

Standards Australia, AS2890.1-1993 *Parking Facilities – Off-street Car Parking*

www.standards.org.au

KPMG Global Automotive Executive Survey (2008) South Africa

Zero Carbon Collective

<http://www.zerocarbonco.co>

Tra-3 Cyclist Facilities

POINTS
AVAILABLE **3**

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of bicycles by staff, visitors and students.

CREDIT CRITERIA

Up to three points are awarded as follows:

All Public Buildings (Education buildings excluded)

Up to two points are awarded where:

- Safe and unimpeded cycling routes are provided between the development and the adjacent street network;

AND

- Cyclist facilities (in accordance with the Additional Guidance) are provided for a nominated percentage of staff, awarded as follows:
 - 3% for one point;
 - OR
 - 6% for two points;

AND

- Bicycle storage (in accordance with the Additional Guidance) is provided for a nominated percentage of daily visitors, awarded as follows:
 - 3% for one point;
 - OR
 - 6% for two points;

For Public Buildings (excluding Education Buildings), the third point in this credit must be claimed as 'Not Applicable', and is excluded from the points available used to calculate the Transport Category Score.

Basic Education Buildings (Primary & Secondary Only)

Up to three points are awarded where:

- Safe and unimpeded cycling routes are provided between the development and the adjacent street network;

AND

Tra-3 Cyclist FacilitiesPOINTS
AVAILABLE**3**

- Cyclist facilities (in accordance with the Additional Guidance) are provided for a nominated percentage of staff, awarded as follows:
 - 3% for one point;
OR
 - 6% for two points;
OR
 - 6% for three points.

AND

- Bicycle storage (in accordance with the Additional Guidance) is provided for a nominated ratio of students (over Grade 4), awarded as follows:
 - One per seven students (over Grade 4), for one point;
OR
 - Two per seven students (over Grade 4), for two points;
OR
 - Three per seven students (over Grade 4), for three points.

Higher Education Buildings (University & College Only)

Up to three points are awarded where:

- Safe and unimpeded cycling routes are provided between the development and the adjacent street network;

AND

- Cyclist facilities (in accordance with the Additional Guidance) are provided for a nominated percentage of staff, awarded as follows:
 - 3% for one point;
OR
 - 6% for two / three points depending on threshold targeted below;

AND

- Bicycle storage (in accordance with the Additional Guidance) is provided for a nominated percentage of the peak number of students (calculated in accordance with the Additional Guidance), awarded as follows:
 - 5% for one point;
OR
 - 10% for two points;
OR
 - 15% for three points.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) 4. Statement of confirmation (1) 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Statement of confirmation (1) 4. Statement of confirmation (2)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Demonstrating through calculations of the percentage of staff members and number of visitors served, and hence the number of bicycle storage spaces required;
- Describing the location and provision of the cyclist facilities;
- For visitors; confirming that the spaces provided are signposted in an accessible location near a major public entrance;
- Demonstrating that the spaces have good natural surveillance (or are in a secured area);
- Describing how access is provided to the bicycle spaces, shower and locker facilities; and,
- Describing how safe and unimpeded cycling routes are provided between the development and the adjacent street network.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

- The minimum number of showers, lockers and storage/parking spaces;
- Storage/parking spaces to comply with the requirements as outlined in the Additional Guidance;
- Applicable signage to comply with the requirements as outlined in the Additional Guidance.

Tender / As Built drawing(s) marked-up to clearly demonstrate necessary cyclists provisions including:

- The number and location of cyclist facilities for staff and the number and location of visitor/student bicycle parking spaces; and,

Tra-3 Cyclist Facilities

POINTS
AVAILABLE**3**

- The route(s) provided for cyclists across the development site, including surface treatment, surface markings, and traffic signage for both motorists and cyclists indicating traffic control for both;

Statement of confirmation (1) in the form of signed correspondence from the Building Owner, confirming:

- The number of staff that will work in the building simultaneously during standard operation;
- The maximum number of visitors/students to the building simultaneously during standard operation; and,
- What basis the above information is calculated upon.

Statement of confirmation (2) from the Contractor in the form of signed correspondence, stating the number of bicycle storage spaces installed and the number of visitor/student bicycle storage spaces installed (where applicable).

ADDITIONAL GUIDANCE

For the purpose of this credit, a major public entrance is defined as a public entrance to the building that is accessible from a public plaza, main street or avenue. Furthermore, the entrance to a multi-storey car park will also be considered to be a major public entrance if the visitor's cyclist facilities are clearly signposted at the entry to the car park and the designated parking is no more than one split level away (in either direction) from the entrance level.

Cyclist facilities for building staff

For the purposes of this credit, cyclist facilities are considered to consist of the following:

- Secure bicycle storage;
- Accessible showers (based on one per 10 bicycle spaces provided or part thereof);
- Changing facilities adjacent to showers; and,
- One secure locker per bicycle space in or adjacent to the changing facilities.

Secure bicycle storage for staff is to be protected from the elements and provided in close proximity to the entrance to the car park or public/education building, in a location that is highly visible, well lit, well signposted and with good passive surveillance.

Secure tenant/building staff bicycle storage can be achieved by one of the following two methods:

1. Racks/rails which are covered and protected from the elements, and designed to allow both a wheel and the frame to be locked securely to the structure;

OR

Tra-3 Cyclist Facilities

POINTS
AVAILABLE**3**

2. A locked bicycle shed, with access for staff only. Sufficient space must be provided to store all bikes without having to move other bikes or rely on a bike's integral stand. Fixtures to lock bikes in this case are not required.

Railings, lamp posts or other non-purposeful bike parking facilities do not comply.

Visitor/Student bicycle storage

Visitor/student bicycle racks must be located within 50m of a major public entrance in an accessible location that is clearly signposted and provides good natural surveillance. While bicycle spaces may be used by couriers and delivery personnel, they are primarily for the convenience of people visiting the public or education building. Racks/rails must be designed to allow both a wheel and the frame to be locked securely to the structure. Railings, lampposts and other non-purposeful bike parking facilities do not comply.

Student peak numbers

The peak number of students in higher educational buildings (universities and colleges) is calculated as 75% of the defined occupancy and student occupancy is defined by the architect or building owner as the maximum number of students in the building simultaneously during standard operation.

Visitor numbers

Visitor numbers are defined by the architect or building owner as the maximum number of visitors to the building simultaneously during standard operation.

Showers and changing facilities

Showers and changing facilities can be available for non-cycling users of the building and must be protected from the elements and available for both male and female users.

The total required number of showers and lockers does not have to be provided in one area. However, all cyclist facilities must be accessible to all staff, i.e. they cannot be located within tenancies or require access through a tenancy

Secure lockers must be adequately sized to accommodate normal office clothing, i.e. must not be smaller than 80 cm tall by 25 cm wide (for box lockers) or 180 cm tall by 40 cm wide (for 'L-shaped' double lockers).

Toilets do not count as changing facilities unless there is sufficient private space and lockers. Even if toilets are fitted out as changing rooms, the minimum number of disabled toilets mandated by statutory requirements cannot contribute to the total number of changing facilities provided, as doing so may detract from their availability for use by disabled persons. Where there are no statutory requirements for showers for people with disabilities, and the project includes one, then it may qualify in the total number of showers provided. If however, showers are required by law for people with disabilities, these cannot be included in the number of showers for cyclists.

Changing facilities must be immediately adjacent to the showers, or for refurbishments, be located on the same floor with direct access that avoids crossing of public spaces such as lift lobbies, reception areas or primary circulation space.

Safe and unimpeded routes

Tra-3 Cyclist Facilities

POINTS
AVAILABLE**3**

The requirement for safe and unimpeded cycling routes within the development and to the adjacent street network is intended to ensure that cyclists have access that is at least as convenient as vehicular access. This includes clear markings of cyclist routes/paths from the development entrance/exit to the bicycle storage areas. This does not necessarily require a dedicated right-of-way or lane for cyclists, but it does require deliberate designing of the route (whether on-street or off-street) to ensure safe passage across the site, and through parking areas (if applicable). Where cycling routes are on internal access roads, the roads must be marked to show the cycle route (so that the cyclist knows where to travel and the vehicles are aware of cyclist using the roads). Vehicle parking areas or basements that need to be accessed or crossed by cyclists should also be marked to show the cycling route. The routes should provide direct access to any cycle storage provided on site and, if relevant and if adjacent to the boundary, connect to offsite cycle paths. The term “unimpeded” implies that cyclists should not be obstructed by security booms, steps, gutters or the like, and should not need to portage bicycles to/from storage area(s).

External cyclist facilities

Although Green Star SA assesses inherent attributes of buildings, external amenities are critical to the success of attempts to encourage alternative forms of mobility. Consequently, while the developer does not have direct control over amenities beyond the assessed property, the absence of certain amenities would reduce the effectiveness of on-site amenities. It would therefore be beneficial to encourage the local municipality to implement cycle network plans.

Opportunities to influence the development of off-site facilities are to be encouraged. For example, a multi-owner development that has a strong body corporate provides an opportunity to coordinate cycling links. Even in the case of individual owner developments such as a large public or education building in a Central Business District (CBD), approval authorities sometimes require off-site transportation improvements to mitigate impacts. If these impacts are extended to consider cyclists, then it might not be unreasonable for provision of off-site cyclist facilities to be negotiated between the developer and the approving agency to complete cycling routes.

Where external amenities are planned or implemented, it would be beneficial to provide connections from the on-site cycle route to the nearest off-site designated route.

As Green Star SA assesses inherent attributes of buildings, external amenities can only be rewarded if they are provided for the life of the building to the same degree of service and certainty as internal facilities. As a result, the following applies to amenities (such as cyclist facilities) that are located on separate premises and not within the assessed building:

- i. The scope of assessment is not extended beyond the assessed building, i.e. the building within which the amenities are housed does not need to meet the Credit Criteria of any claimed credits; only the amenities will be assessed against the Credit Criteria of the credit towards they contribute;
- ii. The assessed building and the amenities are under the same ownership and cannot change ownership separately (i.e. they are on the same title or equivalent);
- iii. The assessed building and the amenities are under the same management and cannot change management separately (e.g. the same facility management to ensure recycling waste storage is processed as designed);

Tra-3 Cyclist Facilities

POINTS
AVAILABLE **3**

- iv. The cyclist facilities are close proximity to the assessed building and the access route is clearly marked and sign-posted, convenient, guaranteed and secure;
- v. The amenities are completed by the date of practical completion of the assessed building; and
- vi. The amenities fully meet the Credit Criteria and are documented in strict accordance with the Technical Manual, including weather protection.

Non Public & Education Building users

The portion of the building that may not be for public or education building usage may be excluded from the calculations for cyclist facilities if it can be demonstrated in the submission that these cyclist facilities are only accessible to the public or education building occupants. If the cyclist facilities are accessible to everyone, the facilities must be sized for all users, and projects must justify the amount provided to meet the needs of the non-public/education-building components.

BACKGROUND

Cycling benefits the environment by reducing levels of potential pollutants from other means of transport, provides substantial health and economic benefits to the cyclist, and helps reduce road congestion.

According to the Australian Bureau of Transport and Regional Economics' Greenhouse Policy Options for Transport report (2002) an estimated one-third of day-to-day car trips are 3km or less in length, which usually represents an easy cycling distance. The average length of each bicycle trip is 2.5 km.

A cold car motor produces more pollutants than a hot one, especially when equipped with a catalytic converter. It can take 5km or more before pollution control devices such as catalytic converters start to become effective.

Short trips in cars are therefore seen as relatively more environmentally damaging whilst being the length of journey most attractive for walking and bicycling. Bicycling and walking are promoted as efficient, low-cost and low-impact modes of travel that can be particularly effective in maximising the effective use of local roads and mass transport services.

Statistics South Africa (2001) reports that approximately 60% of all trips are made by non-motorised transport, but less than 1% of all trips are made by bicycle. A number of South African cities are developing, or have developed, Non-Motorised Transport (NMT) plans with cycle networks, and are adopting support programs to encourage increased use of non-motorised transport.

Over time, and with the development of supporting facilities at public & education buildings and other buildings, these initiatives should make it easier to cycle. Research in Australia and elsewhere has consistently found that people are more willing to cycle when the appropriate facilities are provided at the destination.

Tra-3 Cyclist Facilities

POINTS
AVAILABLE **3**

REFERENCES AND FURTHER INFORMATION

GAUTRANS guidelines for the provision of pedestrian and bicycle facilities on provincial roads in Gauteng

[http://www.up.ac.za/dspace/bitstream/2263/7115/1/Visser_Gautrans \(2003\).pdf](http://www.up.ac.za/dspace/bitstream/2263/7115/1/Visser_Gautrans%20(2003).pdf)

Infrastructure policy, planning and design digest

<http://www.ibike.org/engineering/infrastructure.htm>

Framework for non-motorised transport, January 2009

http://www.joburg-archive.co.za/2009/pdfs/transport/nmt_framework09.pdf

Australian Bicycle Council, 1999-2004 Australia Cycling: The National Strategy

www.austroads.com.au/abc/

City of Cape Town: NMT Policy and Strategy

<http://www.cityenergy.org.za/transport/nmt>

Bureau of Transport and Regional Economics (2002), Greenhouse Policy Options for Transport

www.btre.gov.au

Building Research Establishment's Environmental Assessment Method, BREEAM Tra-4

<http://www.breeam.org>

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE **5**

AIM OF CREDIT

To encourage and recognise developments that select a site near public transport and facilitate the use of mass transport.

CREDIT CRITERIA

Up to five points are awarded for the quality of mass transport options available to building users – 4 points for weekday and 1 point for weekend/evening services.

Scoring points in the calculator is on condition that the project includes at least one dedicated space for providing information about local public transport, cycling, walking and taxi services/facilities. This information must be displayed using a lockable notice board or electronically.

The dedicated space must:

- be in a location that is accessible to all building users, ideally in a main reception or lobby area,
- be signposted at its location and throughout appropriate areas of the development indicating its existence, purpose and location.

The points are determined using the Green Star Mass Transport Calculator based on:

- The type of mass transport services available within 1,000m of the site;
- The number of routes served;
- The average interval between services during weekday peak hours; and
- The average interval between services during weekends and evenings when the facility is open for visitors/students.

Where the building does not operate on weekends or evenings, the 1 point associated to weekend or evening operation is 'Not Applicable' and is excluded from the points available, used calculate the Transport category score.

Tra-4 Commuting Mass TransportPOINTS
AVAILABLE**5**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. Evidence of service frequency 4. Extract(s) from tender documentation 	<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. Evidence of service frequency 4. Statement of confirmation

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by:

- Summarising the transport stops surrounding the site in compliance with the distance requirement;
- Showing the transport stop(s), appropriately labelled route(s) of service(s) and walking distances from the main entrance of the development to the transport stop(s) on an appropriately scaled map;
- Providing a tabulated summary of the service(s) and route(s) using each transport stop;
- Justifying all the inputs into the Mass Transport Calculator with reference to supporting documentation.

Calculator extract from the Green Star SA Public & Education Building v1 Mass Transport Calculator which clearly demonstrates all inputs and results outputs.

Evidence of service frequency for bus, minibus and/or trains in the form of any of the following:

- Extract(s) from timetable(s) for each route showing service frequency during peak periods. The timetable provided must not be more than one year old from the date of Green Star SA submission;
- Survey results of observed bus, minibus or train operations during peak commuter periods;
- Current Public Transport Record (CPTR) completed in accordance with national requirements, and such record is based on data collected less than one year prior to the date of the Green Star SA submission.

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE **5**

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the inclusion of the travel information portal.

Statement of confirmation from the Contractor in the form of signed correspondence, confirming the inclusion and features of the travel information portal.

ADDITIONAL GUIDANCE

The number of points achieved is determined by using the Green Star SA Commuting Mass Transport Calculator in the Green Star SA Public & Education Building v1 rating tool spreadsheet.

The Green Star SA Commuting Mass Transport Calculator must be used in accordance with the Commuting Mass Transport Calculators Guide available from the GBCSA website (<http://www.gbcsa.org.za>).

Evenings and Weekends

The Commuting Mass Transport Guide dictates which periods fall into evenings and weekdays. In summary evenings are defined as any day after 18.30 and weekends are Saturdays and Sundays until 18.30.

Travel Point Information

The information point does not necessarily have to be situated internally. If sited externally however, it must be covered, in an area that is readily accessible to building users and within close proximity of the main entrance or pedestrian routes to and from local public transport nodes, parking areas and the main building entrance.

The credit can be awarded where there is an existing maintained and *up to date* information system within 250m of the assessed development's main entrance via a safe pedestrian route (not '*as the crow flies*').

Distance from development seeking certification to public transport stops

The point at which this measurement begins would depend on the extent of the 'Green Star SA certification boundary'. If the full site is being certified under Green Star SA, then the pedestrian entrance to the site may be used as the starting point for measurements. If only one building on a larger site is being certified, the pedestrian entrance of the building must be used as the starting point for measurements.

BACKGROUND

When a development is poorly located in proximity to transport nodes (stops, stations and interchanges) and/or and the frequency of service is poor, then it is unlikely that residents will use mass transport to travel to work or complete other errands. Conversely, developments that

Tra-4 Commuting Mass TransportPOINTS
AVAILABLE **5**

are within close proximity of good transport nodes with frequent service can encourage residents to use mass transport.

Of all urban work trips made in South Africa by public, private and non-motorised transport in 1998, just under 40% are made on bus, minibus and train services. This is a significant share for public transport, but there has been a shift away from public to private transport, with a resultant increase in greenhouse gas emissions and air pollution. According to the 2001 Census, South Africa at that time had 129 vehicles per 1,000 people, which is higher than the world average of 120, and more than 7 million vehicles were on South African roads. The number of vehicles was growing at a rate of 2% a year (DEAT, 2006).

Private transport trips are often undertaken over longer distances than public transport trips, with a corresponding increase in environmental impact. Nationwide in South Africa, 19% of the trips taken are by private vehicle transport (cars and motorcycles), while minibus taxis account for 11.5% of the trips. In urban areas these numbers are higher, for example in Johannesburg, private car travel accounts for almost 50% of commuter trips with minibus travel being responsible for a further 30% of trips (DEAT, 2006).

REFERENCES & FURTHER INFORMATION

Building Research Establishment's Environmental Assessment Method, BREEAM Tra-7
<http://www.breeam.org>

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment.
<http://soer.deat.gov.za/frontpage.aspx?m=2>

National Land Transport Transition Act 22 of 2000
<http://www.info.gov.za/view/DownloadFileAction?id=68189>

Traffic Impact Study Guideline of the City of Pretoria, July 1998

South African Trip Generation Rate

Manual for Traffic Impact Studies RR93/635, Department of Transport

City of Johannesburg Framework for Non-Motorised Transport (2009)
<http://www.joburg.org.za/content/view/1226/78/1/4/>

City of Cape Town's Non-Motorised Transport Strategy (2005)
<http://www.cityenergy.org.za/transport/non-motorised-transport>

Urban non-motorised transport (NMT) (2001) A critical look at the development of urban NMT policy and planning mechanism in South Africa from 1996 -2006
<http://www.up.ac.za/dspace/bitstream/2263/5953/1/017.pdf>

Tra-4 Commuting Mass Transport

POINTS
AVAILABLE **5**

City Energy Support Unit: Sustainable Transport
<http://www.cityenergy.org.za/transport>

White Paper on National Transport Policy
<http://www.info.gov.za/whitepapers/1996/transportpolicy.htm>

The Sustainable Transport and Mobility Handbook
www.transportandmobility.co.za/

Urban Environmental Management: Sustainable Transportation
<http://www.gdrc.org/uem/sustran/sustran.html>

TDM Encyclopedia; Transit Station Improvements
<http://www.vtpi.org/tdm/tdm127.ht>

Tra-5 Local ConnectivityPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise public or educational buildings that are integrated with or built adjacent to amenities and dwellings to encourage effective car-based trip reduction initiatives.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- At least four amenities listed below are located, or are planned to be located, within 400m unimpeded walking distance of the development site (from the public entrance), or are within the building itself (excluding the building's primary function):

Accepted amenities:

- | | | |
|-----------------------------------|---|---|
| • Hardware store | • Garden nursery | • Officially designated 'Trading Area' |
| • Public sports field | • Neighbourhood park, open landscaped area (minimum 200m ²), open piazza, playground, beach or nature reserve | • Laundromat |
| • Pharmacy | | • Convenience store |
| • Gym, pool or sports facility | | • Restaurant or food outlet |
| • Library | | • Cinema or theatre |
| • Bank or ATM | • Post office | • Places of worship |
| • School, University or Technikon | • Retail shop | • Community centre |
| • Community food garden | • Supermarket or grocery store | • Hospital, clinic or healthcare centre |
| • Recycling depot | • Registered childcare centre | • Offices |

It must be demonstrated that safe, well-lit, dedicated pedestrian facilities are provided between the public or education building development and the adjacent street network. Where this cannot be demonstrated, an amenity cannot be claimed.

One point is awarded where:

- An average gross density of not less than 35 du/ha (dwelling units/hectare) is achieved for the entire area within 400m of the development site.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report Additionally where first point claimed: 2. Evidence of amenity location Additionally where future amenities claimed: 3. Extract(s) of Site Development Plan 4. Statement of confirmation 5. Development program	1. Short report Additionally where first point claimed: 2. Evidence of amenity location Additionally where future amenities claimed: 3. Extract(s) of Site Development Plan 4. Statement of confirmation 5. Development program

Short report prepared by a relevant project team member that describes how the Credit Criteria has been met by:

Where first point claimed:

- Providing a suitably scaled surrounding area map, site plan or aerial image with the location of all amenities (existing and future, where applicable), with unimpeded walking routes indicated;
- Demonstrating that dedicated pedestrian footpaths or walkways are provided between the main entrance of the development and the amenities claimed;
- Demonstrating the provision of lighting for pedestrian footpaths or walkways claimed.

Additionally where existing amenities are claimed:

- Providing a tabulated summary of all existing amenities claimed, their full addresses and the unimpeded walking route distance to each amenity, with reference to supporting documentation;

Additionally where future amenities are claimed:

- Providing a tabulated summary of all future amenities claimed, their full address, the unimpeded walking route distance to each amenity and the expected practical completion date of each amenity, with reference to supporting documentation.

Where second point claimed:

- Mapping the residential areas within 400m of the proposed development, and identifying the number of units in each area and demonstrating that the minimum gross density is achieved.

Tra-5 Local Connectivity

POINTS
AVAILABLE **2**

Evidence of amenity location in the form of any of the following:

- Extracts from web pages, 'White Pages', 'Yellow Pages', 'Google Maps' or equivalent;
- Business card, stationary or advertising material;
- In the case of buildings housing multiple amenities, a store directory is acceptable, or either a letter from the building owner / manager confirming uses, or a survey of uses within the period 08:00 to 21:00 on a weekday and the period 08:00 and 13:00 on Saturday and Sunday;

Extract(s) of Site Development Plan clearly identifying each amenity, or space type classification claimed.

Statement of confirmation in the form of signed correspondence from the Developer stating that the Site Development Plan (of stated revision and date) has been approved by the Relevant Planning Authority and that development rights have been obtained supported by evidence of Site Development Plan approval.

Development program clearly indicating that the practical completion date of the amenities claimed is within 3 years of the practical completion of the public or education building (within the scope of the Green Star SA certification).

ADDITIONAL GUIDANCE

Public amenity

The general intent of this credit is to discourage short car trips. Walking distance must be based on actual routes that allow for unimpeded pedestrian movement on paved surfaces removed from vehicular travel lanes. Distances "as the crow flies" are not acceptable as an indication of walking distances.

For the 'Officially designated trading area' amenity, the trading area must be such that no less than five traders are accommodated.

Unimpeded walking distance

The starting point for distance from the development must be either;

- The approximate geometric centre (at ground level) of the buildings (for multiple building certification); or
- The main pedestrian entrance of the building.

The point at which this measurement begins would depend on the extent of the 'Green Star SA certification boundary'. If the full site is being certified under Green Star SA, then the pedestrian entrance to the site may be used as the starting point for measurements. If only this building on a larger site is being certified, the pedestrian entrance of the building must be used as the starting point for measurements.

Tra-5 Local Connectivity

POINTS
AVAILABLE**2**

Any amenities within the development itself may be included regardless of distance to the main entrance, except if the amenity is the primary function of the building. The pedestrian entrance to the building (not site) in which the amenity is located must be used.

Where pedestrian routes cross barriers such as rivers, canals or roads, crossing opportunities must be indicated on the drawings submitted for the purpose of this credit. This may include bridges over canals, and pedestrian traffic crossings or road intersections (it may not be assumed that pedestrians will cross mid-block where there is no pedestrian crossing facility).

It must be demonstrated that safe, well-lit, dedicated pedestrian footpaths or walkways are provided between the main entrance of the development and the amenities claimed. Where this cannot be demonstrated, an amenity cannot be claimed.

Multiple amenities

Where there are two or more of one amenity, this will count as only two amenities. (For example, three restaurants will count as only two amenities.) Supermarkets, grocery stores and convenience stores count as the same type of amenity, so for example one supermarket and two convenience stores together count as only two amenities. Similarly, a standalone pharmacy and a pharmacy within a grocery or other store both contribute to the total pharmacies and cannot exceed two.

Where a building houses multiple amenities (e.g. a church which operates as a child care centre during the week), confirmation from the building owner/manager is required to confirm the multiple amenities or a survey of uses within the period 08:00 to 21:00 on a weekday and the period 08:00 and 13:00 on Saturday and Sunday.

Future amenities

Local amenities are commonly developed within larger projects, sometimes over many phases and long time periods. Such amenities may be developed under separate development contracts and at different project phases, however will typically be incorporated in the 'Masterplan' or Site Development Plan. Such future amenities may only be claimed within the Tra-5 Local Connectivity credit where;

- The amenities are clearly included within the scope of the Site Development Plan for the development;
- The Site Development Plan has been approved by the Relevant Planning Authority, rezoning has taken place and development rights obtained; and
- The practical completion date of the amenities is within 3 years of the practical completion date of the public or education building within the scope of the Green Star SA certification.

Future amenities which are not included within the Site Development Plan for the development cannot be claimed within the scope of this credit.

Dwelling Unit

For the purposes of the Green Star SA Public & Education Building v1 Tool, "dwelling unit" is defined as "One or more rooms in a building designed as an independent self-contained living accommodation for one or more people."

Tra-5 Local Connectivity

POINTS
AVAILABLE **2**

To further illustrate, the following would be considered a single “dwelling unit” for Green Star SA:

- A free-standing residential home, within or outside of an enclosed community
- A unit in an apartment block and/or townhouse development and/or duplex development and/or multi-unit residential complex
- A unit in a self-catering student accommodation facility
- A unit in a retirement village
- For buildings where visitors would typically be from out of town (e.g. convention centres), a room/suite in a hotel (or similar) facility

Residential density

For the purpose of this credit, a crow-fly distance is acceptable for identifying the number of residential units within a 400 m radius of the proposed development. It is not essential to show pedestrian routes to all residential units included in the calculation of average density; however the development drawings must show that there is a clear, safe pedestrian route to the public entrance of the development building from an adjacent public street.

The configuration and density of individual residential developments is not important for this credit, as long as the average gross density is achieved within the specified radius.

External pedestrian facilities

Although Green Star SA assesses inherent attributes of buildings, external amenities are critical to the success of attempts to encourage alternative forms of mobility. Consequently, while the developer does not have direct control over amenities beyond the assessed property, the absence of certain facilities would hinder access to public amenities. It would therefore not be appropriate to award points for amenities if it were not possible to walk between the land uses (separated by physical barriers or highways without crossings).

BACKGROUND

The practice of staff or visitors/students walking to a public or education building benefits the South African environment by reducing levels of potential pollutants from other means of transport, provides substantial health and economic benefits to the pedestrian, and helps reduce road congestion.

For people who do drive to the building, there are still benefits from walking from the public or education building to carry out errands.

Single-use zoning discourages walking, so this credit is intended to encourage the location of public or education buildings where other land uses are within walking distance. The promotion of public building locations within higher density residential areas is based on the concept that there will be a greater probability of people living close to a public or education buildings. Some people who could use public transport to commute to public or education buildings may

Tra-5 Local Connectivity

POINTS
AVAILABLE **2**

not do so because they wish to run errands while they are out, and the credit for proximity to public amenities is intended to reduce the need for errands to be carried out by car.

REFERENCES AND FURTHER INFORMATION

City of Cape Town (2005), City of Cape Town NMT Strategy.

<http://www.sustainable.org.za/transit/resource-library/non-motorised-transport/7.html>

City of Johannesburg, (2007) City of Johannesburg Planning Framework for NMT in JHB.

http://www.joburg-archive.co.za/2009/pdfs/transport/nmt_framework09.pdf

Mobility Strategy – Dept of Transport and Public Works

NMT Masterplan for Eden District Municipality – July 2007

Public Transport Infrastructure Plan – Dept of Transport & Public Works

DOT Draft National Scholar Transport Policy – Nov 2007

Rural Transport Strategy for South Africa – National DOT Nov 2003

Tra-6 Trip Reduction – Mixed Use

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool.

Tra-7 Vehicle Operating EmissionsPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise public or education buildings that reduce vehicular emissions resulting from traffic congestion by upgrading road infrastructure around the building.

CREDIT CRITERIA

Two points are awarded where:

- Traffic infrastructure is improved over and above the minimum peak hour traffic flow service levels compared to pre-development baseline traffic flows, awarded as follows;
 - One point where a 15% reduction in peak hour average CO₂ emissions per vehicle is demonstrated as a result of improved infrastructure.
- AND
- Two points where a 30% reduction in peak hour average CO₂ emissions per vehicle is demonstrated as a result of improved infrastructure.

Compliance must be demonstrated via a Traffic Impact Assessment (TIA) and the software that is used to undertake the TIA.

Where a Traffic Impact Study is not recommended by the Department of Transport's guideline document this credit is 'Not Applicable' and is excluded from the points available, used calculate the Transport category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Site plan 3. Extracts from traffic impact assessment 4. Statement of confirmation 	<ol style="list-style-type: none"> 1. Short report 2. Site plan 3. Extracts from traffic impact assessment 4. Statement of confirmation

Tra-7 Vehicle Operating Emissions

POINTS
AVAILABLE**2**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria has been met by:

- Description of infrastructure improvements; and
- A summary of the CO₂ calculations showing percentage improvement.

Site plan of surrounding areas, indicating the infrastructure conditions before and after proposed improvements.

Extracts from the traffic impact assessment showing the calculated reduction in peak hour average CO₂ emissions.

Statement of confirmation in the form of signed correspondence from the Building Owner confirming that no traffic impact study was required for the development.

ADDITIONAL GUIDANCE

The majority of the modern software packages used in South Africa as tools to calculate the performance of an intersection provide the evaluator the average delay, number of stops and CO₂ emissions.

Although other gases (CO, NO_x, SO_x, toluene, benzene etc) are emitted by vehicular exhausts, for the purposes of simplicity CO₂ is used as a proxy for total emissions.

CO₂ emission calculations are involved algorithms determined by vehicle designers for a design vehicle which is representing the typical car on the road. The algorithms must not be changed unless done in consultation with vehicle designers.

Traffic impact studies must be conducted in accordance with the Department of Transport's guideline document or, if available, the specific local authority's guideline by a competent person, usually a professional traffic engineer.

Several computer software packages are available that can be used for performing a Transport Impact Assessment. Green Star SA does not prescribe a certain package, however the software programme needs to be able to provide CO₂ calculations to demonstrate the Credit Criteria.

Area of analysis

The prescribed number of intersections to be analysed for the purpose of improving average vehicle delay in the project's Traffic Impact Study, in accordance with Manual for Transport Impact studies (DOT, 1995) and/or the Local/Provincial transport authority's requirements, must be used in the analysis for the reduction in vehicle emissions as per the Credit Criteria.

Tra-7 Vehicle Operating Emissions

POINTS
AVAILABLE**2**

Peak hour

Peak hour vehicle emissions must be assessed for the same peak hour periods analysed in the project's Traffic Impact Study. These are the times that the intersection is likely to operate at or above capacity and the average emissions will be at a maximum.

Emissions calculation methodology

For each intersection analysed, the average vehicle emissions must be determined for the pre-development scenario. The total average peak hour emissions are determined by adding the average vehicle emissions for each intersection. This is used as the base figure for calculating the percentage reduction in emissions resulting from further road upgrades as part of the project.

The transport engineer must obtain average total emissions for the pre-development scenario, as well as average total emissions for the post-development scenario including road upgrades, to quantify the reduction percentage. Projects that implement road upgrades to the infrastructure that reduces delay and therefore emissions by 15% or 30% compared to the pre-development scenario will achieve 1 or 2 points respectively.

BACKGROUND

Usually, 'delay' and 'number of stops' are used to determine the existing, existing plus development and post road improvements operational condition of an intersection. The higher the delay and number of stops the higher the CO₂ emissions per vehicle will be. CO₂ emissions are therefore an alternative tool to measure the operational condition at an intersection or access.

Traffic impact studies must be conducted in accordance with the Department of Transport's guideline document or, if available, the specific local authority's guideline by a competent person, usually a professional traffic engineer. The guideline document recommends that a traffic impact study must be conducted for any development generating more than a 150 vehicle trips during the peak hour. The local authorities can request a study for a development generating fewer trips if in their opinion the road network is already at capacity. The purpose of such a study is to mitigate the impact a new development will have on the existing road network.

The main steps of a typical traffic impact study are:

- Background and description of development;
- Determine study area;
- Determine existing traffic demand and intersection layout;
- Calculate trip generation of new development;
- Allocate trips to road network according to predicted trip distribution;
- Do capacity analyses to determine impact of development;

Tra-7 Vehicle Operating Emissions

POINTS
AVAILABLE**2**

- Determine road improvements to mitigate impact of development trips;
- Address public transport;
- Recommend parking demand; and
- Summary conclusions and recommendations.

Car emissions are a major source of air pollutants, such as oxides of nitrogen, particles and ozone. Poor air quality has been shown to aggravate asthma, bronchitis and cardiac problems. Carbon dioxide from vehicle emissions is also known as a contributing factor to global climate change. Road infrastructure improvements are necessary to reduce the traffic impact of the development to acceptable levels. Although upgrading and improving the road conditions is the responsibility of national, provincial, or local road authority, the developer of a public or education building is required to perform a Traffic Impact Assessment and to contribute to the capital investment to upgrade the road infrastructure.

REFERENCES & FURTHER INFORMATION

Australia Bureau of Statistics (2008) Labour Force, Australia, Detailed, Quarterly, Australian Government, Canberra, Australia

Transport Data Centre (TDC) (2007) 2005 Household travel survey summary report (2007 release) NSW Ministry of Transport, Australia
www.transport.nsw.gov.au/tdc/documents/hts-report-2005.pdf

City Council of Pretoria (1998), Guidelines for Traffic Impact Studies.

Department of Transport (1995), Manual for Traffic Impact Studies. (RR93 / 635)

Department of Transport (1995), South African Trip Generation Rates, 2nd Ed.

Tran:SIT, Transformation towards sustainable and integrated transport for the urban environment.

<http://www.sustainable.org.za/transit/>

Water

Within the Water Category, credits address the reduction of potable water use through design of water efficient systems, rainwater collection and water reuse.

Global water consumption has risen almost ten-fold since 1900, and many parts of the world are now reaching the limits of their supply. In South Africa, water has long been considered a precious and high-demand resource. Fresh water supplies are increasingly affected by a range of factors including catchment locations, contaminated sources drought and rising demand as Government embarks on projects to provide potable water to all communities. By 2006 the South African Government had provided safe drinking water to 16 million people since 1994¹¹.

However, it should be noted that South Africa falls in a region with low and unreliable rainfall and therefore potable water sources do not get adequate annual replenishment from rainwater. A paper written the Directorate of Water Resource Planning on water availability per water management area clearly demonstrated that there is limited capacity to extend water allocation to new consumers in most areas especially those in the western part of the country where rainfall is erratic¹². Therefore sustainable use of potable water in South Africa would not only protect the already stressed sources but also ensure future availability of this precious resource.

In South Africa, water is consumed indirectly through the production of electricity. Currently, Eskom uses 1.35 litres of water and 1kg coal to generate 1 kWh of electricity¹³. Leakages contribute to declining water sources. A toilet leak and or a dripping tap can waste up to 30 litres of water an hour, which adds up to 10 000 litres a year. Water efficient basin taps left running for only 15 seconds, while brushing teeth can account for about 300 litres of water wasted per day if 200 individuals have the same habit. This shows that a dramatic change in the habits by occupants at a large scale can have a significant impact in reducing consumption of potable water. Leakage on building premises is not so much of a problem as improved pressure test standards during commissioning of water supply systems which can virtually eliminate water wastage through leakage. However, at municipality level the problem of water leaks is a major challenge.

Green Star SA aims to simultaneously reduce the pressure and minimise the impacts on the environment from extensive water use in the built environment. Demand for potable water can be reduced through harvesting rainwater, and recycling waste water. Currently, a very small proportion of buildings have water recycling systems.

Green Star SA encourages measures to reduce the potable water consumption in public and education buildings. Such reductions will ease the pressure on South African water sources as well as contributing to more cost efficient operation and savings to residents.

¹¹ Department of Water Affairs & Forestry, <http://www.dwaf.gov.za/Communications/PressReleases/2006/children16Nov06.pdf>

¹² The Department of Water Affairs & Forestry: Directorate of Water Resources <http://www.dwaf.gov.za/WAR/documents/WMAWaterAvailability23Feb06.pdf>

¹³ The Environmental Handbook, www.trialogue.co.za

Wat-1 Potable WaterPOINTS
AVAILABLE **12****AIM OF CREDIT**

To encourage and recognise building design that minimises potable water consumption.

CREDIT CRITERIA

Up to twelve points are awarded where the water efficiency performance of the building achieves a minimum percentage reduction in potable water consumption from a reference case using the Green Star SA – Public & Education Building Potable Water Calculator.

Points are allocated as follows:

Reduction in Potable Water Consumption (%)	Wat-1 Awarded	Points
0	0	
5	1	
15	2	
25	3	
35	4	
45	5	
55	6	
65	7	
75	8	
80	9	
85	10	
90	11	
95	12	

Wat-1 Potable Water

POINTS AVAILABLE **12**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building Design	Green Star SA – Public & Education Building As Built
<p>Submit all the evidence and ensure it readily confirms compliance.</p> <ol style="list-style-type: none"> 1. Short report 2. Statement of confirmation (1) 3. Calculator extract 4. Extract(s) from tender documentation <p>Additionally where off-site reclaimed water is supplied to site:</p> <ol style="list-style-type: none"> 5. Statement of confirmation (2) 	<p>Submit all the evidence and ensure it readily confirms compliance.</p> <ol style="list-style-type: none"> 1. Short report 2. Statement of confirmation (1) 3. Calculator extract 4. Confirmation of the Contractor 5. Manufacturer product datasheet(s) 6. As Built drawing(s) 7. Extract(s) from Commissioning Report(s) <p>Additionally where off-site reclaimed water is supplied to site:</p> <ol style="list-style-type: none"> 1. Statement of confirmation (2)

Please refer to the Potable Water Calculator Guide for guidance on the Potable Water Calculator and documentation requirements.

Wat-1 Potable WaterPOINTS
AVAILABLE **12**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing the building's water efficiency strategy and key systems; and
- Providing a tabulated summary of fixtures and fittings included and nominating the water efficiency performance (i.e. L/min or L/flush) of each, with reference to supporting documentation.

Additionally where water based heat rejection is proposed/installed:

- Describing the heat rejection system proposed for the building;
- Listing the heat rejection loads as determined by the Energy Modeling, or calculated by mechanical engineer if no modelling was done for Ene-01; and
- Justifying all entries to the Calculator relating to water consumption by the heat rejection system (drift co-efficient, condenser water dT, cycles of concentration) by referencing supporting documentation where relevant.

Additionally where efficient landscaping is proposed/installed:

- Describing the landscape areas, sizes and microclimate, with reference to supporting drawings;
- Listing the plant schedule and identifying the projected water demand for each defined landscape area, in line with Appendix B of the Potable Water Calculator Guide; and
- Explaining the irrigation system and their controls for each defined landscape area in line with the Potable Water Calculator Guide.

Additionally where swimming pool(s) are proposed/installed:

- Describing the swimming pool(s), filtration system and initiatives to reduce potable water consumption; and
- Justifying all inputs to the Calculator with reference to supporting documentation.

Additionally where laundry facilities are proposed/installed:

- Describing the laundry facilities, laundry load estimates and equipment proposed/installed; and
- Justifying all inputs to the Calculator with reference to supporting documentation.

Additionally where large kitchen(s) are proposed/installed:

- Describing the kitchen fittings and equipment proposed/installed; and
- Including calculations demonstrating the estimated number of meals served; water demand per meal in line with the guidance provided in the Potable Water Calculator Guide.

Additionally where other major water uses are proposed/installed:

- Describing the major water use and the water saving initiatives; and

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AVAILABLE **12**

- Including calculations justifying the inputs into the Potable Water Calculator.

Note: the project must clearly demonstrate the claimed water consumption through calculations and verification documentation, approved by the GBCSA through a CIR process.

Additionally where sustainable water supply is proposed/installed:

- Describing the type of sustainable water (recycled water, rainwater, other non-potable water supplies) initiatives and systems included in the project; and

Where grey/black water supply is recycled:

Justifying all inputs into the Calculator with reference to supporting documentation, including but not limited to recycled water sources, non-potable water demands, and daily treatment, storage capacity and system operations.

Where rainwater is harvested and reused:

- Justifying all inputs into the Calculator with reference to supporting documentation, including but not limited to rainfall harvesting areas, non-potable water demand, and daily treatment, storage capacity and system operations.

Where other sustainable water supply is used:

- Justifying all inputs into the Calculator with reference to supporting documentation.

Additionally where off site reclaimed water is supplied to site:

- Describing the arrangement with the supply vendor; and
- Confirming the volumes supplied to the site.

Statement of Confirmation (1) from the Building Owner or Project Architect confirming:

- Occupant inputs (occupant type, design number of occupants, occupancy profile, peak days per week, percentage of occupants who have access to shower);
- The number of staff that will work in the building simultaneously during standard operation; and
- The maximum number of visitors/students to the building simultaneously during standard operation.

Calculator extract from the Green Star SA – Public & Education Building Potable Water Calculator that clearly shows the values that have been entered in accordance with the Potable Water Calculator Guide, and showing the output results.

Extract(s) from tender documentation clearly demonstrating;

- The contractual requirement to install fixtures and fittings which meet the minimum water efficiency performance requirements necessary for completion of the Potable Water Calculator; and
- Where specific products are specified, manufacturer datasheets confirming flow rates and controls must also be submitted (*design rating only*).

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AVAILABLE **12**

Additionally where water based heat rejection is proposed/installed:

- Location and type of the water based heat rejection system; and
- The contractual requirement to install the proposed water based heat rejection system, its water sources and all operational parameters (drift co-efficient, condenser water dT, cycles of concentration) necessary for completion of the Potable Water Calculator.

Additionally where efficient landscaping is proposed/installed:

- Tender Drawings marked up to show the different landscaped areas, plant types, irrigation demands, landscape area sizes, and microclimate necessary for completion of the Potable Water Calculator;
- Where irrigation systems are provided: the contractual requirement to install the proposed landscape irrigation system and irrigation system controls necessary for completion of the Potable Water Calculator.

Additionally where swimming pool(s) are proposed/installed:

- The contractual requirement to install the swimming pool, its size and volume, indoor/outdoor, pool filtration system and pump flow rate, pool filtration controls, number of cartridge filters (if applicable), pool cover, heating requirements (if applicable) and filtration area and location (if applicable) necessary for the completion of the Potable Water Calculator.

Additionally where laundry facilities are proposed/installed:

- The contractual requirement to install laundry equipment and the required water efficiency of the equipment in ltr/kg; and
- Where specific products are specified, manufacturer datasheets confirming equipment water efficiency must also be submitted (*design rating only*).

Additionally where large kitchen(s) are proposed/installed:

- The contractual requirement to install kitchen equipment and the relevant required water efficiency of the equipment; and
- Where specific products are specified, manufacturer datasheets confirming equipment water efficiency must also be submitted (*design rating only*).

Additionally where other major water uses are proposed/installed:

- The contractual requirement to install any relevant equipment and its related water efficiency; and
- Where specific products are specified, manufacturer datasheets confirming equipment water efficiency must also be submitted (*design rating only*).

Additionally where sustainable water supply is proposed/installed:

- The contractual requirement to install the proposed sustainable water system, description of the overall system operation, storage capacity, connections to the non-potable water supply/demand and all operational parameters necessary for completion of the Potable Water Calculator.

Additionally where off site reclaimed water is supplied to site:

Wat-1 Potable WaterPOINTS
AVAILABLE **12**

- Showing the connection to off-site reclaimed water supply, and connection to water demands.

Statement of confirmation (2) in the form of signed correspondence from the off-site reclaimed water supply vendor confirming;

- The volume to be supplied (annually or otherwise); and
- The availability of the reclaimed water at the date of practical completion of the project.

Confirmation of the Contractor identifying:

- All fittings and fixtures installed in the project (WC's, urinals, WHB, showers).

Additionally where laundry facilities are installed:

- All laundry equipment installed in the project.

Additionally where large kitchen(s) are installed:

- All kitchen equipment and fittings installed in the project.

Manufacturer product datasheet(s) clearly demonstrating:

- The water usage per flush or per minute of each fixture and fitting (WC's, urinals, WHB, and shower)

Additionally where water based heat rejection is installed:

- The operational parameters (drift co-efficient, condenser water dT, cycles of concentration) used for completion of the Potable Water Calculator

Additionally where efficient landscaping is installed:

- The relevant parameters of the irrigation controls used for completion of the Potable Water Calculator.

Additionally where swimming pool(s) are installed:

- The relevant parameters (pump flow rate, filtration system, filtration controls) of the filtration system and controls used for completion of the Potable Water Calculator.

Additionally where laundry facilities are installed:

- The water usage per kg of linen for each laundry machine.

Additionally where large kitchen(s) are installed:

- The water usage of each kitchen appliance or fitting

As Built drawing(s) marked-up to clearly demonstrate:

Where water based heat rejection is proposed/installed:

- Location and type of the water based heat rejection system.

Additionally where efficient landscaping is proposed/installed:

- The different landscaped areas, plant types, irrigation demands, landscape area sizes, and microclimate necessary for completion of the Potable Water Calculator; and

Wat-1 Potable WaterPOINTS
AVAILABLE **12**

- Where irrigation systems are proposed/installed: drawings showing irrigation system and irrigation system controls.

Additionally where swimming pool(s) are proposed/installed:

- The location, size and volume of the indoor/outdoor swimming pool, and
- Pool cover and pool filtration systems.

Additionally where sustainable water supply is proposed/installed:

- All applicable reclaimed/reuse water systems, storage capacity and the connections to end-uses (where applicable).

Additionally where off site reclaimed water is supplied to site:

- Showing the connection to off-site reclaimed water supply, and connection to water demands.

Extract(s) from Commissioning Report(s) demonstrating:

For Fittings and Fixtures:

- Where projects claim flow rates different from the “factory settings” of the Manufacturers Data Sheets, Extracts from Commissioning Reports must demonstrate the installed settings of the Fittings and Fixtures. Where projects use the “factory settings” Extracts from Commissioning Reports are not required.

Additionally where water based heat rejection is installed:

- That the system has been commissioned and operates as intended by the design.

Additionally where efficient landscaping is installed:

- That the irrigation system and controls have been commissioned and operate as intended by the design.

Additionally where swimming pool(s) are installed:

- That the filtration system has been commissioned and operates as intended by the design.

Additionally where sustainable water supply is installed:

- That the sustainable water system has been commissioned and operates as intended by the design.
-

ADDITIONAL GUIDANCE

This credit addresses the entire building gross floor area (GFA) and must include all base building fixtures and fittings, including common and tenant area fittings and base building fittings in any non-retail usage areas.

Wat-1 Potable Water

POINTS
AVAILABLE **12**

The number of points achieved is determined by using the Green Star SA – Public & Education Building Potable Water Calculator.

The Potable Water Calculator must be used in accordance with the Potable Water Calculator Guide available from the GBCSA website (<http://www.gbcsa.org.za>).

The Potable Water Calculator is a benchmarking tool only and must not be used to design harvesting and recycling systems. As such, it does not undertake detailed calculations of water storage efficiency and it is the responsibility of the design team to ensure appropriate storage capacities given building demands and available harvested sources

Flow restrictors, aerators or other flow controlling devices which can only be removed from a fixture or fitting through the use of specialist equipment or tools commonly used by wet services sub-contractors or building maintenance staff, are considered an “intrinsic attribute” of the fixture or fitting. Similar devices which can be removed without the use of such tools (i.e. by hand) are not deemed intrinsic and cannot be used to claim water efficiency improvements within the Green Star SA Potable Water Calculator. For fixtures and fittings with such ‘intrinsic’ devices, product literature or manufacturer datasheets must clearly state the necessary water efficiency performance of the complete assembly with the flow-controlling device for inclusion in the Green Star SA Potable Water Calculator. Water efficiency data for a fixture or fitting without such a flow-controlling device that is nominally adjusted for the benefit of such flow limiting devices is not acceptable.

Other major water uses

Where a project team feels that there is another base-building major water demand in which they have reduced potable water consumption, which is not covered in the tool, they can include this in the Potable Water Calculator. The project must clearly demonstrate the claimed water consumption through calculations and verification documentation, approved by the GBCSA through a CIR process

Sustainable Water

Sustainable Water is defined as water that is collected on site or recycled/recovered from a previous use such as black water or grey water. Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of sustainable water used. In addition, extracting ground water from any neighbouring fresh-water sources impacts on the water table level and merely localises a problem what otherwise would take place on the municipal or provincial level.

Off-Site Reclaimed Water

The use of reticulated off-site reclaimed water is an acceptable way to reduce potable water consumption within the Green Star SA rating system. Although off-site harvesting and recycling systems are not specific attributes of the building seeking Green Star SA certification (as would be the case of an on-site water harvesting and recycling system), the fact that the building has chosen to incorporate the necessary infrastructure to connect their building services to the off-site service is, in this scenario, viewed as a building attribute.

Ground Water

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POINTS
AVAILABLE **12**

Previously unused groundwater seeping into building basements cannot be used in this credit as sustainable water for amenities (WC's, urinals, etc.), unless it is used and then recycled within the building. Groundwater seeping into building basements may be included as sustainable water for landscape irrigation. However, project teams must submit calculations of the quantity of groundwater available for use, clearly demonstrating reasonable assurance that the quantity calculated will be available in future. These calculations must be submitted for approval via CIR prior to project submission.

BACKGROUND

Rainwater, Greywater & Blackwater

Collecting rainwater from roofs and other impervious surfaces can add to the amount of sustainable water available for use in buildings. Retail centres with large roof areas are particularly well suited for rainwater collection.

Grey water can be recovered from sinks and showers, washing machines, cooling towers and other water sources that do not contain food or human waste. This water can be stored for irrigation and toilet flushing but needs to be used within a short period following collection to avoid having extensive treatment requirements.

In locations where on-site black water treatment is generally not permitted, projects should consider contacting local authorities to discuss the benefits of on-site water treatment for the project and local infrastructure.

Water Efficiency Labelling Scheme

The South African Government, through the Department of Water Affairs (DWA), is currently working with the South African National Standards to introduce the Water Efficiency Labelling and Standards (WELS) Scheme that involves the introduction of national mandatory water efficiency labelling and minimum performance standards for domestic water-using devices.

Landscaping Water Efficiency

Potable water demand can be reduced through the installation of water-efficient irrigation systems (such as sub-soil or drip irrigation) or through the use of sustainable water for landscape irrigation.

A 'xeriscape garden' is defined as a water-conserving garden, or garden requiring no additional watering. Where a xeriscape garden has been installed, provisions must be made to remove any irrigation system within twelve months and ensure that the landscape will not receive watering after that time. Evidence will include, but will not be limited to, a report from the landscape architect confirming why the design can be classified as xeriscape.

Heat Rejection

The use of water based heat rejection systems that consume huge amounts of water through cooling towers is wide spread because of the high energy efficiency of such systems. Minimising or eliminating the use of potable water in heat rejection systems or completely eliminating the need for mechanical cooling in buildings can achieve significant savings in both

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AVAILABLE **12**

energy and water. The use of non-chemical dosing (such as ionisation, UV treatment, etc) can save water by avoiding more frequent flushing of cooling tower water systems.

Laundry Equipment

The typical laundry utilises a washer technology called washer-extractors. This type of machine ranges in size from about 16 kg up to 1 766 kg in the largest laundries. The name washer-extractor is used because after each portion of the wash cycle (soak, suds, pre-wash, wash, rinse, or finish) an extraction imparting centrifugal force removes the water and detergent contents from the wash wheel to the drain.

Other equipment found in large industrial laundries are tunnel washers (or continuous batch washers), which is an industrial laundry machine designed for heavy loads. Tunnel washers are inherently water-efficient; water is used several times before being sent to the drain. Average water consumption of this type of equipment is 16 litres per kilogram of laundry, which is 2/3 of the typical washer extractor.

Water recycling in laundry processes can be done quite easily. The last rinse water used in an industrial washer can be reused as a pre-wash for the next wash cycle. Larger commercial and industrial laundries have been utilising this technology for decades. For smaller laundries it is not common practice due to the high upfront cost. However in recent year, washing machine manufacturers have been designing systems that are less expensive and require less space.

Most commercial washer-extractors can be retrofitted with a tank to save the final rinse water, which can then be reused as pre-wash in the next load. It is possible to cut the potable water consumption by 30% by reusing water from the final rinse cycle for the next load.

Large Kitchens

Inefficient use of water in kitchen operations is usually a result of equipment design and/or behavioural patterns. The main types of water using equipment found in kitchens are dishwashers, sinks, woks, steamers, pre-wash spray rinse units, ice-making machines and garbage disposal units.

Dishwashers

Substantial savings can be made with a new dishwasher, newer models use less water, also different type of dishwashers have different flow rates. Below are the most common ones with their average water consumption.

Type	Description	Litres per rack
Under counter	A machine with an overall height of 1 meter or less, in which a rack of dishes remains stationary within the machine while being subjected to sequential wash and rinse sprays, and is designed to be installed under food preparation workspaces.	13 ltr/rack

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Single Tank Door	A machine in which a rack of dishes remains stationary within the machine while subjected to sequential wash and rinse sprays. This definition also applies to machines in which the rack revolves on an axis during the wash and rinse cycles.	8.4 ltr/rack
Tank conveyor	A washing machine that employs a conveyor or similar mechanism to carry dishes through a series of wash and rinse sprays within the machine. Specifically, a single tank conveyor machine has a tank for wash water followed by a final sanitizing rinse and does not have a pumped rinse tank.	6.0 ltr/rack
Multiple Tank conveyor	A conveyor type machine that has one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a final sanitizing rinse.	4.1 ltr/rack

Source: http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers

Table WAT-1.1: Description of types of dishwashers.

Commercial Car Wash Facility

Commercial Car Wash Facilities use large amounts of water. The amount of potable water to wash cars varies depending on the method used from bucket and hand wash to open hose spray and industrial high pressure conveyor carwash system.

One of the largest car rental companies of South Africa has invested in reducing and recycling the water used to wash the vehicles. They procured a conveyor bay type of wash system which washes a car within 45 seconds. It further included the construction of underground water filtration and recycling facilities that filters the waste water and reuses it in the wash cycle. Rainwater is also collected and used for car washing. Potable water is only used for the final rise, minimising potable water use to the bare minimum. All interventions saved the company approximately 100 million litre of water annually.

Laboratories

In meeting their large cooling and process water demands, most laboratories use significantly more water per square metre than standard commercial buildings (US EPA, 2005). As an example, the Australian National University has estimated that 45% of the 750 million litres of water used annually are consumed in its laboratories, compared to 25% used in accommodation and 15% in irrigation (ANU, 2008). This demand arises from space cooling requirements, water used in the activity of the laboratory and equipment cooling (the focus of this credit).

Single-pass or once-through systems are commonly used to cool a broad range of scientific and medical equipment from CAT scanners to mass spectrometers. These systems circulate water, typically directly from the public water supply, once through the piece of equipment and then discharges directly to the sewer. These systems are the most water intensive cooling methods used in laboratories; consuming approximately 40 times the water required by cooling towers to remove the same heat load (US EPA, 2005).

REFERENCE & FURTHER INFORMATION

South African Weather Service.

<http://www.weathersa.co.za>

South Africa Rain Atlas.

<http://134.76.173.220/rainfall/index.html>

South Africa Department of Water Affairs

<http://www.dwa.gov.za>

Water Efficiency South Africa.

<http://www.waterefficiencysa.co.za>

SANS: 10252-1: 2004, Water Supply and Drainage for Buildings, Part 1 – Water Supply Installations for Buildings.

Landscape Irrigation Association of S.A.

<http://www.liasa.co.za>

Water Conservation & use in Agriculture.

<http://www.wca-efonet.org>

Water Efficiency South Africa.

<http://www.waterefficiencysa.co.za>

Water Use in the Professional Car Wash Industry (2002) International Car Wash Association.

www.carwash.org

Water Conservation in the Professional Car Wash Industry (1999) International Car Wash Association.

www.carwash.org

Australian Car Wash Association

www.acwa.net.au

Australian Car Wash Water Saving Rating Scheme

<http://waterratingscheme.net.au/>

Alliance for Water Efficiency, Commercial Laundry Facilities

http://www.allianceforwaterefficiency.org/commercial_laundry.aspx

Save Water, Money & Environment , Sydney Water – Laundries

<http://www.sydneywater.com.au/Water4Life/InYourBusiness/FactSheets.cfm>

Laundrette Association of Australia. Water Conservation Best Practice Programme for the Industrial and Commercial Laundry Industry

Best Practice Guidelines for Kitchen and Amenities, South East Water

Wat-1 Potable Water

POINTS
AVAILABLE **12**

http://www.sewl.com.au/SiteCollectionDocuments/Business/WaterMAP/1-SEW_IntroKitchensAmenities_WEB.pdf

Save water, Money and the Environment, Sydney Water - Kitchens

<http://www.sydneywater.com.au/Water4Life/InYourBusiness/FactSheets.cfm>

Best Practice – How to Achieve the Most Efficient Use of Water in Commercial Food Service Facilities

www.energystar.com

Labs for the 21st century.

<http://www.labs21century.gov/>

Water Efficiency Guide for Laboratories; Best

Practices**http://www.labs21century.gov/pdf/bp_water_508.pdf**

Wat-2 Water Sub-Metering

POINTS
AVAILABLE**3**

AIM OF CREDIT

To encourage and recognise the installation of sub-metering to facilitate on-going management of water consumption.

CREDIT CRITERIA

Up to three points are awarded as follows:

One point is awarded where it is demonstrated that:

- Water meters are installed for all major water uses in the development.

Two additional points are awarded where it is demonstrated that:

- The first point is achieved, and;
- There is an effective automated mechanism to monitor all sub-meters and water consumption data, which is able to perform as a leak detection system; AND
- An automated metering strategy is developed for the project.

OR

One additional point is awarded where it is demonstrated that:

- The first point is achieved;
- For each toilet/amenity area in the building, the water supply is provided with;
 - Solenoid control valve(s) for automatic shut-off; AND
 - Supply to the toilet/amenity area is automatically controlled by occupancy sensors within each toilet/amenity area.

Wat-2 Water Sub-MeteringPOINTS
AVAILABLE**3**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building Design	Green Star SA – Public & Education Building As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) 4. Automated metering strategy 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Automated metering strategy 4. Extract(s) from Commissioning Report(s) 5. Manufacturer product datasheet(s)

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Providing a summary table of all major water uses in the building and the water sub-metering requirements.

Additionally where the automated monitoring system is proposed/installed:

- Describing how the water consumption data will be effectively monitored during the building's operation;
- Describing the function of the alert and leak detection system.

Additionally where solenoid valves are proposed/installed:

- Providing a summary table of all separate toilet/amenity areas provided with solenoid valves controlled by occupancy sensors;
- Describing the operation of the valves to demonstrate compliance with Credit Criteria.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for:

- Water sub-meters for all substantive water demands and supply, as referenced in the short report.

Additionally where the automated monitoring system is proposed/installed:

- An effective monitoring system;

Additionally where solenoid valves are proposed/installed:

- Solenoid valves and occupancy sensors for the ablution blocks

Wat-2 Water Sub-Metering

POINTS
AVAILABLE**3**

Tender / As Built drawing(s) (schematic wet services) marked-up to clearly demonstrate the inclusion of all sub-meters, solenoid valves and occupancy sensors (where applicable) as referenced in the short report.

Automated metering strategy that describes;

- The frequency of meter readings, data collection and storage, and reporting method; and,
- How metering errors are to be identified and provide guidance on future calibration or verification requirements (where applicable).

Extract(s) of Commissioning Report(s) demonstrating;

- That the sub-meters have been installed and that the meters operate as intended by the design;

Additionally where the automated monitoring system is proposed/installed:

- That an effective monitoring system has been installed and that all systems operate as intended by the design;

Additionally where solenoid valves are proposed/installed:

- That the solenoid valves and occupancy sensors have been installed and operate as intended by the design.

Manufacturer product datasheet(s) of the installed sub-meters, indicating their ability for automatic monitoring.

ADDITIONAL GUIDANCE

'Major water uses' are considered to include the following as a minimum (where installed):

- Base building bathrooms;
- Evaporative heat rejection systems;
- Irrigation systems;
- Car wash facilities;
- Food preparation facilities;
- Laundry;
- Wash-down systems;
- Recycled/rainwater supply;
- Humidifiers; and
- All major water uses claimed under 'Wat-09 Building Specific Major Water Use'.

Wat-2 Water Sub-Metering

POINTS
AVAILABLE**3**

It may be necessary to provide separate sub-metering on other water uses within the building if they are deemed equally substantial.

Effective monitoring system

There must be an 'effective' system for collecting, recording and monitoring data from the sub-meters. In most cases, the requirement for an effective system will lead to the inclusion of automated monitoring systems. Manual monitoring of sub-meters is not acceptable to meet the Credit Criteria. The effective monitoring system must provide a leak detection system and include an alarm that is triggered in the event of a new trend in water consumption.

Water meter requirements

One water meter for all bathrooms is sufficient for meeting the Credit Criteria regardless of the size of the building, as long it covers both hot and cold water. Kitchenette and custodian sinks (regardless of number) do not require a separate meter. However, their water use must be monitored by being on one of the sub-metered lines, such as the bathroom line.

If the water consumption of one of the major uses can be determined by a simple (and in most cases automatic) subtraction of all the other metered uses from the building's total water consumption, it does not have to be separately sub-metered. For example, if all water going into the building and all water going out (e.g. for cooling towers) is sub-metered and if the difference equates to bathroom water consumption, it is not necessary to have a separate bathroom meter.

Automated Metering Strategy

This document must be based on what the actual methodology will be that the development will adopt for the sub-meters, hence must be developed in conjunction with the Building Owner. The strategy document need not be exhaustive and must be written in easy-to-read language for a non-technical reader.

Solenoid Valves

A solenoid valve is an electrically operated shut-off device that controls the flow of water in pipes. The valve must be connected to a control system that signals the valve when there is water running in the ablution block and the occupancy sensors determine that there is no one in the ablution facility.

BACKGROUND

Water is an economic and natural resource which traditionally has not been extensively sub-metered in the built environment. In many cities throughout the world, water metering when installed, has been limited to a building scale only, with a single meter provided to a single building with multiple tenants.

Sub-metering is now gaining popularity as an effective strategy for water resource management, as it permits the signalling of the marginal cost and increasing scarcity of water to consumers. These signals can assist in reducing per capita consumption within a distribution network.

Wat-2 Water Sub-Metering

POINTS
AVAILABLE**3**

Although having extensive building scale water metering, there is increasing pressure in the French capital, Paris, to transition to sub-metering. Three key reasons are driving this change. Firstly, building owners and management bodies see sub-metering as a strategy to reduce the operational costs of managing their properties and to also minimise liability for unpaid bills. Secondly, with increasing water tariffs within a privatised water supply sector, sub-metering is seen by occupants as a method of controlling costs through bills which reflect the actual quantity consumed. Thirdly, with concerns surrounding the environmental footprint of Paris, sub-metering is argued as a strategy to promote water efficiency.

Recent research by the UK NGO Waterwise into the feasibility of water sub-metering for the Greater London Area reviewed several international case studies pertaining to the potential of sub-metering to reduce demand. The case studies from Brazil and the United States all indicated demand reductions to varying extents, with the researchers noting that the effects on demand from sub-metering tend to be more pronounced than from building scale metering.

Solenoid Valves

The lights in toilets are often controlled by occupancy sensors. The sensors used to control the lighting can also be linked to a solenoid valve in the water supply. This will then act as a proximity detection system.

Small water leaks can result in significant losses over time, increasing costs as well as causing damage. There is a significant risk of leaks going undetected, particularly as toilet accommodation is often unoccupied for long periods. A proximity detection shut-off system prevents waste from minor leaks by shutting off the water supply when toilet accommodation is not occupied. This is also an effective mechanism to reduce the water losses incurred through vandalism such as when taps are intentionally left open.

Valves in cisterns supplying urinals and WCs are especially prone to failure, leading to wastage of water via the overflow. Whilst leakage from any valve is variable, a typical value for a leaking valve toilet might be 4 litres/day.

REFERENCE & FURTHER INFORMATION

Waterwise (2007), 'International experiences of sub-metering: An analysis of four case cities to inform planning for domestic metering in the Greater London Area', Commissioned by the Greater London Authority, Waterwise.

<http://legacy.london.gov.uk/mayor/environment/water/docs/international-experiences-sub-metering.pdf>

City of Richmond (Canada) Water Meter Program
<http://www.watermeter.ca/english/about.html>

Water Efficiency South Africa
<http://www.waterefficiencysa.co.za>

Wat-3 Landscape Irrigation

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool; it is integrated into Wat-1 Potable Water.

Wat-4 Heat Rejection Water

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool; it is integrated into Wat-1 Potable Water.

Wat-5 Fire System Water Consumption

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool; it is integrated into Wat-1 Potable Water.

Wat-6 Car Wash Facilities & Refuse Yard Wash Equipment

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool.

Wat-7 Potable Water Efficient Appliances

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool.

Wat-8 Swimming Pool /Spa Water Efficiency

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool.

Wat-9 Building Specific Major Water Uses

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA Public & Education Building tool; it is integrated into Wat-1 Potable Water.

Materials

Within the Materials Category of Green Star SA, the credits target the consumption of resources through selection and reuse of materials, and efficient management practices. The basic concepts of the category are to reduce the amount of natural resources used, reuse whatever materials can be reused, and recycle whenever possible.

The production and use of building materials can have serious impacts on the environment. Energy is used to extract, produce and transport building materials; natural resources are exploited to be used in building materials; the industrial production process of the materials causes pollution; and when the material ends up as waste, it becomes difficult to process.

The environmental impact from building materials is reduced by limiting the quantities of virgin resources used in projects and choosing the least harmful when using virgin building materials. The Green Star SA rating tool rewards initiatives and strategies that do so.

Aspects of materials and resource use that are rewarded under Green Star SA include, but are not limited to: sustainable timber; reuse of building façade and structure; and recycled content of concrete and steel. In particular, this category attempts to focus on the lifespan and lifecycle approach to the use of materials, resources and building fabrics.

Mat-1 Recycling Waste StoragePOINTS
AVAILABLE **3****AIM OF CREDIT**

To encourage and recognise the inclusion of storage space that facilitates the recovery and recycling of resources used within buildings to reduce waste going to disposal.

CREDIT CRITERIA

Up to three points are awarded where:

Waste and Recycling Management Plan

One point is awarded where a comprehensive Waste & Recycling Management Plan is developed for the building to reduce operational waste and increase recycling.

Recycling Storage Space

Additional 2 points are awarded where a dedicated storage area for the separation and collection of recyclables is provided; AND

Is sufficiently sized to handle the collection and sorting of all waste streams for the following recyclables as a minimum:

- Cardboard;
- Paper Products;
- Glass;
- Plastics;
- Metals; and
- Where kitchens are present, grease, cooking oil, and organic compost material.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Waste & Recycling Management Plan Where additional points are targeted: 2. Tender drawing(s)	1. Waste & Recycling Management Plan Where additional point is targeted: 2. As built drawing(s)

Mat-1 Recycling Waste Storage

POINTS
AVAILABLE

3

Waste & Recycling Management Plan outlining the plan for reduction of the overall operational waste. The plan must meet the requirements set out in the Additional Guidance.

The submitted plan must be signed by the building owner.

Tender/As Built drawing(s) marked up to show:

- Location of the recycling storage area(s) with dimensions indicated;
- Location of public bins (where applicable); and transfer routes through the building;
- Location of the collection areas, and transfer routes through the building.

ADDITIONAL GUIDANCE

Waste and Recycling Management Plan

The Waste and Recycling Management Plan must address all waste (recyclable and non-recyclable) generated in the building (occupants, common areas and visitors). The plan must either:

- Set explicit annual operational waste reduction targets, for reduction in the amount (by weight or volume) of the building's overall operational waste; OR
- Provide a plan to audit the operational waste stream for setting such targets.

The Waste and Recycling Management Plan must describe, at a minimum:

- Estimation of waste generation and justification of the size of the recycling waste storage area;
- Frequency of collection and how this has been taken into account in sizing of the recycling waste storage area;
- Waste collection areas for the landlord, tenants, occupants and/or visitors;
- Description of the waste storage areas, in terms of location, size, accessibility, easy access for manoeuvring bins and cleaning storage areas.
- Proposed waste recycling strategy; i.e. what waste is separated and recycled; and how;
- Provision of public bins that separate waste at source; describe the bins that are provided for and how these are distributed throughout the public area to allow for recyclable waste streams; describe the procedure and frequency of emptying bins and how this works together with the waste recycling storage area location and size.
- Waste and recycling streams segregated within the building;

Mat-1 Recycling Waste StoragePOINTS
AVAILABLE **3**

- Transfer of waste bins to storage areas; in terms of surface (free of steps, kerbs), distances, grades;
- Description of the collection points, ease of collection, access for collection vehicles;
- Signage and educational initiatives geared towards building occupants and customers; and
- Monitoring and reporting requirements, (minimum quarterly);
- On-going management and proposed roles and responsibilities of the involved parties.

Recycling Storage Space

The recycling waste storage must effectively serve all building uses and occupants and be sufficiently sized to accommodate the storage of the following recyclables as a minimum: cardboard, paper products, glass, plastics and metals. Where kitchens are present, storage for grease, cooking oil, and organic compost material must also be provided. Although not specifically required for compliance with the credit criteria, other products that require appropriate disposal and/or recycling include printer and toner cartridges, organics, CFL and other light bulbs, as well as computer and electronic equipment. Where there are large areas of landscaping it is also recommended to address disposal/composting of garden waste.

Table Mat-1.1 provides guidance as to the size of the storage area; however projects are encouraged to use their own calculations to inform sizing as the size of the storage area required depends on project specific issues such as the frequency of waste collection.

Min Area of recyclable storage space (% of GFA)							
GFA (m ²)	Office	Convention Retail Exhibition	Restaurant	Library Theatre Museum Art Gallery	Sport Centre Worship Community	Airport Bus/train station	Education Day-care
	500	1.5%	3.0%	4.5%	0.5%		0.75%
1,000	0.8%	1.6%	2.4%	0.3%		0.4%	
5,000	0.35%	0.7%	1.45%	0.12%		0.17%	
10,000	0.25%	0.5%	0.75%	0.8%		0.12%	
20,000	0.15%	0.3%	0.45%	0.05%		0.07%	

Table Mat-1.1: Recommended space requirements for recyclable waste storage

Where the GFA of the building falls between the figures outlined in Table Mat-1.1, linear interpolation could be used to determine an appropriate percentage area for the recyclable

Mat-1 Recycling Waste Storage

POINTS
AVAILABLE

3

storage space. For GFA less than 500m² the minimum area recommended is the percentage used for 500m².

Note that Table Mat-1.1 provides sizing guidance for recycling waste storage only; the area should be increased by a minimum of 25% should general waste be stored in the same location.

Storage area

The recycling waste storage area can be provided by more than one dedicated space, but no more than one area can serve any 1,000m² of GFA (or 500m² of GFA for refurbishment projects). In addition, all storage areas dedicated to recycling must meet all the Credit Criteria and Additional Guidance requirements and be functional (e.g., an area may not be so small that it cannot house at least 3 standard bins as used in municipal waste collection).

Access Requirements

- The recycling waste storage room must be located in a position convenient for both users and waste collection staff;
- Access pathways between central waste storage point and the collection vehicle must be free of steps or kerbs;
- The waste sorting and loading operation must operate on a level surface;
- The waste storage room is located in the same level as the loading dock with clearly marked, signposted, convenient and guaranteed access routes which allows:
 - Level access from tenancies (or goods lifts are provided); and
 - Avoids the need for multiple handling of the waste.
- Collection vehicles must be able to service the development with limited need to reverse.
- Where collection takes place inside a building, appropriate clearances need to be allowed for the collection vehicle to enter the premises, clear the waste container and exit the premises. It must be noted that some systems require the waste container to be lifted above the collection vehicle to be emptied (front lift-bulk bin) or loaded (waste compactor).

Off Site Recycling Waste Storage

As Green Star SA assesses permanent attributes of buildings, external amenities can only be rewarded if they are provided for the life of the building to the same degree of service and certainty as internal facilities. As a result, the following applies to amenities (such as recycling waste storage) that are located on separate premises and not within the assessed building:

- The scope of assessment is not extended beyond the assessed building, i.e. the building within which the amenities are housed does not need to meet the Credit Criteria of any claimed credits; only the amenities assessed against the Credit Criteria of the credit towards which they contribute;
- The assessed building and the amenities are under the same ownership and cannot change ownership separately (i.e. they are on the same title or equivalent);

Mat-1 Recycling Waste StoragePOINTS
AVAILABLE **3**

- The assessed building and the amenities are under the same management and cannot change management separately (e.g. the same facility management to ensure recycling waste storage is processed as designed);
- The recycling waste storage facilities are in close proximity to the assessed building and the access route is clearly marked and sign-posted, convenient, guaranteed, secure and without a step change;
- The amenities are completed by the date of practical completion of the assessed building; and
- The amenities fully meet the Credit Criteria and are documented in strict accordance with the Technical Manual, including weather protection.

BACKGROUND

The South African households, commerce, institutions and manufactures generate 13.5-15 million tonnes of waste per year (1998). This is increasing due to population and economic growth. Gauteng, the most urbanised province, is responsible for 43% of the total waste generated in South Africa. Each person generates on average 760 kg of waste per year. (DEAT, 2006).

Disposal of waste generally has negative impacts on the environment. These impacts include contamination of surface and ground water resources and soil; emissions (methane, CO₂ and others) due to natural decomposition processes, incineration and illegal burning; health and safety risks; unsightly landfill sites, etc. Processing waste provides a large scope for creating employment opportunities. Sorting of waste allows products that have a high reuse or recycle value to be extracted from conventional waste streams turning the burden of waste into a potential resource which reduces use of virgin material (DEAT, 2006).

Waste produced through the operation of a building arises from the daily processes of the building, management and maintenance activities and refurbishment associated churn (Terry & Moore, 2008). The majority of this waste is the consumables associated with the daily functions of the business, but significant environmental impacts can also arise from smaller waste streams. An example of this smaller waste stream is the replacement of the building's fluorescent lights, which commonly is on a time/cost rather than utility basis. Sent to landfill, a single fluorescent light, containing 10mg of mercury, can contaminate 30,000 litres of water beyond safe drinking standards (MTP, 2005).

According to the Paper Recycling Association of South Africa the recyclable paper recovery rate in 2006 for South Africa, as a percentage of paper consumption, was approximately 44%. When segmented, 'Offices' were performing at a recovery rate of 42%, whereas 'Homes' at only 14%. World total recovery levels showed slightly higher than the SA average at approximately 47%, with countries like Switzerland, The Netherlands and Germany at the top of the list with levels between 70% and 80%.

Sustainable Choice, an Australian based organization, states that producing paper from recovered fibres consumes 60% less energy and 55% less water than manufacturing paper

Mat-1 Recycling Waste StoragePOINTS
AVAILABLE**3**

from virgin pulp. Each recycled steel or aluminium can, and each glass bottle, keeps valuable non-renewable resources such as bauxite, iron-ore and sand in the ground, and saves energy that would normally be used in mining, manufacturing and transporting.

In addition to the environmental benefits from an effectively managed waste and recycling plan, there can be considerable economic savings. Sustainability Victoria's (2006) WasteWise program reports that only 10% of the cost of waste is in its disposal. The other 90% is hidden costs including the costs associated with unproductive waste management work, storage and clean-up costs and the loss of valuable materials as waste. Effectively managing waste can result in reduced business risks and an enhanced social and corporate responsibility profile, which leads to improved public relations and business continuity (Wasiluk, 2007).

To make recycling schemes more economic, it is beneficial for waste to be collected quickly and efficiently. A convenient, purpose-designed storage space ensures that sufficient waste is accumulated before it is collected, and helps occupants to store material. The purpose of this credit is to encourage and recognise the inclusion of storage space in the physical attributes of the building, regardless of the tenant operational policies such as contracting another company to segregate waste off-site.

REFERENCES And FURTHER INFORMATION

Department of Environment and Tourism

<http://www.environment.gov.za>

<http://www.environment.gov.za/ProjProg/WasteMgmt/recycling/an-a.htm>

National Waste Management Strategy Implementation Project, (2005).

<http://www.sawic.org.za/documents/235.pdf>

Greenworks

<http://www.greenworks.co.za>

Paper Recycling Association of South Africa

<http://www.prasa.co.za>

Earthlife Africa

<http://www.earthlife.org.za>

Inform Inc. (U.S.), *Waste at Work: Prevention Strategies for the Bottom Line.*

<http://www.informinc.org/wasteatwork.php>

New South Wales Department of Environment and Conservation, *Waste Reduction in Office Buildings: A Guide for Building Managers (2002); Better Practice Guide for Waste Management in Multi-Unit Dwellings (2002).*

<http://www.environment.nsw.gov.au/education/recyclingandwaste.htm>

CalRecycle – California Government fact sheet.

<http://www.calrecycle.ca.gov>

wrap Material change for a better environment.

<http://www.wrap.org.uk>

Institute of Waste Management of Southern Africa

Mat-1 Recycling Waste StoragePOINTS
AVAILABLE **3**

<http://www.iwmsa.co.za/>

Department of Environmental Affairs and Tourism (2006) *South Africa Environmental Outlook, A report on the state of the environment*

<http://soer.deat.gov.za/frontpage.aspx?m=2>

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<http://soer.deat.gov.za/docport.aspx?m=97&d=5>

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http://www.environment.gov.za/ProjProg/WasteMgmt/Polokwane_declare.htm

City of Sydney (2005) *Policy for Waste Minimisation in New Developments*, City of Sydney, Sydney

Market Transformation Programme (MPT) (2005) *Light Emitting Diodes: Eco-Design Innovation Roadmap*, Future Energy Solutions, Didcot, UK

Sustainability Victoria (2006) *Waste Wise*

<http://www.sustainability.vic.gov.au/www/html/2717-resourcesmart-waterwise.asp>

Terry, A & Moore, T [eds] (2008) *Waste and Sustainable Commercial Buildings, Your Building: Profiting from sustainability*

<http://www.yourbuilding.org>

Wasiluk, K.L (2007), *Business Case for Sustainable Commercial Buildings*

<http://www.yourbuilding.org>

Mat-2 Building ReusePOINTS
AVAILABLE**5****AIM OF CREDIT**

To encourage and recognise developments that reuse existing buildings to minimise materials consumption.

CREDIT CRITERIA

Up to five points are awarded as follows:

Two points are awarded where:

- It is demonstrated that at least 50% (by area) of the total façade of the final building(s), comprises building façade reused from the existing building(s) and/or structure(s).

Up to three points are awarded where:

- The minimum proportion of the existing major structure, by gross building volume, is reused within the final building(s), awarded as follows:
 - 30% reuse for one point;
OR
 - 60% reuse for two points;
OR
 - 90% reuse for three points.

Where the site contained no building(s) or structure(s) at the time of purchase, or the total GFA of the existing building(s) or structure(s) is less than 20% of the final building GFA, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Materials category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report Additionally where façade or structure is being reused;	1. Short report Additionally where façade or structure is being reused:
2. Tender drawing(s)	2. As built drawing(s)

Mat-2 Building ReusePOINTS
AVAILABLE**5**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Providing calculations that demonstrate that the GFA of the existing building(s) or structure(s) is greater than 20% of the final building(s) GFA, with reference to 'Site documentation' provided in the 'General' section of the submission;
- Describing what elements of the façade/structure are being retained from the existing building(s) or structure(s);
- Providing calculations demonstrating that the percentage total area (for façade reuse calculations) or percentage volume (for structure reuse calculations) reused from the existing building(s) or structure(s) meet the Credit Criteria, with reference to 'Site documentation' provided in the 'General' section of the submission;

Where credit claimed 'Not Applicable':

- Confirming that the site contained no building(s) or structure(s) at the time of purchase, with reference to 'Site documentation' provided in the 'General' section of the submission;

OR

- Providing calculations that demonstrate that the GFA of the existing building(s) or structure(s) is less than 20% of the final building(s) GFA, with reference to 'Site documentation' provided in the 'General' section of the submission.

Tender / As Built drawing(s) including the following:

- Elevation drawings of the existing building(s) or structure(s) marked-up to show the area of the reused façade or information for gross volume calculation (where applicable). Demolition drawings may be provided in lieu of As Built Drawings of the Original Buildings, provided that the same information is indicated. If demolition elevations are not available, then floor plans must indicate the locations of reused and demolished facades, which can then be correlated with the Tender or As Built elevations of the final building(s);
- Elevation drawings of the final building(s) marked-up to show the area of the total façade or information for gross volume calculation (where applicable);
- Plan drawings of the existing building(s) or structure(s) marked-up to show information for gross volume calculation (where applicable);
- Plan drawings of the new building(s) marked-up to show information for gross volume calculation (where applicable).

ADDITIONAL GUIDANCE

The documentation must clearly demonstrate that the stipulated proportion of the façade/structure has been reused, regardless of how much additional material has been added. This credit addresses the reuse of existing materials, not the final design, therefore, it

Mat-2 Building Reuse

POINTS
AVAILABLE

5

is irrelevant whether the reused elements are clad in, or otherwise refurbished with, additional material.

Existing buildings or structures which are constructed during earlier phase(s) of a multi-phase project, where the explicit intention of the earlier phase(s) is to service the latter phase(s), cannot be claimed as contributing to this credit. For example, it is not permissible to claim basement structures constructed during an earlier phase of a larger development as building reuse for later stages which are registered for Green Star SA certification.

This credit will only be deemed 'Not Applicable' if the calculations account for all of the building(s) and structure(s) that existed on the site at the time of site purchase.

If the building(s) that are being demolished, as a consequence of the development that seeks Green Star SA assessment, extend beyond the site boundary as defined for the purposes of Green Star SA certification, their total GFA must be used in the calculations for this credit.

Externally affixed elements such as fixed shading devices are excluded from the calculation of façade area.

The final building GFA is considered to be the final GFA of the building, including both the original building GFA and any new GFA added to it through the development.

The 'Tender/As built drawings' Documentation Requirement includes demolition documentation such as elevation and plan drawings.

BACKGROUND

At present, construction and demolition waste within the developed world makes up approximately one third of all waste generated, and approximately 40% of all waste disposed to landfill.

Reuse of buildings and parts of buildings can significantly reduce the demand for new construction materials and thus lessen environmental burdens resulting from the development. The reuse of building façades is commonly required for other reasons, such as heritage considerations, but can also lead to a direct environmental benefit.

Repairing a structure saves natural resources, including raw materials, water and energy, and decreases the negative impact that are by-products of extraction, manufacturing and transportation of new materials. It also minimises the amount of demolition waste sent to landfill.

REFERENCES AND FURTHER INFORMATION

Deconstruction as an Essential Component of Sustainable Construction, by Charles J. Kibert, University of Florida, USA

<http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/kibert.pdf>

eThekweni Municipality website

<http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction>

Mat-2 Building Reuse

POINTS
AVAILABLE **5**

Sustainable Built Environment

<http://www.sustainablebuiltenvironments.com>

Smart Growth Online (U.S.), Green Building Case Studies

http://www.smartgrowth.org/casestudies/casestudy_index.html

National State of the Environment Report, South Africa

<http://www.environment.gov.za/soer/index.html>

Mat-3 Recycled Content & Reused MaterialsPOINTS
AVAILABLE**3****AIM OF CREDIT**

To encourage and recognise designs that prolong the useful life of existing products and materials and encourage uptake of products with recycled content.

CREDIT CRITERIA

Up to two points are available where it is demonstrated that materials selected for base building construction or integrated fit-out works have a recycled content or are re-used items as follows:

- One point where the recycled content of materials and/or reused materials represent at least 0.5% of the projects total contract value; OR
- Two points where recycled content of materials and/or reused materials represent at least 1.0% of the project's total contract value

This credit excludes steel, timber and concrete mix components (i.e. aggregates and industrial waste product) and masonry units, which are addressed by other credits, and it does not address the reuse of façade or major structural elements of existing buildings(s) or structure(s) on the site.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Quantity Surveyor Report 	<ol style="list-style-type: none"> 1. Short report 2. Quantity Surveyor Report 3. Statement of confirmation
Additionally where recycled content materials claimed: <ol style="list-style-type: none"> 4. Manufacturer product datasheet(s) 	Additionally where recycled content materials claimed: <ol style="list-style-type: none"> 4. Manufacturer product datasheet(s)

Mat-3 Recycled Content & Reused MaterialsPOINTS
AVAILABLE **3**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Stating the contract value of the project;

Additionally where reused materials claimed:

- Providing a tabulated summary of all uses of reused materials in the project, including the manufacturer/source of the material;
- Indicating the 'fair market value' or actual cost of each material as claimed, with reference to the Quantity Surveyor Report;
- Demonstrating the total cost of all reused material(s) claimed, represented as a percentage of the contract value, confirming compliance with the Credit Criteria;
- Confirming that for each reused material, if the material has been altered from its original form, and what alterations have been completed (where applicable).

Additionally where recycled content materials claimed:

- Providing a tabulated summary of all uses of recycled content materials in the project, including the manufacturer of the material and whether the material is post-consumer, post-agricultural or post-industrial, with reference to supporting documentation;
- Indicating the cost of the recycled material (only) for each material, with reference to supporting documentation;
- Demonstrating the total cost of all recycled content material(s) claimed represented as a percentage of the contract value, confirming compliance with the Credit Criteria.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for;

- The use of the specific material(s) with the nominated recycled content as referenced in the short report, clearly indicating the manufacturer(s) or source(s) (where applicable);
- The use of the reused material(s) as referenced in the short report, clearly indicating the manufacturer(s) or source(s) (where applicable).

Manufacturer product datasheet(s) for each material claimed with recycled content, clearly indicating the quantity or percentage of recycled content within the material. Where a specific datasheet for the product does not exist, a written confirmation from the manufacturer on official letterhead which has been authored and signed may be submitted.

Quantity Surveyor Report confirming the estimated (Design rating) or actual (As Built rating) costs of the reused materials / materials with recycled content as referenced in the Short Report calculations. The report should also confirm the total contract value of the project.

Statement of confirmation from the Contractor, in the form of signed correspondence clearly listing all compliant materials and quantities, stating that the listed compliant materials have been installed within the project (this documentation must be provided for both recycled content and reused materials, as claimed).

Mat-3 Recycled Content & Reused MaterialsPOINTS
AVAILABLE**3****ADDITIONAL GUIDANCE**

Only materials or products permanently installed on the project site are eligible. Temporary materials used within the construction process, such as formwork, must not be claimed.

Reused material content

It must be demonstrated that the cost of reused materials have been confirmed by the Quantity Surveyor on the project. Where estimated, the cost must be based on the 'fair market value' of a reused material.

Examples of reused materials include, but are not limited to windows, cladding, flooring, doors, sanitary and lighting fixtures/fitings.

Projects may claim materials which already exist on the site in the case of refurbishments or redevelopments, where materials are to be reused, with the exception of steel, timber and concrete mix components (i.e. aggregates and industrial waste product) and masonry units, which are addressed by other credits, and it does not address the reuse of façade or major structural elements of existing buildings(s) or structure(s) on the site.

Recycled material content

Only material that is derived from post-consumer, post-agricultural, and post-industrial process may be claimed for this credit, with the exception of steel, timber and concrete mix components (i.e. aggregates and industrial waste product) and masonry units, which are addressed by other credits, and it does not address the reuse of façade or major structural elements of existing buildings(s) or structure(s) on the site. This also excludes re-utilisation of materials such as rework, regrind, or scrap created in a process that is capable of being reclaimed within the same process that generated it.

This credit is calculated as the value of the product multiplied by the percentage recycled content contained therein, summed with other products containing recycled content.

Items with a high recycled content that may be considered for this credit include but are not limited to insulation, aluminium, glazing, gypsum, flooring, carpets, facades, and roofing materials.

Post-consumer material is defined as waste material generated by households, commercial, industrial, or institutional facilities as end-users of products which can no longer be used for its intended purpose.

Pre-consumer or post-industrial material is defined as material diverted from the waste stream during the manufacturing process, or waste incorporated into a product having been generated from a different manufacturing process. An example would be clothing fabric off-cuts incorporated into a cellulose-based insulation.

To calculate the value of recycled content:

$$\text{Material recycled content value} = \text{material cost} \times (\% \text{ post-consumer recycled content} + \% \text{ post-industrial recycled content})$$

Mat-3 Recycled Content & Reused MaterialsPOINTS
AVAILABLE **3**

Total value of recycled material content = sum of all materials' recycled content values

$$\text{Total recycled content percentage} = \frac{\text{Total value of recycled material content}}{\text{Contract value}}$$

Recycled content is defined in accordance with ISO14021 – Environmental labels and declarations – self-declared environmental claims (Type II environmental labelling).

Material	Material Value	% content	Recycled	Reused material	Total value recycled/reused material
Insulation	R 500,000	50%		-	R 250, 000
Aluminium window frames	R 2,000,000	10%		-	R 200, 000
Glass doors	R 750,000			100%	R 750,000
				Total:	R1,200,000
Total Contract Value:					R 355, 000,000
Percentage Recycled/Reused Materials:					0.34%

Table Mat-3.1: Example of recycled/reused material calculations

Total Contract Value

Contract Value is defined as the Rand value that will be required to complete the works for the entire project, including site works (landscaping, external paving, etc.). The contract value must include contractor fees, contingencies and any other items included as part of the contract amount.

There are a number of credits [e.g. Reused Materials (Mat-3), Concrete (Mat-5), Steel (Mat-6), Sustainable Timber (Mat-8)] that reference this definition of Contract value. As such, the following items must be excluded when using the contract value for calculations of such credits:

- Preliminaries;
- Demolition works;
- Consultants, design fees, project management fees;
- Works outside the site area; and
- Buildings or areas within the site that are not being assessed for purposes of Green Star SA.

Where a number of amenities or services are shared between buildings, the cost apportioned to the Green Star SA registered building must be equivalent to the use that the building will have of these facilities (e.g. if a shared parking has 100 spaces but 40 are being allocated to the Green Star SA registered building, then 40% of the car park cost must be allocated to the project's contract value).

Mat-3 Recycled Content & Reused MaterialsPOINTS
AVAILABLE**3****Material Cost**

The cost of a material may include transport/shipping costs to the project site, but may not include installation costs, equipment for installation, contractor fee, contingencies or any other amounts.

BACKGROUND

At present, construction and demolition waste in the developed world makes up around one third of all waste generated. Implementation of appropriate strategies during the construction phase of a building can significantly reduce this figure, helping the transition towards a more sustainable industry. Reusing products and materials is another definite approach towards ensuring that the useful life of products is extended and hence diverted from landfill.

Incorporating recycled products into buildings helps reduce reliance on virgin materials, and creates a market for recycled materials. In addition, many products containing a recycled component, requires significantly less energy to manufacture, reducing the embodied energy of the product (Hammond & Jones, 2008).

REFERENCES AND FURTHER INFORMATION

Kibert, C. J., Deconstruction as an Essential Component of Sustainable Construction, University of Florida, USA.

<http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/kibert.pdf>

National State of the Environment Report, South Africa.

<http://www.environment.gov.za/soer/index.html>

eThekweni Municipality website.

<http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction>

South African Green Building website.

<http://www.greenbuilding.co.za/>

Sustainable Built Environment.

<http://www.sustainablebuiltenvironments.com>

Smart Growth Online (U.S.), Green Building Case Studies.

http://www.smartgrowth.org/engine/index.php/resources/case_studies

Department of Environment and Tourism, South African Government.

<http://www.environment.gov.za>

Hammond, G. & Jones, C. (2008), Inventory of Carbon & Energy (ICE) version 1.6a, Department of Mechanical Engineering, University of Bath.

This credit is not available in the Green Star SA Public & Education Building v1 tool.

Mat-4 Shell and core or integrated fitout

POINTS
AVAILABLE

This credit is not available in the Green Star SA Public & Education Building v1 tool.

Mat-5 Concrete

POINTS
AVAILABLE

3

AIM OF CREDIT

To encourage and recognise the reduction of embodied energy and resource depletion occurring through use of concrete.

CREDIT CRITERIA

Up to three points are awarded:

Up to two points are awarded where:

- The project has reduced the absolute quantity of Portland cement by a minimum percentage, as an average across all concrete mixes, by substituting it with industrial waste product(s) or oversized aggregate, awarded as follows:
 - 30% reduction for one point;
OR
 - 40% reduction for two points.

An additional point is awarded where:

- At least one point above is achieved;
AND
 - 10% of all aggregate used for structural purposes is either, or a combination of, the following:
 - Recycled aggregate (equivalent to Class 1 RCA as per Australian standard HB155-2002)
OR
 - Slag aggregate;
- AND
- No virgin aggregates are used in non-structural concrete applications.

If the material cost of new concrete represents less than 1% of the project's contract value, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Materials category score.

Mat-5 ConcretePOINTS
AVAILABLE**3**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Concrete mix report(s) 3. Extract(s) from tender documentation 4. Extract(s) from Quantity Surveyor report <p>Where credit claimed as 'Not Applicable':</p> <ol style="list-style-type: none"> 5. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 1. Short report 2. Concrete mix report(s) 3. Statement of confirmation (1) 4. Statement of confirmation (2) <p>Where credit claimed as 'Not Applicable':</p> <ol style="list-style-type: none"> 5. Statement of confirmation (2)

Short report prepared by a suitably qualified professional that clearly describes how the Credit Criteria have been met by:

- Providing a tabulated summary of all concrete uses in the project, with the application description, quantities, and proportions of all constituents clearly identified for each mix and application, with reference to supporting documentation;
- Providing a tabulated breakdown of the reference case mix for each application, clearly identifying the proportions of all constituents (i.e. kg/m³);
- Confirming that the reference case(s) are valid for the same strength categories for the applicable applications, correlating with those mixes specified (Design) or used (As Built), and that the reference case(s) are representative of standard mixes;
- With reference to the proposed/actual case and reference case for each mix and application, clearly indicating the quantity of Portland cement replaced by the industrial waste product or oversize aggregate (where applicable);
- Clearly demonstrating the percentage reduction in Portland cement and compliance with the Credit Criteria.

Additionally where additional point claimed;

- Providing a tabulated summary of all aggregate uses in structural applications for the project, clearly describing where recycled, slag or virgin aggregate is used, and demonstrating through calculations that the Credit Criteria has been met;

Mat-5 ConcretePOINTS
AVAILABLE**3**

- Providing a tabulated breakdown of all aggregate uses in non-structural applications for the project, clearly describing where recycled or slag aggregate is used, and demonstrating that no virgin aggregate are used.

Concrete mix report(s) prepared by a Concrete Technologist, Structural Engineer or Civil Engineer for each applicable concrete mix specified (Design) or used (As Built) within the project that provides a tabulated description of the mix composition or proportions of components (i.e. kg/m³).

Extract(s) from tender documentation clearly demonstrating a contractual requirement for;

- The minimum required percentage reduction of Portland cement;
- The proportion or mix constituent of industrial waste product to be used for each concrete application to reduce the total quantity of Portland cement for all applicable concrete mixes (where applicable);
- The source of industrial waste product(s) used in all applicable concrete mixes must not come from industrial facilities co-fired with hazardous waste (where applicable);
- The proportion or mix constituent of oversize aggregate to be used for each concrete application to reduce the total quantity of Portland cement for all applicable concrete mixes (where applicable);

Additionally where additional point claimed;

- The proportion or mix constituent of recycled or slag aggregate to be used for each mix application and stipulating that the recycled aggregate be equivalent to Class 1 RCA (in accordance with the Australian Standard HB 155-2002).

Extract(s) from Quantity Surveyor report confirming the quantity and total material value of the new concrete in the project as a percentage of the project's total contract value, demonstrating the applicability, or not, of the credit criteria.

Statement of confirmation (1) from concrete supplier(s) for each applicable concrete mix, in the form of signed correspondence confirming;

- The quantities of concrete supplied to the project;
- That no industrial waste product used as a supplementary cementitious material came from industrial facilities co-fired with hazardous waste;

Additionally where additional point claimed;

- That all recycled aggregates within the applicable mixes are equivalent to Class 1 RCA (in accordance with the Australian code HB 155-2002).

Statement of confirmation (2) from the Contractor, in the form of signed correspondence demonstrating, through calculations, the total quantity and material value of the actual new concrete used in the project as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

ADDITIONAL GUIDANCE

This credit addresses all concrete, including both structural and non-structural applications. Non-structural applications include, but are not limited to, footpaths, kerbs, channels and gutters. It must be clear that all of the concrete in the project has been accounted for.

A concrete reference case is typically provided in Mat-5 Concrete credit submissions to demonstrate the percentage of total Portland cement replaced in all concrete uses by supplementary cementitious materials (SCM).

To ensure consistency in Green Star project submissions and the assessments of this credit, the GBCSA deems it acceptable for project teams to present concrete reference cases that assume the use of baseline concrete mixes with 100% Portland cement content (i.e. use no SCM).

Projects may still provide concrete reference cases with more realistic mix designs that do contain some percentage of SCM, which is common industry practice, however this is not mandatory.

Supplementary cementitious materials

It must be clearly demonstrated that the amount of Portland cement has been reduced in all mixes used throughout the project. Points are awarded on the basis of reductions in Portland cement use, rather than the quantity of industrial waste product used. The reference case must have the same structural and functional requirements, and apply to the same location and season.

As the use of supplementary cementitious materials to offset Portland cement is common within the construction industry, it is therefore unacceptable for the purposes of the reference case to assume a concrete mix without any supplementary cementitious material (i.e. maximum Portland cement content).

Slag is a by-product of the manufacture of steel. Ground Granulated Blast Furnace Slag (GGBFS) is slag ground to cement fitness and is a cementitious binder.

Reduction in the amount of Portland cement can be achieved through the use of oversized aggregate. Points will only be awarded if it is demonstrated that the amount of cement is reduced due to replacement of standard aggregate with oversized aggregate.

Aggregates

It is a prerequisite to claim at least one point for cement replacement in order to claim the additional point for aggregate. For the purpose of this credit, recycled aggregate is defined follows:

- Aggregates derived from the processing of materials previously used in a product; and/or
- Aggregates from construction that would otherwise be put into landfill.

Mat-5 Concrete

POINTS
AVAILABLE

3

Common types are as follows:

- Recycled concrete aggregates
 - Aggregates produced by the reclamation, crushing and screening of demolition concrete waste; and
 - Slag aggregate which is an industrial waste product.
- Reclaimed aggregates
 - Aggregates produced from unused fresh concrete returned to its manufacturer in a state such that separation of the aggregates from the cement paste is still possible by washing and or screening; and
 - Aggregates produced from crushing selected surface rock from excavation works associated with building construction.

Recycled aggregate may affect the engineering properties of structural concrete, and this should be considered as it is not a desired environmental outcome that projects increase the amount of cement used to counteract this.

HB 155-2002 Guide to the Use of Recycled Concrete and Masonry Materials presents an overview of material and processing requirements of recycled concrete and provides general guidelines for the specification and use of Class 1 and Class 2 recycled concrete aggregate products. Class 1 products can be used in structural concrete, Class 2 as fill or granular sub-base.

This credit deals with the percentage of post-consumer recycled content of the aggregate used in concrete for the project. It is acceptable to calculate the required 10% against the total volume of aggregates used across the project, in all concrete mixes. The recycled aggregate content can therefore be calculated across the entire concrete use in the project.

Industrial waste product

The industrial waste product can be slag or fly ash but must not come from industrial facilities co-fired with hazardous waste. Kilns have been identified in the US EPA Dioxin Inventory as one of the top ten sources of dioxin to the environment (more than 22-fold increase over standard cement, per kilogram of cement fired). Slag (a waste product from steel manufacturing using a blast furnace), whether as an aggregate or cement replacement, is appropriate for meeting the Credit Criteria.

The quality and properties of concrete can actually be improved by replacing a portion of the Portland cement with industrial by-products such as fly ash, blast furnace slag and silica fume.

BACKGROUND

Concrete is a significant element in most buildings for floors, columns, cores, footings and sometimes façades. Reinforced concrete can readily utilise both post-consumer and post-industrial waste, thus reducing waste, consumption of natural resources and greenhouse gas emissions.

Mat-5 Concrete

POINTS
AVAILABLE**3**

The production of cement is responsible for approximately 90% of the greenhouse gas emissions associated with concrete production. Replacing a portion of the Portland cement with industrial by-products such as fly ash, blast furnace slag and silica fume reduces the mining of natural resources and greenhouse gas emissions associated with cement production while disposing of a waste material previously destined for landfill.

In South Africa fly ash, blast furnace slag, and silica fume are commonly used, in varying levels, to replace Portland cement. In KZN, blast furnace slag typically replaces around 30% of Portland cement in common cement products – this is largely due to its availability and the lower cost of slag. In other South African regions, where only fly ash or silica fume are readily available, such high replacement levels are not common practice.

Concrete waste can be processed to produce road base/fill material, recycled concrete aggregate and recycled concrete fines. Extensive research has and is being undertaken to increase the use of recycled concrete worldwide. In the UK, Wessex Water used recycled concrete (from old railway sleepers) to replace approximately 40% of natural aggregates in the structural concrete of their new headquarters.

The primary use of recycled concrete aggregate in South Africa is for general fill and road base material, which reduces the need for natural fill. Further research and concrete mix design optimisation will lead to wider adoption of RCA in structural concrete mixes.

REFERENCES AND FURTHER INFORMATION

Cement and Concrete Institute of South Africa (CNCI)
<http://www.cnci.org.za>

AggRegain, Sustainable aggregate information service from Waste and Resources Action Programme (WRAP)
<http://www.aggregain.org.uk>

SANS 1491-1:2005 Portland cement extender Part 1: Ground granulated blast furnace slag.
<http://www.sabs.co.za>

SANS1491-2:2005 Portland cement extender Part 2: Flyash.
<http://www.sabs.co.za>

SANS1491-3:2006 Portland cement extender Part 3: Silica fume.
<http://www.sabs.co.za>

Mat-6 SteelPOINTS
AVAILABLE**3****AIM OF CREDIT**

To encourage and recognise the reduction in embodied energy and resource depletion associated with reduced use of virgin steel.

CREDIT CRITERIA

Up to three points are awarded as follows:

One point is awarded where:

- For a predominantly structural steel building:
 - The average post-consumer recycled content of the structural steel is at least 24% (by mass);
- OR
- At least 60% (by mass) of the structural steel, is reused.

OR

- For a predominantly reinforced concrete or structural masonry building;
 - The average post-consumer recycled content of the steel reinforcing is at least 54% (by mass)

An additional two points are awarded where:

- The point above is achieved;
- AND
- The total of all applicable steel uses in the development (total of structural steel, steel reinforcing and applicable steel products) consists of;
 - At least 54% (by mass) post-consumer recycled content;
 - OR
 - At least 90% (by mass) reused steel.

If the material cost of new steel represents less than 1% of the project's contract value, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Materials category score.

Mat-6 SteelPOINTS
AVAILABLE**3**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) of tender documentation 3. Statement of confirmation (1) 4. Extract(s) from Quantity Surveyor report <p>Where credit claimed as 'Not Applicable':</p> <ol style="list-style-type: none"> 5. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 1. Short report 2. Statement of confirmation (1) 3. Statement of confirmation (2) <p>Where credit claimed as 'Not Applicable':</p> <ol style="list-style-type: none"> 4. Statement of confirmation (2)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

For a predominantly structural steel building where post-consumer recycled content claimed;

- Providing a tabulated summary of all structural applications and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all structural steel applications the post-consumer recycled content of the steel (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel with confirmed post-consumer recycled content jointly accounts for the stipulated proportion of structural steel in the project, in compliance with the Credit Criteria;

For a predominantly structural steel building where reused content claimed;

- Providing a tabulated summary of all structural applications and the total amount (by mass) of steel used for each application, and the supplier;
- Confirming for all structural steel applications the reused content (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the reused steel jointly accounts for the stipulated proportion of structural steel in the project, in compliance with the Credit Criteria;

Mat-6 SteelPOINTS
AVAILABLE**3**

For a predominantly reinforced concrete or structural masonry building;

- Providing a tabulated summary of all steel reinforcing applications and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all steel reinforcing applications the post-consumer content of the reinforcing (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel reinforcing with confirmed post-consumer content jointly accounts for the stipulated proportion of steel reinforcing in the project, in compliance with the Credit Criteria;

Additionally where additional points claimed for a predominantly structural steel building where post-consumer recycled content claimed;

- Providing a tabulated summary of all steel applications beyond structural applications (as per the Additional Guidance) and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all non-structural steel applications the post-consumer content of the steel (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel with confirmed post-consumer content jointly accounts for the total stipulated proportion of steel in the project, in compliance with the Credit Criteria.

Additionally where additional points claimed for a predominantly structural steel building where reused content claimed;

- Providing a tabulated summary of all steel applications beyond structural applications (as per the Additional Guidance) and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all non-structural steel applications the reused content (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the reused steel jointly accounts for the total stipulated proportion of steel in the project, in compliance with the Credit Criteria.

Additionally where additional points claimed for a predominantly reinforced concrete or structural masonry building;

- Providing a tabulated summary of all steel applications beyond reinforcing applications (as per the Additional Guidance) and the total amount (by mass) of steel used for each application, and the manufacturer/supplier;
- Confirming for all non-structural steel applications the post-consumer content of the steel (by percentage mass), with reference to supporting documentation;
- Demonstrating through calculations that the steel with confirmed post-consumer content jointly accounts for the total stipulated proportion of steel in the project, in compliance with the Credit Criteria.

Extract(s) from tender documentation that clearly demonstrate the contractual requirement to use the specific material with the nominated content of post-consumer recycled material as referenced in the short report.

Mat-6 SteelPOINTS
AVAILABLE**3**

Statement of confirmation (1) from manufacturer(s) or supplier(s), in the form of signed correspondence confirming the post-consumer recycled content of each steel product claimed or that the steel is reused, as referenced in the short report.

Extract(s) from Quantity Survey report clearly demonstrating the total material value of the steel within the project and the cost as a percentage of the projects contract value, demonstrating the applicability, or not, of the credit criteria.

Statement of confirmation (2) from the Contractor in the form of signed correspondence, clearly demonstrating the total quantity and material value of the actual steel used in the project as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

ADDITIONAL GUIDANCE

The first point addresses 'structural steel' applications in predominantly steel-framed buildings and 'reinforcing steel' applications in buildings predominantly framed in concrete (in situ/precast/stressed) or masonry.

The steel applications that are applicable for each structure type include (but are not limited to);

- Predominantly structural steel building: hot rolled beams, columns, angles, hollow sections, parallel flange channels, mullions, purlins, girts and light-steel framing systems (i.e. lightweight cold-rolled galvanised steel sections);
- Predominantly reinforced concrete or structural masonry building: reinforcing bar, reinforcing mesh and permanent steel formwork.

For the purpose of demonstrating compliance with the Credit Criteria for this first point, steel applications within the non-predominant framing method are excluded from the calculations. For example, where a building consists of both steel-framed and concrete-framed components (e.g. on different floors or levels) and the steel-framed component is predominant (by cost), then the concrete-framed steel applications (e.g. reinforcing bar/mesh) are neglected from calculations demonstrating compliance with the Credit Criteria.

The two additional points address all 'major' steel applications in the building regardless of which framing system is more predominant. The 'major' steel applications in a building include;

- Structural steel applications (as above);

AND

Building envelope steel applications.

The steel applications that are applicable for building envelope applications include;

- Wall cladding; and,
- Profiled roof decking

Mat-6 SteelPOINTS
AVAILABLE**3**

It is not the intent of the Credit Criteria to encompass minor miscellaneous steel applications such as door frames, balustrades, railings, fences, UFAD pedestals, or architectural features. Although noted as steel applications, these are excluded from the scope of the Mat-6 credit due to the general quantity of steel represented and the practicalities of quantification.

A predominantly structural steel framed building is defined where the structural steel framing component is greater than 50% (by cost), compared with the reinforced/ precast/ stressed concrete framing of the building.

A predominantly concrete building is defined where all concrete framing (reinforced/precast/stressed) is greater than 50% (by cost), compared with the structural steel framing component of the building.

The evidence of recycled content refers to average proportions of post-consumer content. It is acceptable to use a weighted average of all steel on the project to meet the Credit Criteria.

$$\text{Average post-consumer recycled content} = \frac{\text{Total mass of post-consumer recycled content}}{\text{Total mass of steel (recycled + non-recycled)}}$$

For documenting recycled content of steel in an As Built submission, it is acceptable to provide evidence stating the overall, manufacturer-wide, average recycled content for the particular product or products, rather than the specific batch provided to the project.

Recycled and reused steel

The impact of steel is best reduced by reducing the total amount of virgin steel required in the building, by reusing existing steel and by recycling steel that cannot be reused, in that order. Using reused steel as well as steel with significant post-consumer content within the building structure is rewarded by this credit.

Post-consumer recycled content refers to the product composition that contains some percentage of material diverted from the product user's waste stream. This excludes re-utilisation of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

For documenting recycled content of steel in an As Built submission, it is acceptable to provide evidence stating the overall, manufacturer-wide, recycled content for the particular product or products, rather than the specific batch provided to the project.

BACKGROUND

Over the past decade the international demand for steel has approximately doubled. This demand, coupled with limited natural resources and the high environmental impact of steel

Mat-6 Steel

POINTS
AVAILABLE**3**

production, necessitate making better use of accessible material by re-using and recycling existing steel.

Historically, 50% of the steel produced in South Africa has been exported. However, due to rising local demand in recent years, this figure has decreased and is currently closer to 25%. As a consequence of South Africa's natural reserves of iron ore and coal, the country is one of the world's primary steel producers. More than 70% of the steel produced locally is completely post-consumer recycled. Two processes are used in the processing of steel. Arc furnace processing allows for a much higher recycled content than the basic oxygen blast furnace process. Reinforcing steel and smaller structural steel sections are produced by arc furnace manufacturing, which gives a post-consumer recycled content of approximately 40%. Bigger producers and larger steel sections are blast-furnace produced and have recycled content of about 20%.

Types of scrap

'Home scrap' (also known as 'circulating scrap') is the residue left from the steelmaking, rolling and finishing operations and includes croppings, off-cuts and material rejected by quality inspection procedures. The home scrap usually accounts for about 10% of total crude steel production in an integrated steelworks. 'Home scrap' is considered industrial rather than post-consumer waste and does not count towards this credit.

Post-consumer scrap returns to the industry from various sources, partly as manufacturers' off-cuts and defective materials, and partly as obsolete and worn-out goods discarded at the end of their useful lives. Ship-breakers, for example, recover many tonnes of scrap metals, and automobiles are a major source of post-consumer scrap. Locally, there is a very well-established can collecting initiative, Collect-a-Can, which have a current recovery rate (collection for recycling) of approximately 60%.

REFERENCES AND FURTHER INFORMATION

South African Institute of Steel Construction
<http://www.saisc.co.za>

Steel Recycling Institute (US).
<http://www.recycle-steel.org>

UK Steel
<http://www.uksteel.org.uk>
<http://www.uksteel.org.uk/fact5.ht>

Mat-8 TimberPOINTS
AVAILABLE**2****AIM OF CREDIT**

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

CREDIT CRITERIA

Up to two points are awarded where:

- The project achieves a minimum percentage (by cost) of all timber and timber composite products used in the building and construction works compliant with the sourcing requirements, awarded as follows:
 - 50% (by cost) for one point;
 - OR
 - 95% (by cost) for two points.

Compliant timber and timber composite products must be:

- Reused timber;
- Post-consumer recycled timber; or
- Forest Stewardship Council (FSC) certified timber.

If the material cost of timber represents less than 0.1% of the project's total contract value then this credit is 'Not Applicable' and is excluded from the points available, used calculate the Materials Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Extract(s) from Quantity Surveyor report Where credit claimed 'Not Applicable': <ol style="list-style-type: none"> 4. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 1. Short report 2. Statement of confirmation (1) 3. Chain of Custody Certificates 4. Statement of confirmation (2) Where credit claimed 'Not Applicable': <ol style="list-style-type: none"> 5. Statement of confirmation (2)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Providing a tabulated summary of all timber uses in the project, indicating for each timber application the supplier/source and compliance, or otherwise, with the Credit Criteria;
- Identifying, with reference to the Quantity Surveyor Report the cost of re-used, recycled and FSC certified timber in the project, as well as the total cost of timber in the project;
- Demonstrating through calculations that reused, recycled and/or FSC certified timber jointly account for the minimum stipulated percentage cost as per the Credit Criteria.

Extract(s) from tender documentation clearly demonstrating a contractual requirement that:

- All applicable timber must be sourced from suppliers and sources compliant with the Credit Criteria for each timber application;
- Evidence confirming compliance with the Credit Criteria (e.g. FSC CoC certificates) and receipts must be kept and logged.

Extract(s) of Quantity Surveyor report clearly demonstrating:

- The total estimated material cost (Design) or actual material cost (As Built) of all of re-used, recycled and FSC certified timber in the project, as well as the total cost of all timber used within the project;
- For refurbishment projects only: the estimated fair market value of timber material retained within the existing building which is reused; and,

Mat-8 TimberPOINTS
AVAILABLE**2**

- The total material cost of all timber within the project, as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

Statement of confirmation (1) from each supplier of compliant timber product, in the form of signed correspondence / delivery note, clearly confirming:

- The quantity, type, and cost of the timber supplied to the project;
- The source of the timber as related to the Credit Criteria (i.e. whether the timber is reused, recycled or FSC Certified);

Chain of Custody Certificates for all FSC Certified timber within the project, for the last company in the chain of custody of each product or material prior to it being procured for this project, as per the Additional Guidance.

Statement of confirmation (2) from Contractor signed and confirming;

- All timber uses within the project and the quantity and source of timber installed in the project; and,

ADDITIONAL GUIDANCE

This credit addresses all timber within the project, including formwork, temporary works timber use and composite wood products. All fitout applications are included only for built-in items; loose furniture is not within the scope of the Credit.

No distinction is made between applications, temperate or tropical timbers, or between hardwoods and softwoods.

For each source that is claimed to satisfy the requirements of this credit, the supplier will be required to confirm the credentials of the timber against the Credit Criteria.

Note that any pre-existing timber that is retained in a refurbishment or redevelopment project can be included in the calculation of this credit, providing its quantification and estimate are well justified. The timber cost for such reused materials must be estimated by the Quantity Surveyor using fair market value for equivalent new material.

For a Design certification, it must be evident that nominated suppliers have been sourced for the timber applications. It is not acceptable that design teams specify the requirements without nominating a preferred supplier of compliant timber and composite timber products.

Expected timber uses within the scope of the Credit Criteria include, but are not limited to:

- Structural timber including wall, floor and roof structures;
- External and internal cladding;
- Flooring/wall/ceiling finishes;
- Internal and external joinery including windows, doors and other specialist uses of timber such as installed furnishings, joinery fixtures, or balustrades; and
- Structural formwork.

Mat-8 TimberPOINTS
AVAILABLE**2****Recycled timber**

For the purpose of this credit, recycled timber must contain post-consumer recycled content. Post-industrial content cannot contribute towards this credit.

For each recycled timber product, identify the percentage post-consumer recycled content by weight.

$$\text{Recycled content value (R)} = \frac{\% \text{ post-consumer recycled content by weight}}{100} \times \text{material cost}$$

$$\text{Total percentage recycled content} = \frac{\text{total recycled content value (R)}}{\text{total timber cost}} \times 100$$

Chain of Custody (CoC) Certificates

Forestry Stewardship Council (FSC) Chain of Custody (CoC) Certificates must be presented for all FSC certified timber. As per the FSC, "Chain-of-custody certification provides a guarantee about the production of FSC-certified products. Chain-of-custody is the path taken by raw materials from the forest to the consumer, including all successive stages of processing, transformation, manufacturing and distribution. Companies or individuals that process, transform, or trade (take ownership of) FSC certified forest products must be CoC certified."

CoC Certificates must also be provided for the final party in custody of the material or product until it has been procured for the project, as per Table Mat-8.1.

Wood products identified as 'FSC Pure' and 'FSC Mixed Credit' must be valued at 100% of the product cost. Wood products identified as 'FSC Mixed [X]%' must be valued at the indicated percentage of their cost, e.g. a product identified as 'FSC Mixed 50%' must be valued at 50% of the cost.

$$\text{Certified wood material percentage} = \frac{\text{FSC-certified wood material value (R)}}{\text{Total new wood material value (R)}} \times 100$$

The last 'hands' to supply the FSC Certified piece of timber (e.g. reseller of a finished product) must have a Chain of Custody Certificate; the project itself does not need this Certificate. The current holders of the FSC Chain of Custody and Management Certificate can be found on the following website: <http://www.fsc-info.org>.

For a timber or timber composite product to be awarded points within this credit for FSC certification, full chain of custody must exist. That is, all FSC certified wood materials used on the project must come from suppliers that have a valid FSC Chain of Custody certificate.

For example, if a board manufacturer who has FSC certification sells the board to a contractor for installation on the building, full chain of custody exists. However, if the board manufacturer

Mat-8 TimberPOINTS
AVAILABLE**2**

sells the product to the workstation manufacturer who doesn't have FSC certification, who then sells it to the project, then chain of custody is lost.

Contractors and Sub-contractors are considered the end consumers and need not be chain of custody certified. A manufacturer that installs its own product (e.g. custom cabinetry) is not required to be chain of custody certified.

Industry Type required?	Process Stage	Chain-of-custody
Building & Construction	Sawmills, Lumberyards	YES
	Manufacturers of forest products	YES
	Timber broker	YES
	Building contractors/ sub-contractors	NO*
	Retailers (i.e. DIY stores)	NO

* The last person in the chain of ownership for materials being supplied to the construction project does NOT need to be CoC certified, but the company those materials are being received from does. The important issue here is ownership.

Table Mat-8.1: Chain of Custody requirements

Formwork

For compliance with the Credit Criteria, all formwork must be either, or any combination of, the following:

- New (i.e. first use) formwork with Forest Stewardship Council certification;
- OR
- Formwork that has been previously used in another project (i.e. re-used)

BACKGROUND

The Forest Stewardship Council certification scheme (FSC) is an international labelling scheme for forest products, which provides a credible guarantee that the product comes from a well-managed forest that has been independently certified for its timber resource sustainability, forest ecosystem maintenance, and financial and socioeconomic viability.

Approximately 80% of plantations in South Africa are FSC certified. The majority of these plantations are for the pulp and paper industry, as trees for paper can be felled sooner resulting in faster turnover. There is not significant demand in the local structural timber

Mat-8 Timber

POINTS
AVAILABLE**2**

industry for FSC certified timber, however a large demand exists internationally. Approximately 25% of the FSC certified timber in SA is exported.

REFERENCES AND FURTHER INFORMATION

Forest Stewardship Council
<http://www.fsc.org/>

Rainforest Alliance, Sustainable Forestry (SmartWood)
<http://www.rainforest-alliance.org/>
<http://www.rainforest-alliance.org/forestry.cfm?id=certification>

Australian Forestry Standard.
<http://www.forestrystandard.org.au>

Mat-9 Design for DisassemblyPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise designs that minimise the embodied energy and resources associated with demolition.

CREDIT CRITERIA

One point is 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 contract value, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Materials category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) 3. Extract(s) from Quantity Surveyor report 4. Comprehensive Disassembly Plan 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Comprehensive Disassembly Plan
Where credit claimed 'Not Applicable':	Where credit claimed 'Not Applicable':
<ol style="list-style-type: none"> 5. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 4. Extract(s) from Quantity Surveyor report

Mat-9 Design for DisassemblyPOINTS
AVAILABLE**1**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Outlining the overall approach;
- Identifying the elements designed for disassembly; and
- Providing calculations and a summary table confirming that the stipulated proportion of the relevant elements is designed for disassembly.

Extract(s) from Quantity Surveyor report estimating the total quantity of new structural framing, roofing and façade cladding systems (including existing elements if part of a refurbishment) that are designed for disassembly as a proportion of the project's contract value.

Tender / As Built drawing(s) marked-up to show;

- Detail drawings of connections demonstrating that the relevant building elements can be disassembled without cutting, material damage, or hindrance from adjacent materials;
- Elevation drawings of façades marked to identify elements designed for disassembly and the elements adjacent or consequential to the disassembly of these elements, as referenced in the Disassembly Plan;
- Floor plan drawings of each typical floor marked to identify elements designed for disassembly and the elements adjacent or consequential to the disassembly of these elements, as referenced in the Disassembly Plan; and
- Roof drawings, sectional drawings or any other relevant drawings marked to identify elements designed for disassembly and the elements adjacent or consequential to the disassembly of these elements, as referenced in the Disassembly Plan.

Comprehensive Disassembly Plan developed by the design team and provided separately or as a part of the Operations and Maintenance Manual that:

- Identifies which materials are designed to be recovered during building disassembly; and
- Details how (in terms of technique, expertise and technology required) the identified materials and products should be recovered, indicating the order of disassembly to enable them to be extracted without material damage or interference from other building materials/elements.

ADDITIONAL GUIDANCE

To be designed for disassembly, the relevant building elements must exhibit the following properties:

- Connections allow for disassembly;
- Key elements or elements where information on the inherent properties is essential in allowing re-use of the item (e.g. bespoke structural beams) should be clearly marked,

Mat-9 Design for Disassembly

or have a label permanently attached, showing their inherent properties and date of manufacture to enable reuse; and

- A comprehensive Disassembly Plan (provided separately or as a part of the Operations and Maintenance Manual) illustrating how the elements should be recovered.

It must be clearly demonstrated that:

- The stipulated proportion of the specified building elements can be practically extracted for reuse or recycling;
- The extraction of reusable elements will not be prohibited by other and non-reusable elements; and
- The design, the marking of the elements and the Disassembly Plan are sufficient to enable a team different to the installation team to disassemble the building and reuse or recycle the designated elements at a time in the future.

Inherent properties of a material are those that describe the attributes critical for its intended use, such as structural properties, warranty, useful life, width, length, height, mass, composition, etc.

Façade is defined as the exterior face of a building. 'Face' refers to the surface of a wall, masonry unit, or sheet of material that is exposed to view or designed to be exposed in finish work. The face will be the element in the façade that covers the surface layer of one material with another. Projects will need to consider the total surface area of the façade (as defined above) when calculating the designed for disassembly components. The surface area of structural elements exposed as part of the facade should not be counted when calculating the total area of the facade.

Where the project is a refurbishment, the existing elements of the structure or the façade do not need to be included in the calculations for this Credit.

A disassembled component is defined as a structural or aesthetic element used in the construction of the project, independent from its fixings, so long as the fixings are sourced separately and the element is not manufactured with an attached fixing system. The fixings used in the construction of the structure may be designed for disassembly, but they do not need to form part of the calculation for this Credit. Fixings that have been extracted in the demolition process are usually made redundant as they become warped, bent and otherwise damaged and hence have no prospects for future use.

A building that has been designed for quick demolition, with all materials to be sorted and transferred for recycling, does not meet the intent of the Credit. The aim of the credit is to design a building to be constructed of materials that can be removed for reuse elsewhere or in the reconstruction of the building. Demolishing the entire structure and recycling all materials, while still achieving some level of positive environmental impact, would diminish its practicality and undermine the positives gained from recycling as the embodied energy and resources used to achieve this would be extensive.

Mat-9 Design for Disassembly

POINTS
AVAILABLE

1

BACKGROUND

This credit facilitates the reduction in consumption of construction materials through reusing, redesigning or reconsidering conventional approaches to building. It is evident that reducing the total amount of new materials used for a given purpose, by reusing the same materials or resources from other parts of the same or similar project is an excellent way of reducing the project's overall impact.

The whole lifecycle of a project including the end-of-life reuse and recycling, and the materials used in its construction, should be considered from the design stage, to examine in detail the materials, elements, resources or parts of the building fabric which might be taken apart and easily used again.

An overall reduction in the embodied energy and resources taken up through the demolition, deconstruction and ultimate recycling of buildings has become more of a priority as more research into waste streams, embodied energy within buildings, and resource lifecycles becomes available. At concept design, designers are accepting the responsibility for the building's (or fit-out's) end of life. By designing individual elements, general parts and sections of developments to be readily disassembled, this can enable better and easier deconstruction, energy savings and more recycling and reuse of construction materials. This becomes even more important as urban fabric becomes denser, as the complications and costs of demolition increase substantially in those circumstances.

At present, construction and demolition waste in the developed world makes up approximately one third of all waste generated. Implementation of appropriate strategies during the construction phase of a building can significantly reduce this figure, helping the transition towards a more sustainable property industry.

REFERENCES and FURTHER INFORMATION

Deconstruction as an Essential Component of Sustainable Construction, by Charles J. Kibert, University of Florida, USA

<http://www.sustainablesettlement.co.za/event/SSBE/Proceedings/kibert.pdf>

Green Building.

<http://www.greenbuilding.co.za/>

Sustainable Built Environment

<http://www.sustainablebuiltenvironments.com>

Philip Crowther (2005), *Design for Disassembly – Themes and Principles*. BDP Environmental Design Guide 2005

<http://www.architecture.com.au/i-cms?page=60>

Mat-10 DematerialisationPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise designs that produce a net reduction in the total amount of material used.

CREDIT CRITERIA

One point is awarded where;

- The building's structural requirements and integrity have been achieved, without changing the load path to other structural components, using;
 - 20% less structural steel (by mass) than in a structure with conventional steel framing;
OR
 - 20% less concrete and reinforcing/stressing steel (by mass) than in a structure with conventional reinforced concrete framing;
OR
 - 20% less timber (by volume) than in a structure with conventional timber framing.

OR

- Where any two of the dematerialisation initiatives below are demonstrated:

Structure

Where it is demonstrated that, without changing the load path to other structural components, the building's structural requirements and integrity have been achieved using;

- 10% less structural steel (by mass);
OR
- 10% less concrete and reinforcing/stressing steel (by mass);
OR
- 10% less timber (by volume) than in a structure with conventional steel, concrete or timber framing.

Ductwork

- The building is fully naturally ventilated;
OR
- The requirement for ductwork has been reduced by 95%.

Finishes

- 95% of all base building floor material is exposed structure with no covering (e.g. exposed sealed concrete floor);
OR

Mat-10 DematerialisationPOINTS
AVAILABLE**1**

- 95% of all base building ceiling is exposed structure (and services, where relevant) with no cladding (e.g. exposed concrete ceiling).

Cladding

- 25% of the roof cladding area has a dual function (e.g. roof garden substrate or photovoltaic shingles serve as cladding);
OR
- 25% of the façade cladding area has a dual function (e.g. photovoltaic panels serve as cladding).

Piping

- No supply piping is used for urinals (i.e. all urinals are waterfree);
OR
- No supply piping is used for toilets (i.e. all toilets are waterfree);
OR
- Mass of underground piping is reduced by 25% for the same functional requirement and material.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Statement of confirmation

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Describing which dematerialisation initiatives are claimed;
- Providing calculations, summary tables, figures and drawing extracts wherever appropriate, to sufficiently demonstrate how the Credit Criteria have been achieved for each design initiative implemented;
- Referencing supporting documentation where necessary.

Extract(s) from tender documentation clearly indicating the contractual requirement for the inclusion of the design initiatives (where applicable).

Mat-10 Dematerialisation

POINTS
AVAILABLE

1

As Built drawing(s) marked-up to clearly indicate the dematerialisation initiatives as referenced in the short report.

Statement of confirmation from the Contractor, in the form of signed correspondence confirming the dematerialisation initiatives included in the development, as referenced in the short report.

Extract(s) from Quantity Surveyor report establishing the reference case against which the reduction in steel, concrete and reinforcing/stressing steel, timber, ductwork or piping will be measured. The report must identify the expected, standard practice scenario for the amount of the relevant material.

ADDITIONAL GUIDANCE

The reduction in material must be clearly demonstrated through sufficient supporting documentation. Based on the design, documentation in excess of the outline below may be necessary.

Structure

The percentage of steel structure is measured by the sum of the suspended floor and roof areas. It must be clearly demonstrated, through the use of a reference case, that steel has been used more efficiently rather than replaced with other structural materials.

Ductwork

No additional evidence is required if the building is naturally ventilated as this is expected to be clearly confirmed through the Energy Modelling Report (Ene – Conditional Requirement).

Finishes

As installed final design must require 95% of floor or ceiling with no finish. This initiative is not available to shell and core projects.

Cladding

It must be clearly demonstrated that the dual-function cladding does in fact fulfil both functions and replaces the conventional, single-function cladding.

A roof garden serving as cladding meets the definition of 'dual function.' A roof garden consists of vegetated area. The roof garden does not need to be accessible by occupants. If there is a patio area for use by occupants or serving another purpose, the project team may submit documentation demonstrating a dual purpose. It is important that the roof cladding has not simply been replaced by another material but that the other material serves a second function not typically served by roofing. Assessors will evaluate projects against the credit aim of reducing the total amount of material used.

Mat-10 Dematerialisation

POINTS
AVAILABLE

1

Piping

If piping for toilets or urinals is present, it will disqualify the submission even if it is capped. Reduction in the mass of underground piping must be demonstrated against a reference case that represents standard practice design.

Reference case for structure

The reduction in the total amount of structural steel (by mass), concrete and reinforcing/stressing steel (by mass) or timber (by volume) in the project must be demonstrated against the reference case. The reference case must assume a conventional steel framed, timber or concrete structure.

BACKGROUND

Reducing the total amount of material used for a given purpose is the best initial step to reducing a project's overall impact. This credit aims to reward such dematerialisation by facilitating the reduction in consumption of construction materials through redesigning or reconsidering conventional approaches to building design and its construction.

Reuse and recycling of materials has been encouraged and recognised by the GBCSA, but now an overall reduction in materials used must also be acknowledged and rewarded in order to reduce the overall amount of materials which go into the construction of commercial developments.

REFERENCES and FURTHER INFORMATION

Tonkinwise, C. (n.a.), *Proposed Asia-Pacific Centre for Dematerialisation Design: Design in less materials-intense societies in North-East and South-East Asia and Australia*, Change Design.

http://www.changedesign.org/DMat/documents/AsiaPacCentreForDMat_Draft.htm

Bibliography of international Dematerialisation and Sustainable Consumption research

<http://www.changedesign.org/DMat/BiblioBody.htm>

Mat-11 Local Sourcing

POINTS
AVAILABLE

2

AIM OF CREDIT

To encourage and recognise the environmental advantages gained, in the form of reduced transportation emissions, by using materials and products that are sourced within close proximity to the site.

CREDIT CRITERIA

Up to two points are awarded independently as follows:

One point is awarded where:

- 20% of the project's total contract value is represented by materials or products that have been sourced from within 400km of the site;

AND

- Are fully compliant with the material and product requirements below.

One point is awarded where:

- 10% of the project's total contract value is represented by materials or products that have been sourced from within 50km of the site;

AND

- Are fully compliant with the material and product requirements below.

Eligible materials and/or products must satisfy the following requirements:

- Are permanently installed on the project site;

AND

- Be extracted, harvested, processed and manufactured within the applicable radii.

Mat-11 Local SourcingPOINTS
AVAILABLE**2**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Statement of confirmation (1) 3. Extract(s) from tender documentation 4. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 1. Short report 2. Statement of confirmation (1) 3. Statement of confirmation (2)

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by:

- Providing a tabulated list of all materials and/or products which are claimed as compliant with the Credit Criteria;
- For each material/product, detailing the manufacturer/supplier (for Design ratings, at least one potential manufacturer / supplier), all points of origin, extraction and manufacture with distances to site, with reference to supporting documentation;
- Providing calculations that demonstrate that the total estimated value (Design) or total actual value (As Built) of the products and/or materials from within the specified radii account for the percentages required of the Credit Criteria, with reference to supporting documentation.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the sourcing of specified products and/or materials which are demonstrated as compliant with the Credit Criteria, and the associated quantities, as referenced in the short report;

Extract from Quantity Surveyor report clearly demonstrating the total contract value of the project and the estimated (Design) or actual (As Built) costs of all materials as claimed compliant with the Credit Criteria, as referenced in the short report.

Statement of confirmation (1) from supplier(s) for each material and/or product claimed, in the form of signed correspondence confirming, the location of the material/products' extraction, harvesting, processing and/or manufacturing, and (As Built only), the quantity supplied to the project.

Mat-11 Local Sourcing

POINTS
AVAILABLE

2

Statement of confirmation (2) from the Contractor, in the form of signed correspondence confirming:

- For all materials and/or products claimed compliant, the manufacturer/supplier of the material/product, the quantity installed within the project; and
- The material value of compliant materials/products as a percentage of the project's contract value.

ADDITIONAL GUIDANCE

Mechanical, electrical, wet services equipment and specialty items (e.g. lifts, elevators etc.) must be excluded from the calculations of both local materials total and total contract value.

Sufficient proof must be provided showing all points of extraction, harvesting and processing, and that all these points fall within the allowable radii from the project site.

The material cost is determined as the total cost of materials which must include transport/shipping costs to the site, but must not include installation cost, equipment for installation, contractor fee, contingencies or any other amounts.

If only a fraction of a material or product has been extracted, harvested, recovered and manufactured locally, then only that percentage of the material (by weight) shall contribute to the value of that material for consideration in the local sourcing credit. The cost of the product must be pro-rated based on proportionality of the weight of the various components. For example, the allowable percentage of the cost of concrete containing imported components would be the weight of the locally extracted and manufactured components divided by the total weight of the concrete mix.

In the case of reused or recycled materials or products, the location from where the material was salvaged/recovered for reuse or recycling shall be equivalent to 'point of recovery,' and for reused materials, the location of final vendor shall be considered the 'point of manufacture.'

A suitable professional is to make an informed decision as to when using locally sourced yet higher impact materials are more environmentally beneficial than importing lower impact materials from further afield. This needs to be looked at holistically in the context of the entire project to ensure that the greatest overall benefit is achieved.

BACKGROUND

It has been well established that in limiting the haulage of materials, and thereby reducing the transportation greenhouse gas emissions, one can achieve vast improvements in the environmental impact of a project. Other indirect implications of local sourcing include boosting the local economy by supporting local industries and keeping money in the region, quicker delivery times and reduced transportation costs.

The Beddington Zero Energy Development (BedZed) in the UK put emphasis on sourcing as many products and materials locally as possible. Most of the heavy materials required for

Mat-11 Local Sourcing

POINTS
AVAILABLE **2**

construction were sourced locally, whilst lighter more specialist materials came from further afield. 52% of the materials (by weight) were sourced within a 55km radius of the project site.

The results achieved at BedZed were compared, for both distance-by-volume and distance-by-weight measures, to national average haulage figures for similar buildings using the same materials but with average origin distances. The results for BedZed came in at 18% below average for distance-by-volume, and 40% below average for distance-by-weight.

A transport distance saving of 65km per tonne of material was achieved, which equates to a saving of 120,000 kilograms of CO₂ emissions. This is equivalent to the CO₂ burden of 10 people for a full year.

The choice to source materials and products locally does not in itself lead to any additional costs or staff time, and can therefore be an effective and sustainable policy in reducing a projects footprint.

REFERENCES and FURTHER INFORMATION

Beddington Zero Energy Development: Construction Materials Report: Toolkit for Carbon Neutral Developments Part 1, Nicole Lazarus, Bioregional Development Group.

<http://www.bioregional.com/news-views/publications/bedzed-toolkit-for-carbon-neutral-developments-part-1-construction-materials-report/>

Mat-12 Efficient Dwelling Size

POINTS
AVAILABLE

This credit is not available in the Green Star SA Public & Education Building v1 tool.

Mat-13 MasonryPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise the reduction of embodied energy and resource depletion associated with a reduction of virgin material in masonry units.

CREDIT CRITERIA

Up to two points are awarded where:

- The minimum percentage (by area) of all applicable masonry units where any combination of the following strategies are used, is awarded as follows;
 - 50% (by area) for one point;OR
 - 80% (by area) for two points.

Clay bricks

- Perforated masonry units are used and the minimum percentage of perforations is 20%;
- OR
- Reused masonry units are used.

Concrete bricks

- Perforated masonry units are used and the minimum percentage of perforations is 20%;
- OR
- Concrete masonry bricks have the following recycled content requirement:
 - Minimum 30% recycled aggregate content;AND
 - Minimum 10% Portland cement replacement with industrial waste product.

Concrete blocks

- Concrete masonry blocks have the following recycled content requirement:
 - Minimum 30% recycled aggregate content;AND
 - Minimum 10% Portland cement replacement with industrial waste product.

Mat-13 MasonryPOINTS
AVAILABLE**2**

If the material cost of applicable masonry units represents less than 1% of the project's contract value, this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Materials category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Manufacturer product datasheet(s) 4. Extract(s) from Quantity Surveyor report Where credit claimed 'Not Applicable': <ol style="list-style-type: none"> 5. Extract(s) from Quantity Surveyor report 	<ol style="list-style-type: none"> 1. Short report 2. Statement(s) of confirmation (1) 3. Manufacturer product datasheet(s) 4. Statement of confirmation (2) Where credit claimed 'Not Applicable': <ol style="list-style-type: none"> 5. Statement of confirmation (2)

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Identifying all the applications of clay masonry units in the project, and the products for each application, with reference to supporting documentation;
- Demonstrating through calculations that the Credit Criteria has been met.

Extract(s) from tender documentation clearly demonstrating the contractual requirement for the application specific use of masonry units with compliant specifications as referenced in the short report.

Statement(s) of confirmation (1) from supplier of each masonry product claimed, in the form of signed correspondence, confirming the product and quantities of masonry units supplied to the project.

Manufacturer product datasheet(s) of each masonry unit product supplied to the project, clearly stating the compliant specifications as referenced in the short report.

Extract(s) from Quantity Surveyor report clearly demonstrating the total material value of the masonry units within the project and the cost as a percentage of the project's contract value, demonstrating the applicability, or not, of the credit criteria.

Mat-13 Masonry

POINTS
AVAILABLE**2**

Statement of confirmation (2) from the Contractor in the form of signed correspondence, clearly demonstrating the total quantity and material value of the actual applicable masonry units used in the project as a percentage of the project's contract value, and the applicability, or not, of the credit criteria.

ADDITIONAL GUIDANCE

Applicable masonry units include those used for walling (structural and non-structural) only. Hardscape and miscellaneous landscape uses of masonry units are not included within the scope of this credit.

The demonstration of compliance for this credit is based on area. This area is considered the 'face' or 'elevation' area, irrespective of construction technique (e.g. single leaf, double brick cavity etc.). Where conversion from quantities to areas is required, the assumed number of masonry units per unit area must be clearly demonstrated and justified.

Perforations

The perforation of a clay masonry unit can be defined as the hollow section passing through the unit as a result of the extrusion process. The nominal diameter/size of the perforations must be used as provided by the manufacturer. The reduction in virgin material through perforations must be calculated against an equivalent solid unit with 0% perforations, of the same mix. The credit criteria can then be met by demonstrating the % perforations of the units specified for the project. The reduction of virgin material in the masonry units must be directly related to the % perforations.

BACKGROUND

Fired clay masonry units (i.e. bricks and pavers) are one of the most predominant building materials in South Africa, particularly for residential developments. The South African clay masonry manufacturing industry has an installed annual capacity, within normal working hours, of in excess of 5 billion brick equivalent units. Approximately 13 million tons of clay is extracted annually, processed and fired to supply clay masonry products for new and renovated buildings in South Africa.

South Africa has always had an abundance of brick making clays and good levels of sunshine, which has meant that clay brick manufacturing has traditionally often been manufactured by means of "field ovens" or "clamp kilns". Easy availability of thermal coal resulted in the use of this fuel source to vitrify the clay and form the finished products. Many different firing methods using thermal coal were developed and installed over time. Some of these methods remain common today, and are listed as critical activities in terms of the recently promulgated Air Quality Act and subject to stringent emissions controls.

With technological advancement in brick making, the availability of natural gas and the influence of European and American equipment suppliers in South Africa, many of the more advanced and larger manufacturers have moved to better technology and highly automated processes.

Mat-13 Masonry

POINTS
AVAILABLE

2

Approximately 70% of the brick equivalent units produced in SA are produced in “clamp kiln” facilities, which produce mainly stock bricks. Improvements to this type of facility are on the rise in the industry (for example, to more efficient vertical shaft systems). A quarter of production comes from the more advanced tunnel kiln operations, and 6% from Hoffman/Transverse Arch kilns.

Efficiencies vary drastically between the less-efficient facilities (higher than 8GJ / 1,000 bricks) and the more advanced facilities which align themselves with international best practice (under 4GJ / 1,000 bricks). Based on an internal study by one of the largest clay brick manufacturers in South Africa, approximately 150 MJ gas / 1,000 bricks can be saved, by taking out 100grams of clay per brick, depending on the efficiency of the facility.

There are numerous knock-on benefits of reducing the amount of virgin material in clay masonry units. Firstly, the reduction of virgin materials required reduces the strain on natural resources as well as the required extraction and transportation of these raw materials from the quarry to the brick manufacturing plant.

Through introducing higher levels of perforations into clay masonry units, the mass of the units is reduced which has a direct impact on the required drying and firing times, which are the most energy intensive processes in the manufacturing of clay masonry. Energy consumption during drying and firing is also affected by the mix recipe for the particular masonry product, for example the clay content, and the various types of clays and their water content.

Reducing the mass of a masonry unit impacts on haulage, with lighter loads and reduced transport related greenhouse gas emissions. It also leads to reduced loading on structures, which can lead to reductions in the size of structural members. Reduced mass of the units can also improve handling on site, reducing potential health and safety impacts. The addition of perforations into masonry units can also reduce the amount of mortar required, if laid correctly.

REFERENCES and FURTHER INFORMATION

Calkins (2009) Materials for Sustainable Sites; A complete guide to the evaluation, selection, and use of sustainable construction materials.

Clay brick association
<http://www.claybrick.org.za/news.php>

Brick Industry Association
<http://www.gobrick.com/default.aspx>

Cement Sustainability Initiative
<http://www.wbcscement.org/>

Land Use and Ecology

The credits allocated within the Land Use and Ecology Category of the Green Star SA rating tools promote 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 occur¹⁴.

South Africa has an immensely rich species diversity which is brought on as a result of its wide range of climatic conditions and many variations in topography. In combination, climate and topography give rise to broad vegetation zones which, together with their associated animal life, are called biomes. The land mass of South Africa represents just 2% of the earth's total land surface and contains almost 10% of the world's total known bird, fish and plant species, and over 6% of the world's mammal and reptile species¹⁵. South Africa is one of 17 countries that have been termed as "mega diverse"; these 17 countries collectively house two thirds of the world's biodiversity¹⁶.

Unfortunately this immense natural wealth is under extreme pressure resulting from human demands placed on the environment through economic development, agriculture and urbanisation. Invasive alien vegetation also contributes to the problem.

Many credits in other categories of the Green Star SA rating tools have an indirect impact on the land use and ecology of the South African environment; Emi-5 'Watercourse Pollution', for example, addresses the rainwater run-off from buildings and hard surfaces in an attempt to prevent pollution from reaching nearby natural watercourses. This category, however, addresses the direct impact of a project on the ecological value of the site.

Green Star SA rating tools aim to reduce the impacts on ecological value from urban development, and recognise and reward projects which both minimise harm and enhance the quality of local ecosystems.

The terms 'site' and 'project site' are used frequently in the credits within the Land Use and Ecology category as well as in credits within other categories. While a generic interpretation is often adequate for credits in other categories this is not the case in the Land Use and Ecology category as the spatial extent of the site serves as the basis for the calculation of credit thresholds and benchmarks.

¹⁴ <http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm>

¹⁵ <http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm>

¹⁶ <http://www.biodiversitya-z.org/areas/26>

Eco-0 Conditional Requirement

POINTS
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AIM OF CREDIT

To encourage and recognise development on land that has limited ecological value and to discourage development on ecologically valuable sites.

CONDITIONAL REQUIREMENT CRITERIA

The Eco-Conditional Requirement is met where the project development footprint

- Is not located on prime agricultural land. Refurbishments/redevelopments that remain within the existing development footprint are exempt from this criterion;
- Is not located on vegetation of high ecological value or within a 100 metre buffer of vegetation of high ecological value. Refurbishments/redevelopments that remain within the existing development footprint are exempt from this criterion;
- Is not located on land with confirmed presence or high probability of threatened red listed species, or within a defined buffer relevant to the specific threatened red listed species or habitat found. Refurbishments/redevelopments that remain within the existing development footprint are exempt from this criterion; and
- Is not located within the required buffer zones of watercourses:
 - The project development footprint must not fall within the 100 year floodplain.
 - Watercourses of 'high ecological value': A project's development footprint can be located on land within 100 metres of a watercourse of 'high ecological value' only if the building is a refurbishment that remains within the existing development footprint and the Watercourse Protection Measures (outlined below) have been completed; or
 - Watercourses NOT of 'high ecological value': A project's development footprint can be located on land within 100 metres of a watercourse that is NOT of 'high ecological value' only if the Watercourse Protection Measures (outlined below) have been completed.

Watercourse Protection Measures

- A site-specific Watercourse Management Plan has been produced, exhibited and, for an As Built submission, implemented; and
- The project implements best practice urban stormwater management practices on site. Further guidance on what is considered best practice urban stormwater management in terms of Green Star SA eligibility is available from the GBCSA on request.
- All points are achieved in in Emi-7 'Light Pollution'.

The project must abide by all measures in the Environmental Impact Assessment for the project if one is required, and the GBCSA reserves the right to provide the final ruling on a project's compliance with this Conditional Requirement.

DOCUMENTATION REQUIREMENTS

The Conditional Requirement requires that there is an official and appropriately dated report from a suitably qualified recognised ecologist confirming that none of the above Conditional Requirement Criteria applies, or applied at the time of purchase, to the site.

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Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
<ul style="list-style-type: none"> • Extract(s) from the environmental impact assessment report (if required for development) • Confirmation from a suitably qualified recognised ecologist if not included with the EIA report or no report is available • Watercourse Management Plan if the development footprint is located within 100m of a watercourse. • Letter of confirmation from the building owner if the development footprint falls within 100m of a watercourse. 	<ul style="list-style-type: none"> • Extract(s) from the environmental impact assessment report (if required for development) • Confirmation from a suitably qualified recognised ecologist if not included with the EIA report or no report is available • Watercourse Management Plan if the development footprint is located within 100m of a watercourse. • Letter of confirmation from the building owner if the development footprint falls within 100m of a watercourse.

Extract(s) from the Environmental Impact Assessment report (if required for development) that shows that the site was adequately assessed and that a positive Record of Decision (RoD) was issued for the site. It must also indicate the conditions of the RoD.

The confirmation from a suitably qualified registered ecologist must:

- State whether or not the site is located on or adjacent to any prohibited land types and if so the distance between the development and any vegetation of high ecological value and/or specific threatened red listed species or habitat and/or watercourses;
- Where the development is located within 100 metres of a watercourse, describe the watercourse/s, determine the 'present ecological state' or DWAF Ecological Category equivalent of the watercourse/s, confirm whether they are listed as 'high ecological value' or not as defined by this conditional requirement and reference the supporting documentation; and
- Include the curriculum vitae of the ecologist.

A **suitably qualified registered ecologist** is defined as a Professional Natural Scientist currently registered with the South African Council for Natural Scientific Professions (SACNSP) in accordance with the Natural Scientific Professions Act, 2003 (Act 27 of 2003). The SACNSP practitioner may have other specialists produce components of work under his or her guidance, but he/she must sign off the final report.

The Watercourse Management Plan must relate to what can be addressed by the land owner on his/her own site and be prepared by a suitably qualified and experienced wetland ecologist and include:

- A clearly defined management objective to protect the watercourse;
- A description of the ecological values of the watercourse;

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- A list of risks and threats to the conservation of the watercourse values associated with the development;
- The proposed risk-management actions for all construction and operation stages;
- Assumptions and a statement of resources required i.e. budget and specific actions for the management response;
- Requirements for ongoing quarterly monitoring, annual reporting and management of the watercourse ecosystem for a minimum of five years; and
- A statement regarding the operational timeframe of the Watercourse Management Plan (minimum of five years).

The Letter of confirmation from the building owner must state the commitment to the implementation of the Watercourse Management Plan for at least 5 years from project completion (regardless of whether the owner hands over a portion of the project to another entity) and describe the resources that will be allocated over the life of the plan to ensure successful implementation.

ADDITIONAL GUIDANCE**Development footprint**

The term development footprint is defined as the extent of all disturbance to the site, including the building footprint, parking areas, roads, landscaping and water detention and treatment areas. The development footprint includes all temporary work or structures erected by the contractor. The intent of restricting the extent of the development footprint is to minimise the disturbance to ecologically valuable land. As temporary site works would still disturb ecologically valuable land, they must be considered as part of the development footprint.

Refurbishments/redevelopments that remain within the existing development footprint are exempt from the criterion that the development footprint must not fall within the 100 year floodplain.

How to determine compliance to conditional requirement

The project team must determine whether an environmental impact assessment was carried out for the site and, if so, refer to the findings of the ecological specialist report. Where there is no such report, the project team must approach a suitably qualified recognised ecologist to undertake an ecological site scan or professional opinion to determine if any of the prohibited land types apply to the site.

Where there is no recent report on watercourses, wetlands and riparian habitats on the site, the project team must approach a suitably qualified wetland specialist to provide a professional opinion to determine whether any watercourses, wetlands or riparian habitats occur on the site.

All specialist ecological assessments must be done by a Professional Natural Scientist currently registered with the South African Council for Natural Scientific Professions (SACNASP) in accordance with the Natural Scientific Professions Act, 2003 (Act 27 of 2003).

Where the project is a building extension it will not automatically meet the Conditional Requirement, as the extension may encroach onto prohibited land types.

Prime agricultural land

Prime agricultural land is synonymous with the term 'high potential soils for agricultural use'. Prime agriculture land is to be assessed in a stepped approach by a registered agricultural/soil scientist (as required by the Natural Scientific Professions Act (No. 27 of

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2003) through the South African Council for Natural Scientific Professions (SACNSP)):

Step 1:

The specialist is to do a visual inspection of the site and top soil, and prepare a short report of his/her findings that either:

- Describes the findings that highlight that the site is not of high agricultural potential including reasons for this conclusion (in this case projects will not need to continue with 'Step 2' of this assessment),

or

- Describes the findings that highlight that the inspection and basic assessment was not sufficient to determine whether the site was of high agricultural potential, requiring a more detailed study (in this case the project will need to continue with 'Step 2' of this assessment).

Step 2:

A detailed study and report must be prepared by the registered agricultural scientist to assess whether the site is of prime agricultural potential. The study must address all criteria of the soil classification relevant to the definition of prime agricultural land, as described below. The report must be conclusive in determining the classification of the site in this regard.

Definition of prime agricultural land

Prime agricultural land is classified for the purposes of this Green Star SA conditional requirement as soils of either Class I or II as defined in the 'Development and Application of a Land Classification for South Africa' report dated April 2002 prepared for the National Department of Agriculture, available for download from the AGIS website (www.agis.agric.za) under AGIS: Natural Resources: Assessments: Land Capability: e-Library).

Vegetation of high ecological value

Vegetation of high ecological value is defined as indigenous natural vegetation that is in its untransformed state. For the purposes of Green Star SA this would include any vegetation identified as a 'Critical Biodiversity Area' in a fine-scale systematic conservation plan. The project team must secure a recent site-specific vegetation sensitivity study that confirms or refutes the presence of vegetation of high ecological value on the site. Where present, the vegetation of high ecological value is to be delineated on the site plan. Vegetation of high ecological value would typically be included with the environmental impact assessment report. Where there is no such report, a suitably qualified registered ecologist should be commissioned to provide a report.

Threatened red listed/threatened species

Threatened species are any species (including animals, plants, fungi, etc.) which are vulnerable to extinction in the near future. Threatened species are also referred to as a threatened red listed species, as they are listed in the IUCN Red List of Threatened Species. Threatened red listed species are protected through national legislation, the *National Environmental Management: Biodiversity Act 10, 2004* and at a provincial level through policy by the provincial authorities mandated to enforce the *National Environmental Management Act, Act 107 of 1998*.

For the purposes of Green Star SA, the term "threatened" is as per the IUCN Red List Categories & Criteria (Version 3.1-2000) which defines "threatened" species as those within

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the subcategories of "Critically Endangered (CR)", "Endangered (EN)" or "Vulnerable (VU)" only. Species which are not included within the aforementioned subcategories are not considered "threatened" for the purposes of Green Star SA.

Threatened and protected species lists may be obtained from the local Provincial and National conservation authorities. More information can be found at <http://www.iucnredlist.org>.

In determining compliance with the Conditional Requirement Criteria, a registered ecologist qualified according to currently accepted standards for the threatened red listed species expected to occur on site should apply relevant methodologies as specified in recent guideline documents and available literature.

Watercourses

The following definitions from the National Water Act, 1998 (Act No. 36 of 1998) (NWA) are to be used to determine the presence of a watercourse on or within 100 metres of the site.

The NWA includes wetlands and rivers into the definition of the term watercourse as follows:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows, and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.

A reference to a watercourse includes, where relevant, its bed and banks.

How to determine the buffer from a watercourse

For the purposes of determining the 100 metre buffer from a watercourse, the edge of a watercourse is defined as the outer edge of the combined footprint encompassing the riparian habitat and/or the temporary zone of a wetland/s on or adjacent to the site.

- The edge of the watercourse must be delineated by a wetland specialist. The 100m buffer is then measured from this line.
- In addition, the development footprint must not fall within the 100 year flood plain.

Riparian habitat is the accepted indicator used to delineate the extent of a river's footprint (DWAf, 2005). The NWA defines a riparian habitat as follows:

"riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."

The temporary zone of a wetland is the outer recognisable edge of a wetland which the National Water Act, 1998 (Act 36 of 1998) defines as:

"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Local government policies require that protective river buffer zones be calculated from the outer edge of the riparian zone and that protective wetland buffer zones be calculated from the outer edge of the temporary zone of a wetland (KZN DAEA, 2002; CoCT, 2008; GDACE, 2009).

High Ecological Value Watercourses

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For the purposes of this conditional requirement, a watercourse is considered to be a 'high ecological value watercourse' if it is:

- Deemed significant under a local, provincial or national register;
- A listed wetland under the Ramsar Convention on Wetlands; or
- Rated with a Present Ecological State (PES) of 60% or greater.

How to determine the ecological value of a watercourse

The Ecologist's site assessment must be based on:

- Local, provincial and national watercourse mapping where available;
- The Ramsar Convention on Wetlands;
- Aerial photography;
- Topographic mapping (to identify catchment areas and drainage patterns); and
- A site survey including an assessment of the 'present ecological state' of watercourses in terms of the vegetation, soil and hydrological regime, against the definitions of watercourses of 'high ecological value' using recognised South African functional assessment methodologies.

How to determine the Present Ecological State (PES) of a watercourse

A suitably qualified and experienced wetland ecologist must apply the appropriate methodologies to assess the ecological integrity of the watercourse/s on or adjacent to the site to determine their PES or equivalent DWAF ecological category.

Several assessment methodologies have been developed in recent years which describe the relative integrity of wetlands and rivers. In deciding which rating system is the most appropriate at a given time, it is important to take into consideration the following:

- The particular type of wetland or river conditions present on the site will determine which methodology is best suited for an evaluation;
- Methodologies developed for South African biophysical conditions should take preference to non-South African methodologies;
- Where possible, recent, updated methodologies should be followed;
- Methodologies should be generally accepted by specialists in the field; and
- They should be rugged and scientifically defensible.

The following methodologies have been developed for the assessment of the ecological state and by implication the value of watercourses according to their hydro-geomorphic categories:

- The Riparian Vegetation Response Assessment Index (VEGRAI) (Kleynhans et al, 2007);
- The Wetland Index of Habitat Integrity (WETLAND-IHI) developed by DWAF (2007);
- The WET-Health tool designed to assess the health or integrity of a wetland; and
- The WET-EcoServices tool designed to assess the ecological functionality of a wetland.

Watercourse protection measures

The watercourse management plan must be incorporated on the project for the areas within the owner's control. The owner must remain responsible for implementing the watercourse management plan for 5 years from project completion, regardless of whether the land will be donated or handed over to another entity.

All points in Emi-5 'Watercourse Pollution' and in Emi-7 'Light Pollution' must be achieved, regardless of the areas of the watercourse under the owner's control.

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Excluded drainage systems

Man-made drainage features such as stormwater channels and swales are not included in the National Water Act, 1998 (Act No. 36 of 1998) definition of a watercourse and are therefore not considered to qualify as watercourses in terms of the Eco-Conditional Requirement.

However, care should be taken in the interpretation of this definition due to the fact that natural streams, wetlands and rivers may in some instances become transformed so as to resemble artificial features over many years of human disturbance. Similarly, over time, man-made systems may resemble natural systems. A suitably qualified specialist should be approached to determine the status of these systems according to the National Water Act should any doubt arise based on soil moisture, position in the landscape or vegetation characteristics present on the site.

BACKGROUND

The principal aim of this conditional requirement is to minimise ecological degradation by encouraging the selection of sites for development that have low ecological value. Site selection is one of the easiest ways to gain positive environmental outcomes within the building industry. Following is more information on parameters that are considered to be ecologically sensitive.

Prime agricultural land

Prime agricultural land is potentially a critical ecological resource for food production and must be protected from loss due to development. Schoeman *et al* compiled a report entitled, 'Development and application of a land capability classification system for South Africa' (Schoeman *et al.* 2002) for the National Department of Agriculture. This report is the basis for the categorization of prime agriculture land.

Vegetation of high ecological value

All over South Africa, very little vegetation exists that is in an undisturbed and untransformed state. Where this vegetation does occur, it is often inadequately protected. Mucina and Rutherford (eds) completed a revised study of the vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford, 2006). The book includes descriptions of each vegetation type, including a general introduction to each biome, followed by descriptions for each vegetation type in the Biome. This book is the basis for the calculations contained in the Change of Ecological Value Calculator.

Threatened red listed/threatened species

The World Conservation Union (IUCN) is the foremost authority on threatened species, and treats threatened species not as a single category, but as groups of categories such as vulnerable, endangered, and critically endangered, depending on the degree to which they are threatened.

Watercourses

Watercourses include wetlands and rivers with their associated riparian zones. Wetlands range from springs to seeps, mires and bogs in the mountains, to midland marshes and floodplains, to coastal lakes, mangrove swamps and estuaries. By definition, they are areas of land where saturation with water is the dominant factor determining the nature of soil development and the types of plants and animals living in the soil and on its surface.

The primary task of a wetland is to manage water. It fills with water during floods and releases water during dry periods, thus playing an essential part in the regulation of river flow. It also filters pollutants and fertilizers and provides a habitat for plants, insects and birds.

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Maps, photographs or other documentary evidence showing the site's location and past uses may be requested, to confirm proximity to natural wetlands. The South African Wetland Database contains a list of all wetlands listed under either the Ramsar Convention (<http://ramsar.wetlands.org/>) or the South African National Wetland Inventory Directory of Important Wetlands in South Africa.

REFERENCES & FURTHER INFORMATION

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http://www.agis.agric.za/agismap_atlas/

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Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa. Dini, J., Cowan, G. & Goodman, P. (1998) South African National Wetland Inventory – Proposed Classification System for South Africa. South African Wetlands Conservation Programme.

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Kotze D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.S. and Collins, N.B. (2005). WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands

Eco-0 Conditional RequirementPOINTS
AVAILABLE**0**

KwaZulu Natal Department of Agriculture and Environmental Affairs: Chief Directorate

Environmental Management (2002). Interim Guidelines for Development Activities that may Affect Wetlands.

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Schoeman, J.L., van der Walt, M., Monnik, K.A., Thackrah, A., Malherbe, J & Le Roux, R.E. (2002) Development & application of a land capability classification system for South Africa. ARC Report GW/A/2000/57, Pretoria

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<http://www.sacnasp.org.za/sacnaspact.htm>

The Ramsar Convention on Wetlands

<http://www.ramsar.org>

http://www.ngo.grida.no/soesa/nsoer/resource/wetland/inventory_classif.htm

Eco-1 TopsoilPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise construction practices that preserve the ecological integrity of topsoil.

CREDIT CRITERIA

One point is awarded where:

During construction -

- All topsoil impacted is separated and protected from degradation, erosion or mixing with fill or waste;

AND

At project completion -

- At least 75% (by volume after excavation) of all protected topsoil remains on site;

AND

- Protected topsoil retained is spread over impacted areas to a minimum depth of 200mm and a maximum depth of 600mm;

AND

- 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;

Where no topsoil existed on the site at the time of site purchase, or no topsoil was impacted by the construction works, this credit is 'Not Applicable' and is excluded from the points available, used calculate the Land Use & Ecology Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation 4. Topsoil Management Plan 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Topsoil Management Plan 4. Statement of confirmation
Where credit claimed 'Not Applicable':	Additionally where topsoil transported offsite:
<ol style="list-style-type: none"> 5. Short report 	<ol style="list-style-type: none"> 5. Land holding receipt(s)

Eco-1 TopsoilPOINTS
AVAILABLE**1**

6. Tender drawing(s)	Where credit claimed 'Not Applicable': 6. Short report 7. As built drawing(s)
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Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

- Quantifying the amount (volume and depth) of topsoil on the site at time of purchase and describing the method used for assessment, with reference to supporting documentation;
- Defining the areas of topsoil that are impacted by construction activities and demonstrating with calculations, the 'Before' and 'After' site conditions that account for all topsoil on the site;
- Describing how the integrity of the site's topsoil specifically within the impacted area is protected throughout construction works, with reference to the Topsoil Management Plan;
- Describing the measures used to ensure topsoil integrity where transportation offsite is required, with reference to the Topsoil Management Plan;
- Clearly demonstrating that the Credit Criteria is met for the project.

Where credit claimed 'Not Applicable':

- Clearly demonstrating, with reference to supporting documentation, that no topsoil was impacted by the construction activities and that the existing landscaped area is unchanged (in size and characteristics) from the final landscape;

OR

- Clearly demonstrating, with reference to supporting documentation, that no topsoil existed on the site at time of site purchase.

Tender / As Built drawing(s) clearly marked up to show;

- The total landscape area and characteristics (i.e. location and depth of topsoil);
- The location of all areas where topsoil was disturbed and/or redistributed;
- Where topsoil is redistributed, to what depth the topsoil is redistributed.

Extract(s) of tender documentation clearly demonstrating the contractual requirement for topsoil management as referenced in the short report, and the implementation of a Topsoil Management Plan.

Topsoil Management Plan prepared by a suitably qualified professional in accordance with the Additional Guidance.

Statement of confirmation from the Contractor in the form of signed correspondence, confirming that the Topsoil Management Plan was adhered to throughout the construction process and the Credit Criteria was achieved.

Land holding receipt(s) clearly demonstrating that any topsoil transported off site was delivered to the appropriate land holding facility as detailed in the Topsoil Management Plan.

ADDITIONAL GUIDANCE

Pre-existing contaminated topsoil is excluded from this credit and must not be included in the topsoil calculations.

Productive topsoil

Topsoil is defined as the surface layer of soil containing partly decomposed organic debris, which is usually high in nutrients, contains many seeds, and is rich in mycorrhizae. To remain productive, topsoil must not be covered by permanent hard surfaces.

Impacted area

The impacted area includes the total footprint on the site where construction activities including building works, materials handling and traffic occur especially where these activities disturb the existing topsoil cover.

Protected topsoil

The calculation of protected topsoil to remain on site is based on the pre-development volume of topsoil not covered by hard surfaces.

Topsoil Management Plan & correct topsoil management

The Topsoil Management Plan must be prepared by a suitably qualified professional and be based upon a site specific soil survey of the project area as a part of baseline investigations. The soil survey will identify the soils suitable for salvaging, their depth and amount prior to disturbance.

The correct implementation of a topsoil management plan will demonstrate that the integrity of the site's topsoil was not compromised during construction works. A project-specific topsoil management plan should include (at minimum):

- The methodology for determining quantity and quality of topsoil;
- Locations of on-site stockpiles or appropriate off-site land holdings;
- Specifically define all suitable topsoil occurring within the impacted area of construction, and must be salvaged and stockpiled in a demarcated and protected area for later reapplication;
- Where conditions permit, taking into account project schedules, topsoil must be applied directly to re-contoured areas within the impact area and protected from disturbance by construction activities.
- A protective vegetation layer must be established to cover topsoil stockpiles that will be stored for more than three months. The stockpile must be kept suitably moist to maintain the vitality of the vegetation. The vegetation must not include weed species and must comprise of grass or groundcovers. The vegetation cover protects the stockpile from erosion and desiccation. Long term storage of soils may result in the loss of vital organisms within the soil, thus reducing the productivity of the soil and consequently reducing re-vegetation or landscaping success.
- The topsoil stockpiles that will be stored for less than three months must be covered with a material that is durable yet permeable to protect the topsoil from wind, rain and erosion. The stockpile must be kept moderately moist to maintain the vitality of the soil.

Eco-1 Topsoil

POINTS
AVAILABLE

1

It is acceptable to contain the requirements of the Topsoil Management Plan within the Environmental Management Plan, and as such it does not necessarily need to be a separate document. Compliance with the Credit Criteria and Additional Guidance for the Eco 1 Topsoil credit must be clearly demonstrated in the EMP.

Topsoil transportation and relocation

Transportation of excess topsoil must be in a method and to a nearby area that ameliorates soil loss or contamination. Areas for topsoil relocation must be within the same soil classification as the impacted area as described by the South African Council for Geoscience. Areas should be selected that require proactive soil conservation practices and where topsoil depth is not currently over 600 mm.

Externally sourced topsoil

The importation of topsoil is not rewarded by this credit as it may compromise the topsoil's ecological integrity. Projects that substitute topsoil from the site with other topsoil and where in situ topsoil has been removed from site cannot claim this credit.

Non-permanent topsoil

Topsoil contained within non-permanent landscape, such as potted plants, planter boxes, or other non-in situ landscape features, which can be removed or relocated, is not considered part of the 'site' and is therefore not within the scope of the Eco-1 Topsoil credit. All other topsoil, including that contained in permanent or insitu landscape features, must be included in calculations demonstrating compliance with the credit criteria

BACKGROUND

Topsoil is a valuable and diminishing natural resource in South Africa and globally. The most meaningful indicator for the health of the land, and the long-term wealth of a nation, is whether soil is being formed or lost. If soil is being lost, so too is the economic and ecological foundation on which production and conservation are based.

Conservation is necessary because soil formation is a slow process. One centimetre of soil takes between 100 and 400 years to develop.

REFERENCES & FURTHER INFORMATION

Water Related Best Management Practices in the Landscape, Watershed Science Institute
United States Department of Agriculture and Mississippi State University 1999
<http://abe.msstate.edu/csd/NRCS-BMPs/contents.html>

Eco-2 Reuse of LandPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise the reuse of land that has previously been developed and where the site is within an existing municipally approved urban edge.

CREDIT CRITERIA

Two points are available as follows:

One point is awarded where:

- The project is a refurbishment, redevelopment or a building extension (within the same site);

An additional point is awarded where:

- The point above is achieved;

AND

- The project site is located within a municipally approved urban edge.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
1. Short report Where additional point claimed: 2. Extract(s) from relevant planning authority documentation	1. Short report Where additional point claimed: 2. Extract(s) from relevant planning authority documentation

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by confirming that the project is a refurbishment, redevelopment or extension (within the same site), with reference to 'Site documentation' provided in the 'General' section of the submission;

Extract(s) from relevant planning authority documentation that clearly demonstrates the location of the project site and that it is located within the municipal approved urban edge.

Eco-2 Reuse of Land

POINTS
AVAILABLE**2**

ADDITIONAL GUIDANCE

Please refer to the Glossary for the definition of development footprint.

Previously developed land

Previously developed land is defined as either of the following:

- Land with any permanent structure (building or car park); or
- Land with any impervious or semi-impervious surfaces (paved or unpaved car parks).

'Previously developed land' is land that is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure. 'Curtilage' is defined as the enclosed area immediately surrounding a building or dwelling including yards and paved surfaces.

The definition excludes:

- Land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures; and
- Land that was previously developed but where the remains of the permanent structure or fixed surfaces have blended into the landscape in the process of time (to the extent that it can reasonably be considered as part of the natural surroundings).

Approved urban edge

An approved urban edge is defined as (DEADP, 2005):

"A defined line drawn around an urban area as a growth boundary, i.e. the outer limit of urban areas. The urban edge marks the transition between rural and urban land use, i.e. generally between urban areas where full municipal services are provided to land uses other than agriculture and the rural, predominantly agricultural, conservation and nature areas. Urban edges are intended to include an adequate supply of land that can be efficiently provided with urban services (roads, sewers, water, storm water systems and streetlights) to accommodate the expected growth of the urban area for a defined period. By providing land for urban uses within the urban edge (growth boundary), the rural area can be protected from urban sprawl."

To determine the alignment and status of an urban edge within a municipality, the project team may need to contact the relevant planning authority and seek applicable documentation which identifies this boundary.

BACKGROUND

Redevelopment of previously built-upon or reclaimed sites will not only reduce the burden on previously undeveloped sites and greenfield space, but can also provide investment and regeneration in previously defunct industrial and landfill sites. This in turn can help create socially and environmentally sustainable communities.

Development pressure and urban sprawl are key threats to sensitive and threatened ecosystems and natural resources identified by the South African State of the Environment Report. Reusing previously developed land is a significant method of reducing the need to clear undeveloped land for construction of new buildings, and building within the urban edge is vitally important in preventing urban sprawl and the associated impacts on the environment.

Eco-2 Reuse of Land

POINTS
AVAILABLE**2**

REFERENCES & FURTHER INFORMATION

DEADP (2005) Provincial Urban Edge Guideline. Western Cape Department of Environmental Affairs and Development Planning: Directorate Integrated Environmental Management.

State of the Environment Report, Department of Environmental Affairs and Tourism, The Republic of South Africa

<http://soer.deat.gov.za/themes.aspx?m=492&amid=3444>

Eco-3 Reclaimed Contaminated LandPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise developments that reclaim contaminated land that otherwise would not have been developed.

CREDIT CRITERIA

Two points are awarded where:

- The site was contaminated at the time of purchase;
- AND
- The developer has undertaken full remedial steps to decontaminate the site prior to construction, in accordance with the National and Provincial legislation and standards.

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.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
<ol style="list-style-type: none"> 1. Extract(s) from Site Contamination Survey Report 	<ol style="list-style-type: none"> 1. Extract(s) from Site Contamination Survey Report
Where credit claimed 'Not Applicable' (refurb/extension only):	Where credit claimed 'Not Applicable' (refurb/extension only):
<ol style="list-style-type: none"> 2. Short report 	<ol style="list-style-type: none"> 2. Short report

Extract(s) from Site Contamination Survey Report prepared by a suitably qualified environmental scientist that:

- Describes the location of the site, the scope of the survey and the methodologies used or contaminants tested for;

Where no contamination identified:

- Confirming that no presence of contamination (regardless of extent, concentration, toxicity or otherwise) requiring remediation as determined by the relevant national, provincial or local authorities, was identified on the site;

Where contamination identified:

- Identifying the type and extent of contamination on the site;

Eco-3 Reclaimed Contaminated Land

POINTS
AVAILABLE **2**

- Outlining all available decontamination options, and proposing the remediation strategy where required;
- Where encapsulation recommended, clearly identifying, with robust and valid justifications, that no other remediation options exist for this site, thus encapsulation represents a reliable method to ensure no further propagation of the contamination.
- Describing the remediation strategy used;
- Confirming that the site has been decontaminated in accordance with the National and Provincial legislation and standards applicable to the contamination type;

Short report prepared by a relevant project team member confirming that the development is a refurbishment or building extension, with reference to 'Site documentation' provided in the 'General' section of the submission.

ADDITIONAL GUIDANCE

Contamination is defined in the National Environmental Management: Waste Act as: the presence in or under any land, site, buildings or structures of a substance or micro-organism above the concentration which is normally present in or under that land which substances directly or indirectly affect or may affect the quality of soil or the environment adversely. Existing building contamination is addressed in credit IEQ-11 Hazardous Materials while this credit deals with reclaimed contaminated land only.

It is noted that minor local contamination will occur on most previously used sites and such minor decontamination is not addressed by this credit. For the purpose of this credit, existing contamination must be 'significant'. This means that there must be substantial recommendations for containment and/or removal in the site contamination report.

Encapsulation is only an acceptable form of remediation if there are technically no other remediation options.

Remediation of the environment refers to the clean-up or making safe of a site or water body that is contaminated by toxic substances, whether they are natural or man-made.

Treatment as defined in the National Environmental Management: Waste Act means any method, technique or process that is designed to change the physical, biological or chemical character or composition of a waste, or to remove, separate, concentrate or recover a hazardous or toxic component of a waste or to destroy or reduce the toxicity of the waste in order to minimise the impact of the waste on the environment.

To be deemed no longer contaminated, the site must meet the regulated levels deemed suitable by the relevant competent authority. The environmental auditor or waste management control officer who certifies that the site has been duly decontaminated must meet the requirements of standards set at National, Provincial and local level.

Please note the contamination resulting from this development (e.g. with asbestos from demolition of the existing buildings) cannot contribute to this credit.

The statement 'prior to construction' as stated in the Credit Criteria refers to construction of actual building structures, not to the beginning of any construction works on the project (e.g. land clearing). Therefore, if remediation occurs during earthworks or any other stages during the construction phase of a project prior to the building of any structure, it is still considered as 'prior to construction'.

The submission must clearly demonstrate that:

Eco-3 Reclaimed Contaminated Land

POINTS
AVAILABLE **2**

- The site was designated as significantly contaminated at the time of purchase, where 'significant contamination' is defined as any contamination (regardless of extent, concentration, toxicity or otherwise) requiring remediation as determined by the relevant national, provincial or local authorities;
- The site was correctly and appropriately decontaminated prior to the beginning of the construction phase of the project in accordance with the relevant National and Provincial legislation and standards, including but not limited to the National Environmental Management: Waste Act (2008); and
- As a result of decontamination, the site was certified as uncontaminated and satisfactory for use.

BACKGROUND

Numerous sites throughout South Africa are affected by contamination, caused by petrochemical, manufacturing, military, urban, agricultural and mining activities.

Many of these sites are suitable for development following the correct treatment and remediation measures. The development of contaminated sites not only brings back into use a redundant, formerly developed land but also makes safe land that would otherwise be considered unhealthy for human occupation and a danger to the local natural environment. The treatment and remediation of contaminated sites for reuse also limits the demand for undeveloped sites that may be of ecological importance.

REFERENCES & FURTHER INFORMATION

National Environmental Management: Waste Act,
2008. <http://www.info.gov.za/view/DownloadFileAction?id=97351>

Eco-4 Change of Ecological ValuePOINTS
AVAILABLE**4****AIM OF CREDIT**

To encourage and recognise developments that maintain or enhance the ecological value of their site.

CREDIT CRITERIA

Up to four points are awarded where:

- The outcome of the ecological assessment of the site indicates that;
 - For greenfield sites, the site has no threatened or vulnerable species or sensitive ecological units;
- OR
- For reused (i.e. brownfield) sites, threatened or vulnerable species or sensitive ecological units are to be adequately protected if present.

AND

- There is no net reduction of native vegetation (where present);

AND

- There is no change in sensitivity class through transformation of, or reduction in extent of, threatened vegetation types;

AND

- The ecological value of the site is either not diminished, or is enhanced beyond its previously existing state.

The points awarded are determined using the Green Star SA Public & Education Building v1 Change of Ecological Value Calculator.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. Extract(s) from Ecologist report 4. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. Calculator extract 3. Extract(s) from Ecologist report 4. As Built drawing(s)
Additionally for reused sites where threatened or vulnerable species are present:	Additionally for reused sites where threatened or vulnerable species are present:
<ol style="list-style-type: none"> 5. Endangered Species Protection Plan 	<ol style="list-style-type: none"> 5. Endangered Species Protection Plan

Eco-4 Change of Ecological ValuePOINTS
AVAILABLE**4**

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by;

- Clearly identifying all land types present on the site at time of purchase and indicating the area they occupy, with reference to 'Site documentation' provided in the 'General' section of the submission;
- Clearly identifying all land types on the site and indicating the area they occupy for the proposed/as built cases, with reference to supporting documentation.
- Clearly identifying the inputs to the Change of Ecological Value Calculator based on extract(s) of ecologists report.

Calculator extract from the Green Star SA Public & Education Building v1 Change of Ecological Value Calculator that clearly demonstrates the inputs used, consistent with supporting documentation, and the resulting calculator output.

Extract(s) from Ecologists report prepared by a suitably qualified registered ecologist that includes:

- Nominating the bioregion and vegetation type of the site and describing land types, with corresponding areas, in the 'before' and 'after' condition of the site (as input into the Calculator);
- Justifying the selection of a brownfield site and selecting the urban area 'vegetation type' (where applicable);
- Confirming or refuting the presence of threatened or vulnerable species on the site;
- Where project claims to create land types with ecological value of 25 or greater, confirming ecosystem viability by demonstrating that measures are in place to ensure installed landscape will function as intended, including but not limited to:
 - Maintenance requirements;
 - Irrigation requirements and schedules; and,
 - Any temporary physical interventions (e.g. fencing);

Tender / As Built drawing(s) clearly identifying all land types present on the site in accordance with the Change of Ecological Value Calculator and indicating the area they occupy.

Endangered Species Protection Plan prepared by a suitably qualified registered ecologist for protecting the existing threatened or vulnerable species that includes:

- Identifies the threatened or vulnerable species present on the site;
- Identifies the conditions necessary for the thriving of these species; and
- Outlines the plan for protecting these species.

ADDITIONAL GUIDANCE

The inputs used for the Change of Ecological Value Calculator must be justified by supporting documentation and used consistently throughout the submission, wherever relevant.

The previously existing state is defined as the state at the time of site purchase.

Eco-4 Change of Ecological Value

POINTS
AVAILABLE

4

To achieve more than one point in the Calculator, it is expected that the project team will need to substantially enhance the site's ecological value. It is also anticipated that in most cases, initiatives that enhance the site's ecological value will contribute towards other Green Star SA credits.

The region where the project is to be located must be nominated in the documentation provided.

Where threatened species are present on the site of a refurbishment project, points can be achieved only if it is clearly demonstrated that those species are adequately demarcated and protected from disturbance and deterioration.

The project team can increase the number of points awarded by substantially enhancing the ecological value of the site in the following ways:

- Most importantly do not reduce the area of existing indigenous vegetation and wetland areas;
- Rehabilitate or create wetland or riparian areas;
- Set aside an area and provide management plans to regenerate indigenous habitat on site;
- On brownfield sites replace impermeable surfaces, bare ground and weed infested areas with either indigenous landscaping or indigenous plantation forests or add wetland area;
- Include a roof garden planted with indigenous vegetation; and
- Include a vertical garden, preferably using indigenous plant species.

Generally aim to increase the ratio of regenerated indigenous vegetation and wetland cover on site compared to that of the building and paved footprint.

Where the project submission claims to create land types with ecological value of 25 or greater in accordance with Table Eco-4.1 in the Additional Guidance, e.g. a wetland, more than one point will only be awarded if it has been clearly demonstrated that the proposed ecosystems will function as intended by the design.

Non-permanent landscape, such as potted plants, planter boxes, or other non-insitu landscape features, which can be removed or relocated, are not considered part of the 'site' and are therefore not within the scope of the Eco-4 credit. The area of, and ecological contribution to, the site for such non-permanent landscape are to be excluded from calculations to demonstrate compliance with the Credit Criteria.

CHANGE OF ECOLOGICAL VALUE CALCULATOR GUIDE

The Change of Ecological Value Calculator compares the relative ecological value of land at the time of site purchase and after development.

The following information is required to use the Calculator:

- Whether the site contains threatened or vulnerable species;
- The bio-region in which the site is located;
- The vegetation type in which the site is located;
- The area of each different ecological land type on the site before development; and
- The area of each different ecological land type on the site after development.

Eco-4 Change of Ecological Value

POINTS
AVAILABLE

4

How the Calculator works

The Change of Ecological Value Calculator is used to assess the different types of vegetative and non-vegetative cover on a proposed development site using the following:

- The different ecological land types have been assigned relative Ecological Weightings by qualified ecologists for comparative purposes only (refer to information following for further advice);
- The area of each land type is multiplied by the Ecological Weighting, for the site both before and after development, to give an Ecological Score for each;
- For existing natural indigenous land types, wetlands and waterways the Ecological Score is multiplied by a Bioregion Reservation Importance Factor;
- Where the vegetation type is unknown ('Don't know' option selected), the opportunity to score points is severely diminished;
- For certain existing natural land types, wetlands and waterways/riparian zone the Ecological Score after development is limited and cannot exceed the before development score (this is based on the understanding that truly natural systems cannot be created in the relatively short term of a design implementation and therefore the existing natural land types cannot increase in extent);
- For a brownfield site with the 'Brownfield Site' vegetation type selected, the Ecological Weighting Score of certain man-made vegetated land types are multiplied by 2 (resulting in the doubling of the score) while certain indigenous natural vegetation land types are multiplied by 0 (resulting in a zero score – refer to information following for further advice);
- A total Ecological Score for the site both before and after development is determined by then adding the Ecological Scores for each land type;
- A comparative Ecological Diversity Index for the site before and after development is calculated by dividing the Total Ecological Score by the site area;
- The Change in Ecological Value is calculated by subtracting the Ecological Diversity Index (before) from the Ecological Diversity Index (after); and
- Points are then awarded based on the Change in Ecological Value achieved.

Except for the selection from the drop down lists and the data entered into the 'Before' and 'After' columns, the scores and final points are calculated automatically. There are many national and provincial threatened species and ecosystems. The presence or absence on site of either must be verified by a suitably qualified and registered ecologist.

Weightings for greenfield versus brownfield sites

The Change of Ecological Value Calculator is structured in a way so as to acknowledge the stark difference in baseline ecological value between an undeveloped greenfield site and a previously developed brownfield site.

On a greenfield site the ecological value is predominantly dictated by the climate, geology & soils and the living systems that inhabit it. Where the site is cultivated, the agricultural management practices will affect the ecological value. A greenfield site is located within a much larger regional area of vegetated land types.

The ecological value of a brownfield site is predominantly dictated by the extent of hard surface land types and disturbance through human activities on and surrounding the site. A brownfield site is located within an urban area with little to no ecological habitat.

Due to the much higher land cost in urban areas, the doubling of the weighting on brownfield sites for man-made vegetated land types encourages the project team to consider enhancing

Eco-4 Change of Ecological Value

POINTS
AVAILABLE **4**

the ecological value of the site despite the limited area that can viably be allocated to vegetated or wetland land types.

Since the brownfield site is isolated by urban development from the regional natural and agricultural landscape, areas of regenerated indigenous habitats cannot be integrated with broader natural landscape and are unlikely to be self sustaining. They are therefore zero weighted.

Using the Change of Ecological Value Calculator

This involves four steps:

1. Determining if the site is a greenfield or brownfield site;
2. Where the site is a greenfield site, determining the bioregion and vegetation type in which the site occurs;
3. Determining whether rare, threatened or vulnerable flora or fauna occur on site ; and
4. Entering the land type data to determine the Ecological Diversity Index of the site 'Before' and 'After' design.

How to select a brownfield site

A brownfield site is one that has been previously developed and typically occurs within a fully developed urban environment. It could include existing structures that may be derelict. It can include sites where previous structures have been demolished and where the site is in a neglected condition. It may or may not be contaminated. A brownfield site will be separated on all sides by fully developed sites, covered by buildings and paved surfaces, either immediately adjacent to it or on the opposite side of the street. The surrounding developed sites essentially isolate the site from the regional open space system or any large defined open space.

Where the site is determined to be a brownfield site then:

1. Using the Change of Ecological Value Calculator sheet answer the first question 'Does the site contain any rare, threatened or vulnerable flora or fauna that are not adequately protected?', answer 'Y' or 'N'.
2. If the answer is 'Y' no points are awarded and no further input is required for the calculator.
3. If the answer is 'No' then select the 'Urban Area and Unallocated' option from the bioregion type.
4. The 'Brownfield Site' option must then be selected from the list of vegetation types.

On a brownfield site the ecological value of non natural land types are doubled while the indigenous natural land types have zero values. This increases the reward for enhancing the ecological value in urban areas where there was little to no ecological value to start with.

Determine the bioregion and vegetation types

To acknowledge that biodiversity importance varies across different regions of South Africa, a Bioregion Reservation Importance Factor has been included in the Change in Ecological Value Credit Calculator. Using a Bioregion Reservation Importance Factor results in an increased Ecological Score being given to the indigenous vegetation, wetlands and waterways in areas where the vegetation is less abundant and ecosystems are threatened.

The ecological weightings allocated to the calculator are based on the IUCN Red Data categories used to describe the conservation status of the vegetation types in The vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006). These categories have been assigned a numerical rating between 0.25 and 2.

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Where the vegetation type is unknown, the 'Don't know' option can be selected; however the ecological weightings of this option are punitive.

In all scenarios other than the brownfield scenario, the site is considered to be a greenfield site and the ecological weightings of the land types are influenced by the ecosystem status/sensitivity of the vegetation type in which the site occurs.

The most recent atlas of vegetation types in South Africa documented in Vegetation map of South Africa, Lesotho and Swaziland 1:1 000 000 scale sheet maps is referred to in the calculator. The ecosystem status of each vegetation type is provided in the book supporting the vegetation maps. Four categories of ecosystem status are used:

- Critically Endangered (CE),
- Endangered (EN);
- Vulnerable (VU); and
- Least Threatened (LT).

Where:

Sensitivity Category	Importance Factor
CE	2
EN	1
VU	0.5
LT	0.25

Table Eco-4.1: *Bioregion importance factors*

To determine the relevant bioregion and vegetation type for the site the project team can either obtain a copy of the Vegetation map of South Africa, Lesotho and Swaziland 1:1 000 000 scale sheet maps or consult a suitably qualified registered ecologist. The vegetation maps are available for purchase from the SANBI bookshop in Pretoria and the Botanical Society bookshop at Kirstenbosch National Botanical Garden in Cape Town. Reference must be made to:

Mucina, L., Rutherford, M.C. & Powrie, L.W. (eds) 2005. **Vegetation map of South Africa, Lesotho and Swaziland**, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria.

Establish the presence of rare, threatened or vulnerable flora or fauna

The presence of rare, threatened or vulnerable flora or fauna on the site must be determined by a suitably qualified registered ecologist. If the answer is positive no points will be awarded. Select the 'Yes' option from the first drop down list adjacent to the question 'Does the site contain any protected, rare, threatened or vulnerable flora or fauna?'. No further input is required in the calculator.

Where there is no protected, rare, threatened or vulnerable flora or fauna on site, continue to use the calculator to determine the change in the Ecological Diversity Index as discussed in the following text.

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Land Type and Ecological Diversity Index

The instructions below will enable the project team to enter the 'Before' and 'After' land type data and complete the Change of Ecological Value Calculator. The Calculator determines the number of points achieved based on the following:

- The area (m²) entered into one or more of the land types in the 'Before' column;
- The area (m²) entered into one or more of the land types in the 'After' column based on the project design;
- The default ecological value of each land type;
- Whether the site is a brownfield or greenfield site; and
- The ecosystem status of the selected vegetation type.

The project team needs to define the land types and their extent for the entire area of the site before any construction or clearing activities take place and complete the 'Before' column of the calculator according to one or more of the land types in Table Eco 4.

The system of ecological weightings to fulfil this requirement was established in consultation with local ecologists to reflect South African conditions.

Land Type	Ecological Value
Building	0
Impermeable/concreted Area	0
Bare Ground	1
Weed Infestations	2
Exotic Garden	5
Indigenous Garden	10
Indigenous Roof Garden	10
Exotic Grazing	5
Existing Natural Grazing*	25
Crop Farming	5
Existing Natural Waterway/Riparian Zone*	75
Existing Natural Wetland*	100
Rehabilitation/Creation of Wetland/Riparian	50
Exotic Plantation Forest	5
Indigenous Plantation Forest	20
Regenerated Indigenous Habitat(< 10 years old)*	50
Indigenous Habitat (> 10 years old)*	75
Indigenous Habitat (> 20 years old)*	100

Items with an asterisk * are affected by the ecosystem status weighting of the vegetation type.

Table Eco-4.2: Relative ecological weightings for different land types

Permeable pavers are classified as 'bare ground' for the purposes of this credit. Gravel must be inputted as 'bare ground'. Traditional water features with underlying impermeable brick or concrete structures are classified as 'impermeable/concrete area' for the purposes of this credit. Lawn areas are classified as 'bare ground' for the purposes of this credit.

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The Calculator automatically adjusts and in specific circumstances overrides the default ecological value of each land type for both the 'Before' and 'After' columns based on the selected option under the bioregion and vegetation type lists.

Only the soil surface of roof gardens contributes towards recognition in this credit (i.e. in vertical or roof gardens only the amount of soil/substrate in which the plants are rooted is recognised, not the total area covered by the plants). For example, a project with a building area of 10,000 m² and a roof garden of 2,000 m² (soil planted area) comprising indigenous garden would be entered into the Calculator as: building area of 8,000 m²; and an indigenous roof garden area of 2,000 m².

Vertical gardens are to be included as follows:

- Only outdoor vertical gardens can be included in this Calculator;
- Only the soil/substrate area of the vertical garden can count;
- The Ecological Land Type is determined by the associated vegetation; and
- The substrate area of the vertical garden can offset impervious horizontal areas at the ratio of 2-to-1 (e.g. two square meters of a vertical garden offsets one square meter of pavement). The area of pavement offset by the vertical garden must be added to either the Exotic or Indigenous Garden land type depending on the plant species used.

Landscape enclosed within the building such as enclosed atria gardens, vertical gardens or water features, are deemed not to serve the full ecological function as equivalent external landscape within the scope of this credit. This is due to the disconnection of enclosed landscapes to broader ecosystems external to the building, limiting the contribution to biodiversity. Such areas are to be excluded from calculations to demonstrate compliance with the Credit Criteria.

The table below provides the accepted description of each land type. It is acknowledged that in certain instances a design may include a land type that does not fit neatly into one of these descriptions. In these instances the project team needs to provide a motivation for using either one land type or dividing the area across two or more of the specified land types.

Land Type	Description
Building	All built structures with a roof or cover either fully or partially enclosed.
Impermeable/concreted Area	All horizontal surfaces in contact with the soil which are largely impervious to water infiltration either of natural or man-made materials.
Bare Ground	Soil that is not covered by either impermeable or vegetative material. Lawns and permeable pavers are included in this type.
Weed Infestations	Soil that is predominantly covered by plants considered to be weeds or invasive species.
Exotic Garden	Landscaped areas comprised predominantly of an equal mix in area of exotic plant species: trees, shrubs, ground covers, perennials, grasses; with few if any indigenous species.
Indigenous Garden	Landscape areas comprised of an equal mix in area of indigenous preferably locally occurring plant species: trees, shrubs, ground covers, perennials, grasses. Landscapes dominated by mowed lawn areas even if comprised of indigenous grass species would be considered to be Exotic Gardens.
Indigenous Roof Garden	As described in the Indigenous Garden but occurring in planters or soil substrate on the roof of the building.
Exotic Grazing	Land that has either specifically been cultivated or has been invaded by

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		exotic grasses and is used for grazing of domesticated animals.
Existing Natural Grazing*		Land that has not been cultivated and where the vegetation is used for grazing of domesticated animals.
Crop Farming		Land that is being or has been cultivated in the last ten years.
Existing Natural Waterway/Riparian Zone*		Waterways that have naturally formed along the drainage line in a catchment area and are largely unmodified by man. This includes the vegetation associated with the waterway and that would be described as the riparian zone.
Existing Natural Wetland*		As defined under Eco – Conditional Requirement.
Rehabilitation/Creation of Wetland/Riparian		The rehabilitation of once natural wetlands that have been degraded through past human activities, the creation of new man-made wetlands or riparian zones that provide some or all of the ecological functions typically provided by a natural wetland.
Exotic Plantation Forest		Land planted with exotic trees for commercial use or other purpose whether actively managed or neglected.
Indigenous Plantation Forest		Land planted with indigenous trees for commercial use or other purpose. Where the project team wishes to enhance the ecological value of the site using an indigenous plantation forest this must include a management plan that address the sustainable harvesting of trees and prevents the degradation of the forest over time.
Regenerated Indigenous Habitat(< 10 years old)*		Land that has naturally or through a managed process been repopulated by the diversity of plant species that make up the habitat associated with the vegetation type of that area and which includes mature plant specimens.
Indigenous Habitat (> 10 years old)*		Land that has naturally or through a managed process been repopulated over a period of not less than ten years by the diversity of plant species that make up the habitat associated with the vegetation type of that area and includes mature plant species or communities ten years or more in age.
Indigenous Habitat (> 20 years old)*		Land that has naturally or through a managed process been repopulated over a period of not less than twenty years by the diversity of plant species that make up the habitat associated with the vegetation type of that area and includes mature plant species or communities twenty years or more in age.

Table Eco-4.3: Description of land types

The Calculator checks that the cumulative area in the two columns match. Where the cumulative areas do not match no points are awarded. The Ecological Diversity Index for both the 'Before' and 'After' states is determined by dividing the overall ecological score by the cumulative value of each state.

The change in ecological diversity index is calculated by subtracting the value of the 'Before' state from that of the 'After' state. The result is used to look up the number of points to award based on the degree of change in the ecological diversity index. Up to 4 points can be awarded with each additional point requiring a proportionally larger change in the ecological diversity index.

The calculations will be executed automatically once the areas of the appropriate land types have been entered in both the 'Before' and 'After' columns.

Points awarded for enhancing ecological value on site

The project team can increase the number of points awarded by substantially enhancing the ecological value of the site in the following ways:

- Most importantly do not reduce the area of existing indigenous vegetation and wetland areas;

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- Rehabilitate or create wetland or riparian areas;
- Set aside an area and provide management plans to regenerate indigenous habitat on site;
- On brownfield sites replace impermeable surfaces, bare ground and weed infested areas with either indigenous landscaping or indigenous plantation forests or add wetland area;
- Include a roof garden planted with indigenous vegetation; and
- Include a vertical garden, preferably using indigenous plant species.

Generally aim to increase the ratio of regenerated indigenous vegetation and wetland cover on site compared that of the building and paved footprint.

BACKGROUND

South Africa is one of the world's most biologically diverse countries, with a rich and spectacular array of terrestrial, aquatic, and marine ecosystems. It occupies only 2% of the world's land surface, yet contains a disproportionately large share of global biodiversity, being home to nearly 10% of the planet's plant species and 7% of the reptile, bird, and mammal species.

The species richness per taxonomic group of the biomes of South Africa is indicated in the charts on the following pages.

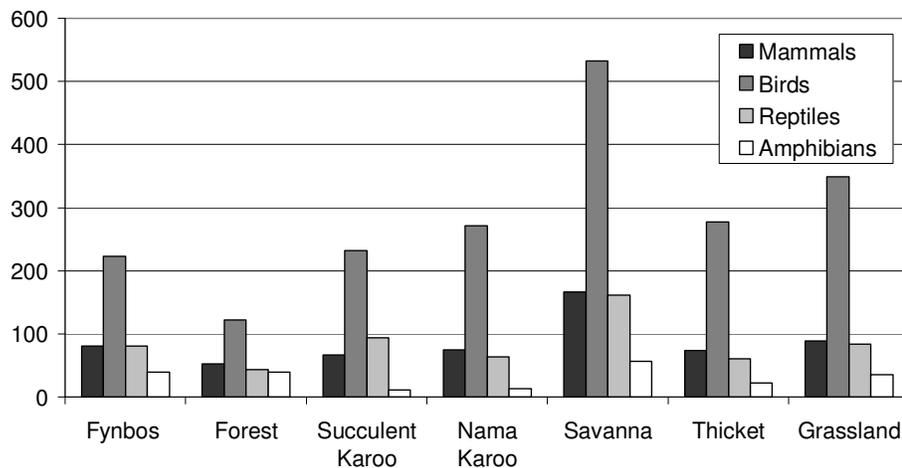


Figure Eco-4.1: Fauna species richness per taxonomic group of the biomes of South Africa

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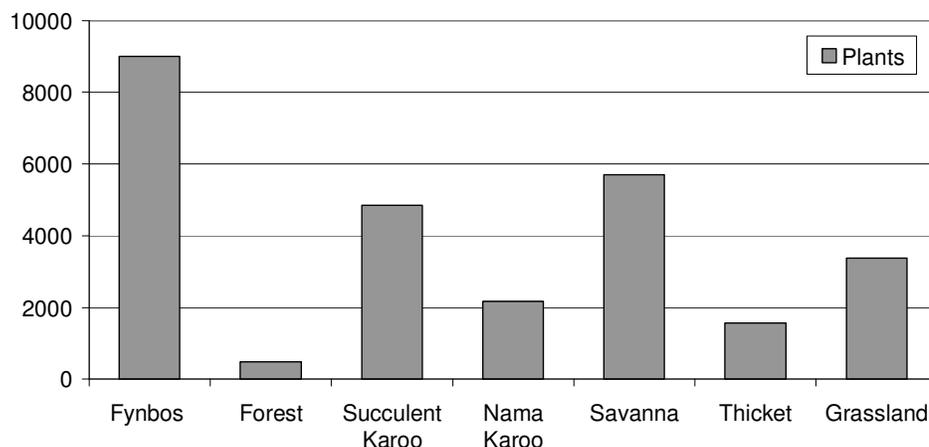


Figure Eco-4.2: Flora species richness per taxonomic group of the biomes of South Africa

Source: Endangered Wildlife Trust (2002). *The Biodiversity of South Africa 2002: Indicators, Trends and Human Impacts*. Struik, Cape Town. In Department of Environmental Affairs and Tourism (2005) (<http://soer.deat.gov.za/indicator.aspx?m=433>).

Changes to the landscape and indigenous habitat as a result of human activity and habitation have put many of these unique species at risk. Over the last 200 years many species of plants and animals have become extinct. The aim is to reward those sites that have a limited impact on the local ecology and/or enhance such sites through the re-introduction of indigenous species, thus helping to reduce the impact of building development on the local environment.

REFERENCES & FURTHER INFORMATION

Mucina, L. & Rutherford, M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. SANBI, Pretoria. 804 pages.

EA (2001), Draft National Framework for Assessing Indigenous Vegetation Condition, Environment South Africa.

Department of Environmental Affairs and Tourism (2005) South African National State of the Environment Report
<http://soer.deat.gov.za/frontpage.aspx?m=2>

Endangered Wildlife Trust (2002). *The Biodiversity of South Africa 2002: Indicators, Trends and Human Impacts*. Struik, Cape Town. In Department of Environmental Affairs and Tourism (2005)
<http://soer.deat.gov.za/indicator.aspx?m=433>

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AIM OF CREDIT

To reduce 'urban heat islands' to subsequently minimise impacts on microclimates, human and wildlife habitats.

CREDIT CRITERIA

Two points are available independently as follows:

One point is awarded where for the **site hardscape**:

- Any combination of the following strategies are used for 50% of the site hardscape:
 - Provide shade using vegetation;
 - Provide shade using structures with;
 - A solar reflectance index (SRI) of ≥ 29 .
 - OR
 - Are covered by solar energy systems.
 - Use hardscape materials with an SRI of ≥ 29 .
 - Use an open-grid pavement system (at least 50% pervious).

OR

- The total site hardscape represents 10% or less of the total landscape area.

Where the total building footprint represents greater than 80% of the total site area, this point is 'Not Applicable' and is excluded from the points available, used to calculate the Land Use & Ecology category score.

One point is awarded where for **roofs**:

- For a minimum of 75% of the total roof plan area, all roofing materials have a solar reflectance index (SRI) of:
 - ≥ 78 for low-sloped roofs ($\leq 10^\circ$ pitch)
- OR
- ≥ 29 for steep-sloped roofs ($> 10^\circ$ pitch).

OR

- For a minimum of 50% of the total roof plan area, a vegetated roof is installed.

OR

- For the building roof plan area, the project installs roofing meeting the SRI requirements and vegetated roof surfaces that, in combination, meet the following criteria:

$$\frac{\text{Roof plan area meeting minimum SRI}}{0.75} + \frac{\text{Plan area of vegetated roof}}{0.5} > \text{Total roof plan area}$$

Where the total building footprint represents 20% or less of the total site area, this point is 'Not Applicable' and is excluded from the points available, used to calculate the Land Use & Ecology category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation Where credit(s) claimed 'Not Applicable': <ol style="list-style-type: none"> 4. Short report 5. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Manufacturer product datasheet(s) Where credit(s) claimed 'Not Applicable': <ol style="list-style-type: none"> 4. Short report 5. As Built drawing(s)

Short report prepared by a relevant project team member that describes how the Credit Criteria have been met by;

- Describing what strategies have been implemented;
- Demonstrating that the sum of the qualifying area meets the Credit Criteria requirements, with reference to the supporting documentation;
- Where SRI compliant hardscape or roofing, or open-grid pavement system, references to tender documentation (Design) or manufacturer product datasheets (As Built);

Additionally where shade by vegetation claimed:

- Solar shade modelling results or calculations in accordance with the Additional Guidance, justifying the area claimed as shaded by vegetation and clear assumptions (where necessary) of vegetation size.

Where point(s) claimed 'Not Applicable':

- Demonstrating through calculations that the credit(s) are 'Not Applicable', with reference to supporting documentation.

Tender / As Built drawing(s) marked up to clearly demonstrate:

- All hardscape, landscape and building footprint areas, indicating extents of shading provided by vegetation or structures (where applicable);
- All roof areas, identifying roof types and extents (where applicable).

Extract(s) from tender documentation clearly demonstrating a contractual requirement for the application of the hardscape, landscape and roof initiatives as referenced in the short report.

Manufacturer product datasheet(s) for each nominated product or material, clearly demonstrating:

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- The solar reflectance index values for the product/materials and the applicable standard tested to (where applicable);
- The pervious percentage for open-grid pavement systems (where applicable).

ADDITIONAL GUIDANCE

Strategies for mitigating heat island effect include using materials with higher solar reflectance properties in the site and roof design, providing shaded areas, and reducing hardscape surfaces. Note that each surface may only be counted once, even if it meets multiple criteria. For example, a 10 square metre area of paving with compliant SRI value, 60% pervious and shaded only counts as 10 square metres.

Hardscape surfacing refers to non-roof hard surfaces: total site area less building footprints and vegetated areas (i.e. softscape). Please refer to the definitions provided in the glossary.

Shading

Landscape features such as trees, large shrubs and vines can reduce heat islands by shading buildings and pavements from solar radiation and cooling the air through evapotranspiration. Trellises and other exterior structures can support vegetation to shade parking lots, walkways and plazas. Deciduous trees allow solar heat gain during winter months while providing shade during the hot summer months. Newly installed landscape features must provide the desired level of shading within 5 years of being planted. These must be in place at the time of building occupancy.

Vegetation shading is calculated at 10h00, 12h00 and 15h00 on the summer solstice (21 December), with the arithmetic mean of these three values used as the effective shaded area;

Where tree planting is not possible, consider using architectural shading devices and structures to block direct sunlight. Shading from both architectural devices/structures and solar energy panels are calculated from a direct overhead aerial perspective. The architectural devices/structures must have an SRI of at least 29, but solar energy system installations, including photovoltaics, of any SRI value can contribute to shading hardscape and roof surfaces.

Solar reflectance for hardscape

Hardscape materials vary in their ability to reflect light and radiation. Dark paving materials generally have low reflectance and consequently low SRI values. Table Eco-5.1 provides the Solar Reflectance Index (SRI) for standard paving materials.

Material	Emissivity	Reflectance	SRI
Typical new grey concrete	0.9	0.35	35
Typical weathered grey concrete	0.9	0.20	19
Typical new white concrete	0.9	0.70	86
Typical weathered* white concrete	0.9	0.40	45
New asphalt	0.9	0.05	0
Weathered asphalt	0.9	0.10	6

*Reflectance of surfaces can be maintained with cleaning. Typical pressure washing of cementitious materials can restore reflectance close to original value. Weather values are based on no cleaning.

Table Eco-5.1 Solar Reflectance Index for standard paving materials (from LEED, 2009).

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Light coloured concrete weathers over time and inadequate maintenance will result in lower SRI values as time goes on. Where projects have existing grey concrete hardscapes that are older than one year, documentation must demonstrate that the weathered surfaces have been sufficiently cleaned and lightened to qualify for the default SRI values listed in Table Eco-5.

Micro-surfaces and coatings over tar paving can be used to meet the required SRI value for this credit. Coatings and integral colorants can be used in cement or insitu concrete slabs, as well as precast concrete parking surfaces to improve solar reflectance.

The solar reflectance index (SRI) is calculated from emissivity and solar reflectance values. Various testing methods are available for measuring emissivity and solar reflectance. Visible reflectance correlates to solar reflectance, but the two quantities are not equal because solar gain covers a wider range of wavelengths than visible light.

Emissivity is calculated according to ASTM E408 or ASTM C1371, and solar reflectance is calculated according to ASTM E903, ASTM E1918 or ASTM C1549.

Projects may use the SRI values for typical paving material in Table Eco-5.1 in lieu of obtaining specific SRI or emissivity and solar reflectance measurements for the listed materials

Reduce hardscape

Limiting the amount of impervious hardscape areas on the site can reduce heat island effect. For features such as parking lots, roads, and walkways, open-grid pavement systems that are at least 50% pervious and accommodate vegetation within the open cells can qualify for the credit.

Solar reflectance for roofing

A material that exhibits a visible reflectance usually has a lower solar reflectance. Table Eco-5.2 provides examples of SRI values for typical roof surfaces. These values are for reference only not for use as substitute for actual manufacturer's data.

SRI Values for Solar temperature	Solar Infrared reflectance	Solar Infrared emittance	Temperature rise	SRI
Grey EPDM	0.23	0.87	37.8°C	21
Grey asphalt shingle	0.22	0.91	37.2°C	22
Unpainted cement tile	0.25	0.9	36.1°C	25
White granular surface bitumen	0.26	0.92	35°C	28
Red clay tile	0.33	0.9	32.2°C	36
Light gravel on built-up roof	0.34	0.9	31.7°C	37
Aluminium coating	0.61	0.25	26.7°C	50
White coated gravel on built up roof	0.65	0.9	15.6°C	79
White coating on metal roof	0.67	0.85	15.6°C	82
White EPDM	0.69	0.87	13.9°C	84
White cement tile	0.73	0.9	11.7°C	90
White coating, 1 coat 8mils	0.8	0.91	14°C	100
PVC white	0.83	0.92	7.8°C	104

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White coating , 2coats 20mils	0.85	0.91	5°C	107
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Information source: Lawrence Berkley National Laboratory Cool Roofing Materials Database. These values are for reference only and are not for use as substitutes for actual manufacturer data.

Table Eco-5.2 Solar Reflectance Index (SRI) for typical roofing materials (from LEED, 2009)

The SRI of a product may be calculated if it is not available from suppliers, using the SRI calculator developed by the Lawrence Berkley National Laboratory, where solar reflectance and thermal emittance values are entered to calculate the SRI.

Roofing materials with lower solar reflectance levels than those listed in the Credit Criteria may be used if the weighted rooftop solar reflectance average meets the following criteria:

$$\frac{\text{Area roof meeting minimum SRI}}{\text{Total roof area}} \times \frac{\text{SRI of installed roof}}{\text{Required SRI}} \geq 75\%$$

Equation 1 (from LEED, 2009).

Vegetated Roofs

A vegetated green roof is a layered system that typically consists of vegetation in a layer of growing medium underlain by a drainage system, root barrier, waterproofing barrier and insulation. Potted plants do not qualify as a vegetated roof because they do not offer the same magnitude of environmental benefits.

Vegetated/green roofs can have a significantly positive environmental impact by replacing heat absorbing surfaces with various kinds of vegetation, which cool the air through evapotranspiration. Vegetated roofs also have some insulating benefits, retain stormwater, are aesthetically appealing, add biodiversity, act as a CO₂ sink and have a longer lifespan than conventional roofs, especially related to the waterproofing that is not directly exposed to expanding and contracting roofs due to the harsh temperature differences. Vegetated roofs can act as proper gardens and amenities, and require significant plant care and maintenance; others have plants that require little or no maintenance. Typically, all types of vegetated roofs require semi-annual inspection.

When designing green roofs, select indigenous or adapted plant species to reduce or eliminate the need for irrigation. Where irrigation is required, consider using greywater or harvested stormwater to reduce potable water use.

Methodology for calculating roof compliance

Once the roofing material's SRI value from the manufacturer has been obtained:

- Determine the total roof surface area of the project building (square metres).
- Determine the area of the roof covered by mechanical equipment, solar energy panels and accessories, and deduct these areas from the total roof surface area.
- Determine whether the areas of qualifying reflective and vegetated roofing are adequate to meet the credit requirements, using Equation 2. If more than one type of low slope or steep-slope material is used, determine the weighted rooftop SRI average and verify that 75% or more of the roof area complies with the credit requirements.

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$$\left(\frac{\text{Area of low-slope SRI material}}{78 \times \frac{0.75}{\text{SRI value}}} + \frac{\text{Area of Steep-slope SRI Material}}{29 \times \frac{0.75}{\text{SRI value}}} + \frac{\text{Vegetated roof area}}{0.5} \right) > \left(\text{Total roof area} - \text{deducted area} \right)$$

Equation 2 (from LEED, 2009)

BACKGROUND

The use of dark, non-reflective surfaces for parking, roofs, walkways and other hardscapes contributes to the heat island effect by absorbing the sun’s warmth, which then radiates into the surroundings. As a result, ambient temperatures in urban areas are artificially elevated, increasing cooling loads, electricity consumption and emissions of greenhouse gases and pollution. Heat islands are detrimental to site habitat, wildlife and animal migration corridors. Plants and animals are also sensitive to large fluctuations in daytime and night-time temperatures and may not thrive in areas affected by heat islands.

Causes of urban heat island effect

The urban heat island effect is a measurable increase in ambient urban air temperatures resulting in thermal gradient differences between developed and undeveloped areas. This effect forms ‘islands’ of higher temperatures in the landscape, and each city’s urban heat islands vary based on the city structure.

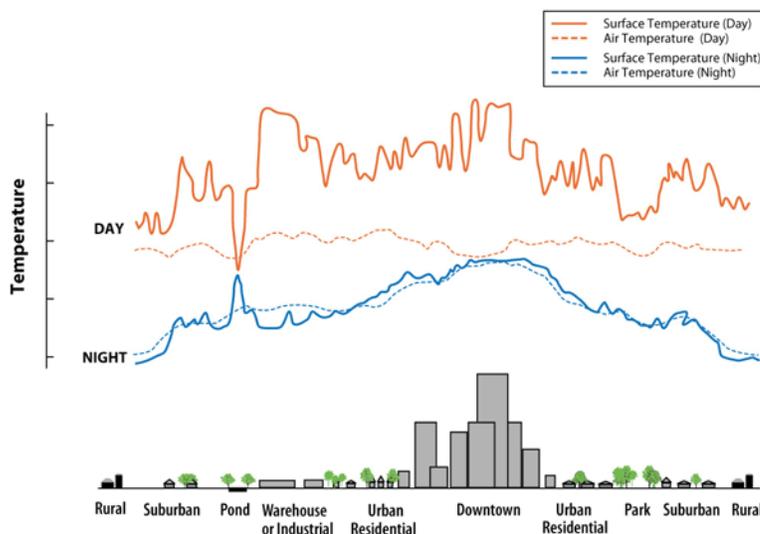


Figure Eco-6.1: Urban heat island effect (from U.S. Environmental Protection Agency, 2009)

The causes of urban heat island effect include the following:

- Buildings block surface heat from radiating into the cold night sky;
- Tall buildings provide multiple surfaces for the reflection and absorption of sunlight, increasing the efficiency urban areas are heated, and is called the ‘urban canyon effect’;
- Buildings block wind thereby inhibiting cooling by convection;

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- Materials commonly used in urban areas, such as concrete and asphalt, have significantly different thermal bulk properties and surface radiative properties than surrounding rural areas;
- Lack of vegetation in urban areas inhibits cooling by evapotranspiration;
- Land once permeable and moist becomes impermeable and dry with urban development;
- Waste heat from concentrated automobile and air conditioning use; and
- Many forms of pollution change the radiative properties of the atmosphere.

Impacts of urban heat island effect

Elevated temperature from urban heat islands, particularly during the summer, can affect a community's environment and quality of life. While some heat island impacts seem positive, such as lengthening the plant-growing season, most impacts are negative and include:

- Increased energy consumption: Higher temperatures in summer increase energy demand for cooling and add pressure to the electricity grid during peak periods of demand.
- Elevated emissions of air pollutants and greenhouse gases: Increasing energy demand generally results in greater emissions of air pollutants and greenhouse gas emissions from power plants. Higher air temperatures also promote the formation of ground-level ozone.
- Compromised human health and comfort: Warmer days and nights, along with higher air pollution levels, can contribute to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality.
- Impaired water quality: Hot pavement and rooftop surfaces transfer their excess heat to stormwater, which then drains into storm sewers and raises water temperatures as it is released into streams, rivers, ponds, and lakes. Rapid temperature changes can be stressful to aquatic ecosystems.

Economic issues

Roofs with high SRIs or vegetative roofs can often reduce the costs associated with the operation of HVAC systems. Vegetative roofs can also assist in stormwater retention, and in some cases reduce the on-site stormwater attenuation requirements. Cool roofs that reflect the sun's radiation could cost the same as conventional roofing systems although vegetative roofs have a higher initial capital outlay. According to a report by the EPA which surveyed 10 buildings in California and Florida, cool roofs save residents between 20% and 70% of their annual cooling energy costs.

Efforts to reduce heat islands of hardscape may translate into higher initial costs for additional landscaping, open grid paving or architectural shading devices. However these items have an acceptable payback when integrated into a systems approach to maximising energy savings. Higher reflectance of hardscape material may enable a project to provide less artificial lighting.

Definitions and descriptions

Solar reflectance, also called 'albedo', is the ability of a material to reflect (rather than absorb) energy emitted from the sun. Solar reflectance is measured on a scale from zero to one with values approaching one as reflectance increases. As the shade of a material darkens, its reflectance typically is reduced. However, since colour is not always an accurate indicator of solar reflectance, testing is recommended to correctly characterize the attribute.

Emissivity, also called 'thermal emittance', or is defined as the ability of a body to release heat. Similar to solar reflectance, thermal emittance is measured on a scale from zero to one,

Eco-5 Urban Heat Island

POINTS
AVAILABLE**2**

with a higher value implying a larger release of absorbed energy. However, materials exhibiting low emissivity can still remain relatively cool in sunlight if their solar reflectance is exceptionally high.

The solar reflectance index is essentially a combination of the two above characteristics. It is defined by the Cool Roof Rating Council (CRRC), and is calculated as 'the ratio of the reflected flux to the incident flux.' Essentially, it is the ability of a material to reject solar energy, and is expressed on a scale from 0 to 100.

REFERENCES & FURTHER INFORMATION

Intergovernmental Panel on Climate Change, Land-Surface Air Temperature
http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg1/052.htm#2221

Lawrence Berkeley National Laboratory, Heat Island Group
<http://heatisland.lbl.gov/>

LEED (2009), 'LEED Reference Guide for Green Building Design and Construction', U.S. Green Building Council.
<http://www.usgbc.org/DisplayPage.aspx?CategoryID=19>

U.S. Environmental Protection Agency (2009), Heat Island Effect
<http://www.epa.gov/heatisld/>

Cool Roofs
<http://www.coolroofs.org>

ENERGY STAR® Roofing Products
<http://www.energystar.gov>

LBNL SRI Calculator
<http://coolcolors.lbl.gov/assets/docs/SRI%20Calculator/SRI-calc10.xls>

Eco-6 Outdoor Communal Facilities

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool

Eco-7 Non-Invasive and Indigenous Plants Island

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA – Public & Education Building v1 tool

Eco-8 Community FacilitiesPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise integrated planning and shared land use in developments through the provision of on-site outdoor facilities for use by the local community.

CREDIT CRITERIA

One point is awarded where:

- At least one of the following 'Community Facilities' are provided within the project for at least 5% (or 50m² whichever is the greater) of the site area:
 - Playground area;
 - Open landscaped area for active play (minimum area 200m²);
 - Outdoor gym / exercise;
 - Community market;
 - Recycling depot;
 - Open piazza; or,
 - Community food garden.

AND

- The Community Facility can be freely accessed by members of the general public;

AND

- In the design/development of the Community Facility, potential users of the facilities (e.g. community groups or associations etc.) have been consulted and their criteria have informed the brief.

AND

- They met formally to consider feedback according to the consultation plan.

Where the project is a refurbishment and the building footprint (excluding hardscaping and external car-parking) is greater than 95% of the site area, or where the total site area less the existing building footprint is less than 50m², this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Land Use and Ecology category score.

Eco-8 Community FacilitiesPOINTS
AVAILABLE**1**

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building V1 Design	Green Star SA – Public & Education Building V1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extracts from tender documentation 3. Extract(s) from Consultation Report 	<ol style="list-style-type: none"> 1. Short report 2. As Built drawing(s) 3. Extract(s) from Consultation Report
Where credit claimed 'Not Applicable':	Where credit claimed 'Not Applicable':
<ol style="list-style-type: none"> 4. Short report 	<ol style="list-style-type: none"> 4. Short report

Short report prepared by suitably qualified professional that describes how the Credit Criteria have been met by:

- Detailing the facility provided and how it meets the Credit Criteria;
- Detailing the free public access strategies for the facility/facilities.

Where credit claimed 'Not Applicable':

- Demonstrating through calculations that the credit is 'Not Applicable', referencing site plans where necessary.

Extract(s) from tender documentation clearing demonstrating the contractual requirement for:

- The type, size and location of the community facility/facilities referenced in the short report;
- The provision of the features of each facility and highlighting the appropriate signage as necessary;
- The provision of the free public access points.

Extract(s) from Consultation Report with community, prepared by a suitably qualified professional containing;

- The details of community members consulted;
- A summary of feedback received;
- How the feedback was taken into account in the design of the shared community facilities; and,

Eco-8 Community Facilities

POINTS
AVAILABLE

1

- Minutes from at least two meetings held with community members where ideas for the community facility were raised and feedback given by the project team.

As Built drawing(s) showing the size and location of the community facility/facilities as well as public access points. The location of signage indicating the community facility and free public access must be clearly shown.

ADDITIONAL GUIDANCE

Playground area

Includes such items as climbing apparatuses, slides, balance beams, ropes, swings etc. Playground areas are to be exclusively for play. The playgrounds must be designed to accommodate children aged 0-14. Playground should comply with South African Standards: SANS 51176 SERIES: Playground equipment and surfacing.

Open landscaped areas for active play

Includes open areas for group and/or individual play such as areas for running, jumping, chasing, ball games, sporting activities, and areas for wheeled toys such as bike pathways. Landscaped areas for active play should be a minimum of 200m².

Outdoor gym/exercise

An outdoor gym must include, as a minimum, three separate apparatus for exercise. Instructions must be signposted for all the exercise facilities.

Community market

Community market should include a minimum of 4 demarcated and numbered trading bays.

Recycling depot

Include as part of the project a recycling depot that is available to members of the general public, dedicated to the collection, separation and storage of materials for recycling. The recycled materials must include, at a minimum, 3 of the following waste streams: paper, cardboard, glass, plastic, compact fluorescent lights (CFLs) and metals.

It is possible for projects to combine this facility with the Mat-1 Recycling Waste Storage facility. However, should the facilities be combined, the credit criteria of both credits must be achieved and the facility must have an area that meets Mat-1 requirements plus a minimum of 50m² as required in Eco 8. At a minimum, the 50m² area must be accessible to the public.

Open piazza

Include as part of the project a Piazza, which is a public square designed for members of the general public to gather and interact with each other. The piazza should include shaded seating areas, and can either be landscaped or paved.

Eco-8 Community Facilities

POINTS
AVAILABLE**1**

Community food garden

Signage should be in place explaining the communal nature of the facility, and how to use and maintain it appropriately. The signage is to be demonstrated in the Specification and evidence of the organizing body is to be provided.

BACKGROUND

As the pressure on land becomes greater, with increased land values and less accessibility to the general public as a consequence, especially in urban areas, so opportunities for shared land use for local communities become more important. Projects catering for public assembly type activities offer a unique opportunity to promote the concept of shared land use by providing such community facilities thus encouraging neighbourhoods with real character and a sense of place (CABE Space, 2005).

There is a growing body of evidence that demonstrates how communal green spaces can offer lasting economic, social, cultural and environmental benefits. These benefits include increasing the value of homes; improving the image of an area and attracting investment; contributing to the protection of biodiversity; and promoting exercise and other activities beneficial to the health of residents (CABE Space, 2005). Outdoor community facilities are not only a good way to use the available space in a public building type development in the most efficient way, but can contribute significantly to the well being, and sense of community experienced by local residents. Access to outdoor public facilities allows people to get first hand exposure to the natural systems as well as providing access to these amenities by foot. The more amenities offered within the open spaces that transverse cities and the more continuously these are linked, the more people will use them.

In 2004, the Commission for Architecture and the Built Environment (CABE) Space published 'The Value of Public Space', a collation of research that highlighted a wide range of benefits that outdoor communal facilities can offer. The contributions included:

- A Merseyside study that showed how the presence of trees and green spaces can make places pleasantly cooler in summer and reduce surface water run-off;
- Findings showing that community gardens and urban farms increase social inclusion by providing opportunities for interaction; and
- Conclusions suggesting that providing multiple types of outdoor facilities can help to stimulate different kinds of activity in the shared space throughout the day. For example, it is important to provide many different activity zones within parks for both active and passive uses, in order to encourage use by as diverse a range of people as possible.

Design plays a large part in whether a space feels private, communal or public. The distinction between public and private can be indicated by boundaries, such as fences and walls; planting, such as hedges or trees; water features; changes in surface treatment; planting; or the design and orientation of buildings (CABE Space, 2005).

REFERENCES & FURTHER INFORMATION

Green Building Council of Australia. (2009) 'Technical Manual Green Star Public & Education Building version 1.

Commission for Architecture and the Built Environment (CABE) Space (2005), 'Start with the park', England. <http://www.cabe.org.uk>, accessed November, 2010.

Woolley, H. and Rose, S. (2004), 'The Value of Public Space: How High Quality Parks and Public Spaces Create Economic, Social and Environmental Value', Commission for Architecture and the Built Environment (CABE) Space.
<http://www.cabe.org.uk/default.aspx?contentitemid=475>.

Todeschini, F. & Dewar, D. (s.a). The Street as Pre-requisite Open Space: Current South African Settlement Practice and the Need for a Paradigm Shift Fabio, School of Architecture, Planning and Geomatics, University of Cape Town

Todeschini, F. & Dewar, D (2004) Chapter 5 in Rethinking Urban Transport After Modernism. Ashgate Publishing Company, Aldershot.

Swilling, M.(ed) Sustaining Cape Town: Imagining a livable city, Sun MeDIA, Stellenbosch: 2010

Fair Play for Children NGO, www.fairplayforchildren.org

Emissions

The credits in the Emissions Category target the environmental impacts of a development's emissions or substances emitted from the site (excluding greenhouse gas emissions which are dealt with in the Energy category). The Green Star SA rating tools target emissions including and relating to watercourse pollution, light pollution, ozone depletion and sewerage.

Traditionally in South Africa, stormwater has been transported separately from sewerage. Unlike sewerage it receives little, if any, treatment and is channelled as rapidly as possible from within urban areas to the nearest waterway, which has caused increased pollution to watercourses and risk of flooding. The necessity to deal with both the quantity and quality of runoff is now recognised, as well as benefits from capturing and recycling stormwater.

Light travelling up into the night sky is also seen as a form of pollution; it can disrupt the habits of migratory species, causing major impacts upon overall biodiversity. Light pollution might also disrupt biological rhythms and otherwise interfere with the behaviour of nocturnal animals and insects.

Substances such as Chlorofluorocarbons (CFCs) as well as Hydrochlorofluorocarbons (HCFCs), used as refrigerants and in the manufacture of insulation materials, deplete the ozone layer when emitted to atmosphere¹⁷. Long-term damage to the Earth's stratospheric ozone layer will expose living organisms to harmful radiation from the sun.

¹⁷ Chlorofluorocarbons, Ozone Hole Watch, <http://www.nasa.gov/About/Education/Ozone/cfc.html>

Emi-1 Refrigerant / Gaseous ODP

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

Emi-2 Refrigerant GWP

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

Emi-3 Refrigerant Leaks

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

Emi-4 Insulant ODP

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

AIM OF CREDIT

To encourage and recognise developments that minimise stormwater run-off to, and the pollution of, natural watercourses and wetlands.

CREDIT CRITERIA

Up to three points are awarded independently as follows:

One point is awarded where:

- The development does not increase (pre-development) peak stormwater flows for rainfall events of up to a 1-in-2 year storm;
AND
- The Total Suspended Solids (TSS) are reduced by 80% for the runoff volume resulting from the 1-in-2 year storm;
AND
- Litter, oil and grease are trapped at source.

One point is awarded where:

- The development does not increase (pre-development) peak stormwater flows for rainfall events of up to a 1-in-20 year storm;
AND
- Litter, oil and grease are trapped at source.

One point is awarded where:

- The runoff volume resulting from the 1 day rainfall, that is equalled or exceeded on average 3 times per year, is either captured and re-used on-site or infiltrated within the site;
AND
- Litter, oil and grease are trapped at source.

Emi-5 Watercourse PollutionPOINTS
AVAILABLE **3**

DOCUMENTATION REQUIREMENTS

Green Star SA – Design	Green Star SA – As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Tender drawing(s) 3. Extract(s) from tender documentation 4. Maintenance Plan(s) 	<ol style="list-style-type: none"> 1. Short report 2. As built drawing(s) 3. Maintenance Plan(s) 4. Extract(s) from Management Rules

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

Where the first point is claimed:

- Providing calculations of original peak stormwater flow based on pre-development site conditions;
- Providing calculations of projected peak stormwater flow based on proposed site conditions;
- Confirming that the development does not increase the peak stormwater flow for up to a 1-in-2 year storm;
- Clearly nominating the design guidelines/manuals used for the treatment system design and justification for applicability to the site, and describing the treatment system(s) for TSS reduction;
- Providing calculations of the runoff volume;
- Confirming the TSS reduction as required can be achieved and that the system is capable of achieving the treatment reduction for the runoff volume;
- Describing the system's features to trap litter, oil and grease at source; and,
- Describing the on-going maintenance for the attenuation and treatment facilities, with reference to the 'Maintenance Plan'.

Where the second point is claimed:

- Providing calculations of original peak stormwater flow based on pre-development site conditions;
- Providing calculations of projected peak stormwater flow based on proposed site conditions;
- Confirming that the development does not increase the peak stormwater flow for up to a 1-in-20 year storm;
- Describing the system's features to trap litter, oil and grease at source; and,

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

- Describing the on-going maintenance for the attenuation facility, with reference to the 'Maintenance Plan'.

Where the third point is claimed:

- Providing calculations demonstrating the design rainfall used;
- Providing calculations of the sizing of any stormwater storage systems (where applicable);
- Describing the infiltration areas and justification for any infiltration assumptions such as rates, slope and area over which infiltration occurs (where applicable);
- Describing the system's features to trap litter, oil and grease at source; and,
- Describing the on-going maintenance for the infiltration facility, with reference to the 'Maintenance Plan'.

Tender / As Built drawing(s) clearly demonstrating the stormwater systems included in the project design, including all landscaping stormwater mitigation initiatives.

Extract(s) from tender documentation where requirements for control and treatment of stormwater are stipulated.

Maintenance Plan(s) clearly describing the on-going maintenance requirements of the applicable infiltration, attenuation and/or treatment systems.

Extract(s) of Management Rules clearly demonstrating the commitment of the Management Entity to implement the maintenance plans for the infiltration, attenuation and/or treatment systems into the future.

ADDITIONAL GUIDANCE

Although the three credit points available in this credit can be targeted independently, achieving the Credit Criteria of one point may assist in achieving the Credit Criteria for the remaining credit points.

It must be evident that the Management Entity is committed to the maintenance of the infiltration, attenuation and/or treatment systems into the future. The Management Rules must clearly demonstrate the requirement for maintenance in accordance with the 'Maintenance Plan' for the infiltration, attenuation and/or treatment systems.

Pre-development site condition

For the purposes of peak stormwater flow calculation in Green Star SA, the 'pre-development' site condition is considered as the condition of the site in its natural state prior to any development on the site. For refurbishments or brownfield developments, the pre-development site condition is not the condition of the existing landscape and hardscape, but of the site prior to any development (i.e. greenfield condition).

Peak Flow Control

Where a system is designed to control the flows from the site for events up to both the 1-in-2 year and the 1-in-20 year storms, two or more outflow controls are likely to be required.

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

Consideration should also be made of what will happen when the design storm is exceeded (e.g. overland escape routes).

TSS reduction

For the purposes of Green Star SA, a stormwater management system that is designed, constructed and maintained to specific guidelines as deemed appropriate by the design team will be accepted to reduce TSS as outlined in those guidelines, based on existing field data. Guidelines should be selected to ensure relevance to the site's physical characteristics (e.g. climate, soil, vegetation, slope etc.). Recommended stormwater design guidelines/manuals include, but are not limited to;

- Georgia Stormwater Management Manual (2001);
- Municipal Stormwater Management 2nd Ed. (2003);
- Virginia Stormwater Management Handbook (Vol. 1 & 2) 1st Ed. (1999); and,
- Melbourne Water WSUD Engineering Procedures: Stormwater (2005).

Please see References & Further Information for full details.

Shared stormwater services

If an attenuation/retention pond or other strategy is shared between sites or projects it must be demonstrated how this provides sufficient attenuation/treatment and achieves the applicable credit criteria for the Green Star SA project and all other sites/projects linked to the same pond (i.e. the applicable Credit Criteria must be met for all sites served by the shared/district system). It is not required that Project Teams submit Credit Interpretation Requests (CIR) for this scenario.

Watercourses and wetlands - definitions

The following definitions of watercourses and wetlands from the National Water Act, 1998 (Act No. 36 of 1998) (NWA) are adopted by the GBCSA with regards to the Green Star SA rating tools:

Watercourses: The NWA includes wetlands and rivers into the definition of the term watercourse as follows:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and,
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.

A reference to a watercourse includes, where relevant, its bed and banks.

Wetlands: Defined as "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

Design Rainfall Depth

Daily rainfall data for locations across South Africa may be obtained from the South African Weather Service, where a site-specific record does not exist. A minimum of three complete years' data should be used, and ideally five years or more. The correct design rainfall depth should be calculated in accordance with the guidance provided below:

1) Obtain rainfall data

Daily rainfall data specific to the site (with justifications) should be sourced for a minimum of 3 complete years, however if longer records are obtainable, they should be used. For example, daily rainfall data obtained from 1st January 1999 to 31st December 2003 represents five (5) full years of data (i.e. $N = 5$)

2) Determine Relevant Daily Rank

The relevant daily rank can be determined by multiplying the number of years of data (i.e. N) by the desired annual frequency that the 1 day rainfall is equalled or exceeded per year. For the purposes of Green Star SA and this credit, this frequency is 3. Hence; *Relevant Daily Rank* = $3 \times N$ (e.g. $3 \times 5 = 15$)

3) Rank data

Using a data processing software package such as Microsoft Excel, the daily rainfall data obtained in Step 1 must be ranked based on daily rainfall from highest (i.e. heaviest rain event) to lowest (i.e. least intense rain event, or no rain) including the days where no rain was recorded. For this example, this is simulated below:

Original Data			Ranked Data	
Date	Rainfall (mm)	Rank	Date	Rainfall (mm)
01/01/1999	0	1	23/01/2003	205.5
02/01/1999	4	2	07/01/2003	198
03/01/1999	0	3	08/02/2000	102.9
04/01/1999	3.9	4	12/01/2000	80.1
05/01/1999	0	5	09/02/2000	75.5
06/01/1999	0	6	12/09/2001	73.1
07/01/1999	28.5	7	07/02/2000	52
08/01/1999	0	8	01/02/1999	50.6
09/01/1999	0	9	25/10/2001	46.2
10/01/1999	0	10	21/10/1999	40
11/01/1999	14.6	11	02/03/2000	36
12/01/1999	0	12	10/02/2000	35.6
13/01/1999	0	13	01/03/2000	34.2
14/01/1999	0	14	18/09/2000	32.1
15/01/1999	0	15	16/11/2001	31.8
16/01/1999	0	16	24/01/2002	31
17/01/1999	0	17	18/03/2003	30.9
...
...
26/12/2003	14	1821	23/12/2003	0
27/12/2003	0	1822	27/12/2003	0
28/12/2003	0	1823	28/12/2003	0
29/12/2003	0	1824	29/12/2003	0
30/12/2003	0	1825	30/12/2003	0
31/12/2003	0	1826	31/12/2003	0

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

4) *Determine design rainfall depth*

To determine the design rainfall depth to use in calculations to demonstrate compliance with the Credit Criteria, simply take the relevant daily rank (determined in Step 2) and count backwards from highest intensity rain event as ranked in the data set (i.e. the 15th ranked rain event). On the basis on the worked example, the rainfall depth to use is therefore **31.8mm**.

BACKGROUND

Stormwater in South Africa has traditionally been channelled away from sites as rapidly as possible to the nearest watercourse, wetland or coastline without much consideration for quality. The necessity to deal with both the quantity and quality of runoff is now recognised through the encouragement of groundwater recharge through infiltration, and for storage and reuse of runoff.

Stormwater quantity

From an ecosystem perspective it is the high frequency of smaller floods that cause the most cumulative damage. In its natural state, a landscape will absorb the rainfall from normal rainfall and minor storm events. The high surface area of the leaves of trees, shrubs and grasses holds a large percentage of a light rain shower before the rainfall even reaches the soil. Often this moisture on the leaves will evaporate before the next shower.

During heavier or longer rainfall events once the leaf's surfaces are saturated, the rainwater begins to soak into the soil. The amount of rainfall that will soak into the soil depends on how deep it is and its structure (clay to sandy). The water in the soil will be drawn up and lost through evaporation and evapotranspiration. The remaining water will continue to percolate downwards to recharge the water table or deeper still to recharge aquifers. The ground water, once it reaches an impermeable layer, will move laterally to re-emerge as a seep either on the hillside or adjacent to the water course where it slowly and continuously discharges into the watercourse. The vegetation along the watercourses which protects the soil against erosion has adapted to these conditions.

Only after a number of showers in close succession or a period of extended rainfall will the soil reach saturation point and excess rainfall move across the surface as runoff. The surface runoff is constantly dispersed and the energy dissipated by the vegetation cover until it reaches the watercourse or wetland. Damage to vegetation on the slopes and along the water course is usually limited and can recover between excessive storm events. In natural conditions it is normally only the infrequent large flood events that cause extensive damage to vegetation and soil. The vegetation recovers in the years between these events.

In developed areas the scenario changes. Rainfall is collected on impervious surfaces, roofs, roads and parking areas and immediately concentrated into stormwater pipes or surface channels. There is no vegetation to absorb the light showers, the surface is impermeable and there is no infiltration into the soil. Runoff is channeled to the nearest watercourse in a concentrated stream of high energy water. This means that every rainfall event results in a flood which results in damage to vegetation along the watercourse and soil erosion. Since every rainfall event results in a damaging flood within the watercourse there is no time for vegetation to recover and it is systematically removed and the exposed soil eroded. This

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

damage is evident for some distance below the storm water discharge point until the vegetation along the watercourse eventually dissipates the energy.

The result of frequent minor and major floods along the watercourse is excessive ongoing scouring of the base of the watercourse to form erosion gullies and deeply incised watercourses. The water table either side of the watercourse drops to the lower level of the watercourse and deprives the riparian vegetation along the banks of the necessary water which is then replaced by terrestrial vegetation. The deeper cross section of the channels with no vegetation to dissipate the energy of the storm water means that storm water is further accelerated and does more damage further downstream.

Stormwater quality

The contaminants in stormwater can be grouped according to their water quality impacts:

- **Oils, grease and surfactants:** Rubber from tyres and oil and grease washed from road surfaces, domestic and industrial sites, plus surfactants from detergents used for washing vehicles, materials or surfaces are common sources of toxic pollutants in stormwater.
- **Litter:** This includes organic waste matter, paper, cigarette buds, plastics, glass, metal and other packaging materials from paved areas in urban catchments.
- **Total Suspended solids:** Suspended solids have two main constituents: organic, primarily from sewage, and inorganic, primarily from surface runoff. Turbidity from suspended solids reduces light penetration in water, affecting the growth of aquatic plants. When silts and clays settle, they may smother bottom dwelling organisms and disrupt their habitats. Since metals, phosphorus and various organics are adsorbed and transported with these particles, sediment deposits may lead to a slow release of toxins and nutrients in the waterway.
- **Nutrients:** Potential sources of nutrients are:
 - Sewage overflows;
 - Industrial discharges;
 - Animal wastes;
 - Fertilisers;
 - Domestic detergents; and
 - Septic tank seepage.

Excessive amounts of nutrients, such as nitrogen and phosphorous, can promote rapid growth of aquatic plants, including toxic and non-toxic algae. This excessive growth and oxygen depletion can cause fish and aquatic organisms to die.

- **Oxygen demanding materials:** Sources of oxygen-demanding materials are biodegradable organic debris, such as decomposing food and garden wastes, and the organic material contained in sewerage. Biological and chemical oxygen-depleting substances can cause water-borne diseases and present serious health risks.
- **Micro-organisms:** Bacteria and viruses found in soil and decaying vegetation, and faecal bacteria from sewer overflows, septic tank seepage and animal waste, are common contaminants in stormwater after heavy rain. Pathogens and micro-organisms, including bacteria, viruses and faecal coliforms, cause water-borne diseases. These can present

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

serious health risks from cholera, typhoid, infectious hepatitis and a range of gastrointestinal diseases.

- **Toxic organics:** These include garden pesticides, industrial chemicals and landfill leachate. They may cause long-term ecological damage and threaten human health. Organochlorine pesticides, herbicides and insecticides can be accumulated in organisms and persist in the environment over long periods.
- **Toxic trace metals:** Industrial chemicals can enter stormwater from a number of sources including sewerage overflows, illegal dumping and accidental spillages. Dust from brake and clutch linings of motor vehicles coupled with waste from degrading roadways and water pipes can inject ammonia, hydrogen sulphide and heavy metals (mercury, cadmium, lead and zinc) into the stormwater system.

Effects of good stormwater design and treatment

Recent research and demonstration projects in the USA have shown that stormwater can be exploited in a cost effective and environmentally sensitive manner for new urban developments. A well-designed stormwater system will control peak flows and reduce a variety of contaminants. Designs that reduce TSS typically provide additional water quality benefits, which are less easy to quantify.

In this context:

- Water reclamation can reduce potable water demand considerably;
- Properly managed stormwater flows can prevent the increase in flood risk and watercourse erosion typically caused by urbanisation and provide important flow return to streams, offsetting the environmental impact of upstream water supply diversions and reducing the need for costly in-ground stormwater infrastructure;
- The enhanced use of natural drainage corridors and depressions can provide open space, landscaped and recreational areas and conservation benefits increasing the amenity of new urban developments (multiple use corridors); and
- Treatment of stormwater closer to source minimises uncontrolled discharge of water containing high suspended solids, nutrients and organic material.

Control and treatment of stormwater and surface runoff from developments can be achieved through a variety of technologies and strategies, including for example:

- **Petrol, oil and sediment arresters** can have different design and operating dynamics, ranging from plate separators, to vortex, swirl and dynamic separators. Such separators are often sited in car parks and other points of high traffic density;
- **Sand filters**, grassed swales and porous pavements, can be effective treatment techniques, especially in car parks, commercial and industrial sites. Roof runoff, which is predominantly clean, can be directly infiltrated into the soil near a building by connecting the downpipe to a subsoil drain system with an overflow for large events, providing that there is a 'first flush' diverter or catchment system to filter out the initial flow of roof runoff;
- **Swales** are open, grass-lined channels that receive runoff from roads and other impervious surfaces. Small check dams can be added to slow velocities and increase

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

pollutant removal, but a sequence of swale sections with proper growing medium and planting is necessary to properly filter and confine pollutants;

- **Permeable paving materials**, such as porous asphalt or porous concrete, are surfaces that mimic natural infiltration. Permeable surfaces can also be designed with a turf cell reinforcement structure or open-celled pavers, and concrete or plastic grids with voids that are filled with topsoil, growing medium or aggregate to ensure that vehicle or foot traffic can still use the area securely whilst surfaces remain permeable;
- **Constructed pollution control ponds**, or wet detention basins, are largely open water bodies of several metres depth; mosquitoes may become a problem if their prevention or deterrence is not factored into the design, and health and safety regulations must be observed for depths of water in publicly-accessible locations;
- **Constructed wetlands** resemble local natural wetlands and provide a balanced and productive ecosystem. When a constructed ecosystem is productive, it means that there is a significant biomass of plants and microscopic algae that take up nutrients, and provide habitat and food for animals. Note that birds are often attracted to constructed wetlands and can themselves increase the nutrient and pathogen levels in these systems. The problem can be limited by ensuring that roosting sites for large flocks (e.g. cormorants, ibis etc.) are not incorporated in the design.
- **Rainwater harvesting** for on-site uses will help to attenuate peak flows;
- **Roof gardens** can absorb significant amounts of rainfall, helping to attenuate peak flows. Super-imposed loads on the roof structure, plus retained rainwater, means that the roof needs to be designed to the extra loading;
- **Bio-Basins** are planted and shaded infiltration basins which trap polluted stormwater. The basin surface appears 'dry' as its surface is gravel and there are no ponds for mosquitoes to breed. The Bio-basin contains specialised wetland plants that act upon the water pollutants in much the same way they do in natural wetlands. Larger detained pollutant particles settle out to allow the natural bacteria processes to occur. Bio-Basins are easier to maintain and manage than constructed wetlands, but must be protected from fine sediment loads which could eventually clog the system;
- **Vegetated Filter Strips (VFS)** can also be used to help remove pollutants from stormwater; these are strips of grasses or plants placed across stormwater flow paths which filter stormwater runoff and minimise speed of stormwater discharge by encouraging a longer, more winding flow, especially where sheet flow rather than concentrated flow is intended; and,
- **Floating treatment systems** have rooted, emergent macrophytes growing on a floating artificial mat on the surface of the water. They are capable of surviving water depth fluctuations that typically occur in stormwater systems, without the risk of the plants becoming inundated or desiccated and stressed. The roots floating beneath the structure support a diverse microbial population which aid uptake of dissolved nutrients.

All of the above stormwater treatment technologies require careful and specific maintenance steps to be taken in order to ensure their on-going efficacy. Failure to undertake required maintenance will ultimately result in more costly repairs or even full replacement of the system.

Landscaping also plays an integral role in the design of most stormwater treatment systems, offering opportunities for their aesthetic incorporation in the surrounding area. The use of

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

particular plants species is important since some species will be more effective in treating stormwater and better suited for surviving the ambient conditions. Co-ordination between stormwater engineers, landscapers and nurseries/growers is advised to ensure that the required plants are available for planting at the correct stage in the project.

REFERENCES & FURTHER INFORMATION

South African Weather Service

<http://www.weathersa.co.za/web/>

CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines

<http://www.publish.csiro.au/nid/18/pid/2190.htm>

Georgia Stormwater Management Manual (2001)

<http://www.georgiastormwater.org>

Idaho Department of Environmental Quality (2005), Catalogue of Stormwater Best Management Practices for Idaho Cities and Counties

<http://www.deq.idaho.gov>

North Carolina Division of Water Quality (July 2007), Stormwater Best Management Practices Manual

<http://portal.ncdenr.org/web/wq>

SANS 1200:LE 1982 Stormwater Drainage – Standardized Specification for Civil Engineering Works

<http://www.sabs.co.za>

Department of Water and Environmental Affairs (Water Quality)

http://www.dwaf.gov.za/Dir_WQM/default.asp

National Environmental Management Act No. 107 OF 1998

<http://www.environment.gov.za/PolLeg/Legislation/NatEnvMgmtAct/NatEnvMgmtAct.htm>

CSIR (2000), Guidelines for Human Settlement Planning and Design, Chapter 6, Stormwater Management http://www.csir.co.za/Built_environment/RedBook/

Department of Environment and Water Resources (2002), Introduction to Urban Stormwater Management in Australia. Canberra.

<http://www.environment.gov.au/coasts/publications/stormwater/pubs/stormwater.pdf>

South African Water Research Commission

<http://www.wrc.org.za>

Emi-5 Watercourse Pollution

POINTS
AVAILABLE **3**

ANZECC (2002) Guidelines for Urban Stormwater Management:
dataserver.planning.sa.gov.au/publications/840p.pdf

CIRIA C697 (2007) The SUDS Manual.
<http://www.ciriabooks.com>

Debo, TN and Reese, A (2003), Municipal Stormwater Management. 2nd Edition, Lewis Publishers, CRC Press Company, Boca Raton, 2003.

US EPA (2007) Reducing Stormwater Costs through Low Impact Development
<http://www.epa.gov/owow/NPS/lid/costs07>

Emi-6 Discharge to Sewer

POINTS
AVAILABLE **5**

AIM OF CREDIT

To encourage and recognise developments that minimise discharge to the municipal sewerage system.

CREDIT CRITERIA

Up to five points are available as follows:

Up to four points are awarded where:

- The development's outflow to the municipal sewerage system has been reduced against an average-practice benchmark, by a minimum percentage, as determined by the Green Star SA Sewerage Calculator, awarded as follows:
 - 30% for one point;
 - 50% for two points;
 - 70% for three points;
 - 90% for four points.

An additional point is awarded where:

- At least one point above is achieved;

AND

- Where blackwater treatment system(s) installed:
 - A Blackwater Treatment Maintenance Plan has been prepared;AND
 - A maintenance contract has been entered into for a minimum of five years to ensure that the blackwater treatment system(s) operate as intended by the design.

Where no blackwater treatment system(s) installed, the additional point is 'Not Applicable' and is excluded from the points available, used to calculate the Emissions Category score.

Emi-6 Discharge to SewerPOINTS
AVAILABLE**5****DOCUMENTATION REQUIREMENTS**

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Calculator extract Additionally where additional point claimed: 2. Blackwater Treatment Maintenance Plan	1. Calculator extract Additionally where additional point claimed: 2. Blackwater Treatment Maintenance Plan 3. Extract(s) of contract

Calculator extract from the Green Star SA Public & Education Building v1 Sewage Calculator, completed in accordance with the Potable Water & Sewerage Calculators Guide, clearly demonstrating the calculator results.

Blackwater Treatment Maintenance Plan clearly demonstrating a robust maintenance plan and in accordance with the Additional Guidance.

Extract(s) of contract between the Building Owner and the service provider for maintenance of the blackwater treatment system, where it is clearly demonstrated:

- Which parties are responsible for the maintenance;
- That the contract is for a minimum of five years after commissioning; and
- That the maintenance must be completed in accordance with the Blackwater Treatment Maintenance Plan.

ADDITIONAL GUIDANCE

The Green Building Council of South Africa strongly encourages the reuse of water to protect the potable water resources in South Africa through rainwater, greywater and blackwater recycling.

Consent for blackwater treatment should however be sought from relevant authorities in line with SANS 10400 and the NEMA regulations.

Points can be achieved for this credit by minimising water use through efficient fittings, or through treatment and reuse of water.

Emi-6 Discharge to Sewer

POINTS
AVAILABLE **5**

The number of points achieved is determined by the Sewage Calculator from the information entered in the Potable Water Calculator. The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculators Guide. All teams claiming this credit are required to comply with the requirements outlined in this guide.

All inputs into the Sewerage Calculator must be referenced consistently throughout the rest of the submission (i.e. in Wat-1 'Potable Water') and be clearly justified by the documented design or by the as built documentation.

Blackwater Treatment Maintenance Plan

The blackwater treatment maintenance plan must include, at a minimum, the following:

- A simplified diagram of the system(s);
- Description of its intended operation and its conditions;
- A list of the main components (including controls), and the value and conditions of their efficient use;
- Details on maintenance, including recommended frequency; and
- A list of likely and tell-tale signs of system failure, system 'do's and don'ts', and notes on inefficient operation.

BACKGROUND

Wastewater from buildings places a significant demand on public infrastructure and the local environment. Inadequately treated wastewater disposed to watercourses can be a significant source of pollution. As a result, wastewater represents a polluting emission from the developments and minimisation of this emission is encouraged through this credit with added benefit of reducing high demands on potable water sources.

REFERENCES & FURTHER INFORMATION

Department of Environmental Affairs
<http://www.environment.gov.za/>

South Africa Department of Water Affairs & Forestry
<http://www.dwaf.gov.za>

Emi-7 Light PollutionPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise developments that minimise light pollution into the night sky.

CREDIT CRITERIA

One point is awarded where:

- No light beam, generated from within the building or outside of the building boundary, is directed at any point in the sky hemisphere without falling directly onto a non-transparent surface;

AND

- Facade lighting produces an average building Luminance of no more than 10 candelas/m²;

AND

- 95% of the outdoor spaces do not exceed the minimum requirements of CIBSE Lighting Guide: 1992, The Outdoor Environment for maintained illuminance levels.

AND

- The lighting design complies with the additional guidance given in the Green Star SA – PEB v1 Technical Manual (Figure Emi-7.1 to Emi-7.4).

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building PILOT Design	Green Star SA – Public & Education Building PILOT As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation 3. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. Manufacturer product datasheet(s) 3. As built drawing(s)

Emi-7 Light Pollution

POINTS
AVAILABLE

1

Short report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Detailing the external lighting on the site and the areas illuminated;
- Calculations and illumination diagrams (including horizontal and vertical light distribution) to demonstrate that no light spill is impacting the night sky.
- For any façade lighting, calculation(s) to show that the building Luminance meets the requirements above;
- Confirming through calculations the achieved light levels and that 95% of areas do not exceed the minimum requirements given in CIBSE LG6.

Extract(s) from tender documentation where external lighting and its design requirement(s) are identified, nominating the type, lighting distribution and quantity of each luminaire.

Tender / As Built drawing(s) marked-up to clearly show;

- The location and type of all external luminaires; and
- Illuminance levels demonstrating that the minimum requirements of CIBSE LG6 are not exceeded; and

Where lighting is directed at a façade or structure:

- Sections showing the set angle of the fitting(s) to ensure that light does not spill past the non-transparent surface of the facade or structure into the sky hemisphere.

Manufacturer product datasheet(s) for all relevant luminaires indicating light output levels and light distribution diagram.

ADDITIONAL GUIDANCE

For the credit to be achieved, there is to be no point in the sky hemisphere which is exposed to a direct light source.

Light reflected off external surfaces (which do not form part of the light fitting) is not considered as light spill for the purposes of the credit.

Table Emi-7.2 provides the most relevant illuminance levels for Public Buildings eligible under the Public Building v1 rating tool. Please refer to the lighting guide where the project has areas that are not covered by Table Emi-7.2. Where a project has areas that are not covered by LG6, a maintained illuminance level of 20 lux should be used.

The illuminance levels in LG6 are minimum maintained illuminance levels. For the purpose of this credit these maintained illuminance levels can be used as *Average Maintained Illuminance*.

It is recommended that projects carry out lighting simulations of the outdoor areas to demonstrate compliance with the illuminance requirements.

Emi-7 Light PollutionPOINTS
AVAILABLE**1**

General Areas	CIBSE LG6 Lighting Levels	Maintained Illuminance [lux]
	Area, location or task	
Shopping precincts and pedestrian areas (CIBSE LG6, Section 4.1)	Open pavement	20/15
	Covered pavement	75
Covered precincts and arcades (Section 4.2)	Circulation areas	75
	Entrances (after dark)	75
Vehicle parks (Section 4.4)	Surface car parks: ground (public)	20
	Surface car parks: ground (private)	10
	Multi-storey and underground car parks: general areas	50
	Ramps, corners and intersections	75
	Stairways	100
	Open roofs	20
	Lorry parks: low risk	20
	Lorry parks: high risk	30
	Loading and unloading	50
	Concourse	200
Railway and coach stations (Section 4.6)	Printed timetable	200
	Platform	10
	Coach loading areas	150
Educational precincts (Section 4.9)	Roadways and general movement	5
	Carparks and bicycle storage	10
	Walkways, perimeter zones and security	20
	Facades and signs (vertical)	100
	Recreational and club sports	100
Community buildings (Section 4.10)	Notice boards (vertical)	150
	Pathways, main access	10
	Pathways, secondary	
	Car park area ¹⁸	10
	Notice boards	150
	Entrance porch	200
Subways, stairways and	Subway, short (ground)	150

¹⁸ Project specific requirements, see CIBSE LG 6 Section 4.4

Emi-7 Light PollutionPOINTS
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public footpaths (Section 4.13)	Subway, long or complex (ground)	300
	Intersections and internal stairways (day and night)	300
	Entrances (daytime)	300
	Foot-bridges (open)	50
	Open stairways ¹⁹	50
Roads and associated areas (Section 4.14)	Local distributor road with active/high crime rate or high crime rate or extensive night-time public use.	10
	Residential access roads or with average crime risk or moderate public use after dark.	6
	Residential area road with low crime risk or low pedestrian usage at night-time.	3.5
Parks and gardens (Section 4.16)	Main pathways	10
	Secondary pathways	5
	Steps	50
	Trees and bushes	10
	Large focal points	100
	Small focal points	200
	Outdoor sports ²⁰	
Structures (Section 4.17)	Footbridges	50
Statues and sculptures (Section 4.18)	Statues and sculptures ²¹	
Monuments and memorials (Section 4.19)	Access walkways	50
	Adjacent car park areas	10
Clocks and sundials (Section 4.20)	Dark surroundings, light surface	200
	Bright surroundings, light surface	500
	large sundial	100
	small sundial	200
	clock towers ²²	
Flags (Section 4.21)	dark background, light flag	200
	bright background, light flag	500
	Towers ¹¹	

¹⁹ Every effort should be made to illuminate the risers differently from the treads in order to accentuate the steps

²⁰ Refer to CIBSE Lighting Guide: Sports

²¹ Project specific requirements – see CIBSE LG6 Section 4.18

²² Project specific requirements – see CIBSE LG6 Section 5.3

Emi-7 Light Pollution

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Festive illuminations (Section 4.23)	steps, stairways and hazards	50
	audience areas	20
Outdoor bandstands and auditoria (Section 4.24)	access points, exits and main pathways	50
	car parking	10
	bandstands general	300
	music stands	300
Illuminated signs and hoarding (Section 4.26)	externally illuminated signs: low district brightness	100
	externally illuminated signs: high district brightness	500

Table Emi-7.2 Maintained Illuminance Levels for Public Buildings (CIBSE LG6)

The following figures diagrammatically explain the concept of avoiding direct light beam escape from luminaires/ fittings.

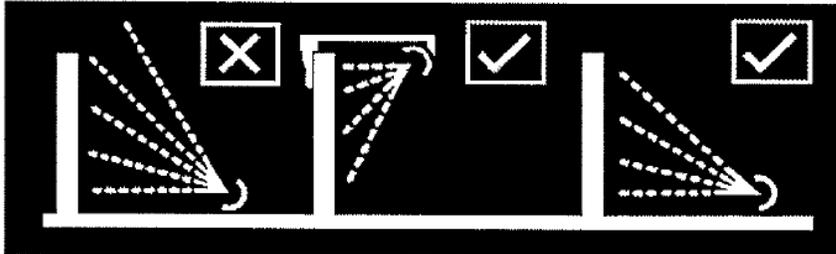
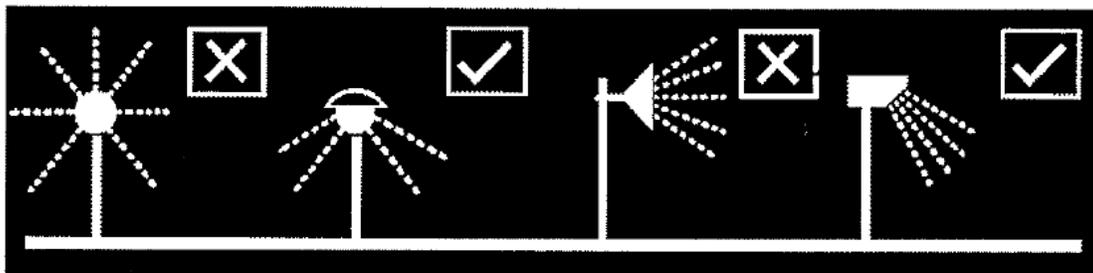


Figure Emi-7.1 Illustration of acceptable and unacceptable external lighting to achieve this credit (from Institute of Lighting Engineers, 2005)



Emi-7 Light Pollution

POINTS
AVAILABLE

1

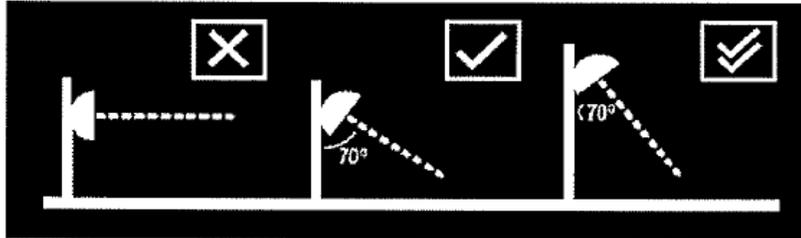


Figure Emi-7.2 Illustrations of acceptable and unacceptable column lighting to achieve this credit (from Institute of Lighting Engineers, 2005)

Light fittings that have an opaque canopy or polished asymmetrical reflectors will meet the requirements for the awarding of this credit.

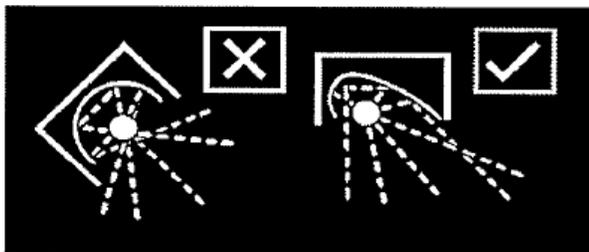


Figure Emi-7.3 Symmetrical and asymmetrical reflectors (from Institute of Lighting Engineers, 2005)

Reflectors for light fittings directed downwards should also be in accordance with the following diagram, where no direct light beam is permitted upwards above the horizontal plane of the light fitting:

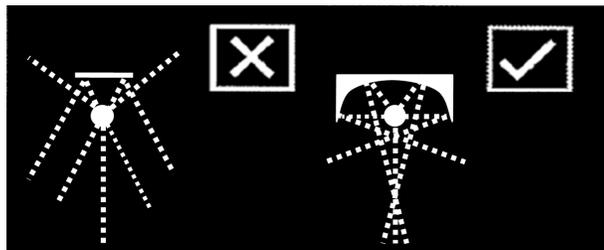


Figure Emi-7.4 Downward facing reflectors (diagram prepared by the GBCSA)

Emi-7 Light Pollution

POINTS
AVAILABLE

1

BACKGROUND

Light travelling up into the night sky (sky glow) or spilling on to neighbouring properties is a form of pollution. Light pollution harms the environment in many ways:

- Effect on migratory birds - nocturnal birds use the moon and stars for navigation and can become disorientated. In the US birds often crash into brilliantly-lit broadcast towers or buildings, or circle them until they drop from exhaustion;
- Disrupting biological rhythms and otherwise interfering with the behaviour of nocturnal animals and insects;
- Urban sky glow hinders professional and amateur astronomy and deprives the public of its view of the night sky; and
- Additional greenhouse gasses are emitted merely to light the night sky.

REFERENCES & FURTHER INFORMATION

GN01 Guidance Notes for the Reduction of Obtrusive Light, 2005
Institution of Lighting Engineers
<http://www.ile.org.uk>

CIBSE Lighting Guide 6: 1992, The Outdoor Environment
Chartered Institute for Building Service Engineers
<http://www.cibse.org>

Fatal Light Awareness Program
<http://www.flap.org>

Lighting for Exterior Environments, 1999, Illuminating Engineering Society
<http://www.iesna.org>

Illuminating Engineering Society of North America
<http://www.iesna.org>

International Dark-Sky Association
<http://www.darksky.org>

International Electro technical Commission
IEC 60364-7-714 Edition 1.0 (1996-04): Electrical installations of buildings - Part 7:

Requirements for special installations or locations - Section 714: External lighting installations.
<http://www.iec.ch>

Emi-7 Light Pollution

POINTS
AVAILABLE

1

The Urban Wildlands Group
<http://www.urbanwildlands.org>

Emi-8 LegionellaPOINTS
AVAILABLE**1****AIM OF CREDIT**

To encourage and recognise building systems design that eliminate the risk of Legionnaires' disease (Legionellosis).

CREDIT CRITERIA

One point is awarded where:

- There are no water based heat rejection system(s) serving the building;
- OR
- Water-based heat rejection system(s) serving the building meet all of the following:
 - Do not contain water that is kept at a temperature between 20°C and 50°C;
AND
 - Do not release an aerosol spray during operation;
AND
 - Are designed and built to maintain constant movement of the water in the system, when in operation, to prevent stagnation;
AND
 - Are designed and built for routine and periodic flushing to remove bio-film buildup and stagnant water from the system(s) whenever it is not in operation;
AND
 - Are designed, located and built in accordance with AS/NZS 3666.1:2002;
AND
 - A Legionella Risk Management plan has been prepared in accordance with AS/NZS 3666.2:2002 or AS/NZS 3666.3:2000 and has been included in the O&M manual provided to the Building Owner.
AND
 - All water storage system(s) serving the building must be designed in accordance with SANS 10252-1:2004.

Emi-8 LegionellaPOINTS
AVAILABLE**1****DOCUMENTATION REQUIREMENTS**

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
<ol style="list-style-type: none"> Short report <p>Additionally where water-based heat rejection provided:</p> <ol style="list-style-type: none"> Extract(s) from tender documentation Legionella Risk Management Plan 	<ol style="list-style-type: none"> Short report <p>Additionally where water-based heat rejection provided:</p> <ol style="list-style-type: none"> As Built drawing(s) Extract(s) from Commissioning Report(s) Manufacturer product datasheet(s)

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by;

- Describing the HVAC system(s) and confirming the inclusion or exclusion of water-based heat rejection systems;

Additionally where water-based heat rejection systems included:

- Detailing the operating characteristics of the system and demonstrating that the Credit Criteria have been met; and,
- Stating that the design is in accordance to SANS 10252-1:2004, and all water storage temperatures are designed to be maintained at the specified temperatures..

Extract(s) from tender documentation of the HVAC system highlighting where the systems relevant to this credit have been specified.

Legionella Risk Management Plan which describes how the mechanical plant is required to be maintained to manage the risk of Legionella associated with the plant – the plan must be specific to the project and in accordance with the Additional Guidance.

Manufacturer product datasheet(s) of the water-based heat rejection system.

Emi-8 Legionella

POINTS
AVAILABLE**1**

ADDITIONAL GUIDANCE

It must be demonstrated clearly and consistently throughout the submission that the building is fully naturally ventilated or that the mechanical heat rejection systems in place do not rely on evaporative heat rejection.

The certified Assessors will look for evidence that the design of the system and the on-going maintenance prescribed ensure that the temperature is not within this range.

Water-based systems that do not meet the Credit Criteria are not eligible for this credit – disinfection systems, such as ultraviolet light, chlorination, heat or other method, are not an equivalent method for meeting the Credit Criteria. Drift eliminators are not an acceptable solution to claim elimination of aerosol spray during operation or maintenance.

Aerosol spray is defined as droplets which are suspended in the air. Typically these droplets are less than five micrometers.

While the steps outlined in the Credit Criteria and Documentation Requirements have been developed to ensure that the risk of Legionella is eliminated as far as reasonably practicable, achieving this point does not mean that the risk of Legionella has been entirely eliminated from the water-based heat rejection systems. By awarding this point the Assessors are only confirming that the system meets the Credit Criteria outlined above.

Legionella Risk Management Plan

The Legionella Risk Management Plan must as a minimum contain the following provisions:

- Regular and periodic inspections (at least monthly) and maintenance of the system(s) (at least every 3 months) as per AS/NZS 3666.2:2002 or AS/NZS 3666.3:2000.
- Flushing of the system(s) where the system(s) are not in use for more than 3 days; and
- Inspection, cleaning and flushing of the system(s) prior to reactivation

Alternatives to water-based heat rejection systems

There are a number of alternatives to water-based heat rejection systems for buildings with heat rejection requirements. Alternatives which have already been applied on projects worldwide include:

- Natural ventilation;
- Mechanically assisted natural ventilation;
- Air-cooled heat rejection;
- Harbour heat rejection;
- River heat rejection; and
- Ground heat rejection.

Emi-8 Legionella

POINTS
AVAILABLE**1**

BACKGROUND

Colonisation and growth of bacterium 'Legionella' (the causative agent for legionnaire's disease) can take place in any water-based system if the water is warm and supplied with nutrients. Such organisms can be transported outside the water-based heat rejection systems within drift aerosol. There is evidence that the inhalation of such drift containing Legionella is a means of infection.

In Philadelphia in 1976, the American Legion held a bi-centennial conference to celebrate 200 years since the signing of the declaration of independence from Britain. More than 180 delegates, all staying at the same hotel, developed an acute, severe illness and 29 died. The final toll was 34 deaths; some simply passers-by in the street.

Initially the cause of their illness was unknown, with food poisoning a major suspect. It is now known that what they had was 'Legionnaires' disease', a form of pneumonia, or infection of the lung.

The cause of Legionnaires' disease is a family of bacteria and as such, it is a micro-organism, not a virus. This distinction is important when it comes to treatment because few viral diseases respond to antibiotics, whereas most bacterial diseases do.

Legionella pneumophila is the name scientists gave to the bacterium but there are at least 50 other species, all closely related. The micro-organism is relatively hard to grow and detect in laboratory cultures, compared with other types of bacteria, but modern culture techniques have improved analysis. Growth on laboratory culture media is very slow, typically 7 days. Incubation in the lung is similarly slow and may not be detected until a few days after infection. Growth in water-based heat rejection systems can also be relatively slow.

Although legionnaires disease is a reportable disease, according to the Legionella Action Group, many cases remain undetected as not all laboratories test for the disease. The prevalence of the disease is therefore unknown, however it is definitely present. The South African Bureau of Standards is currently compiling Best Practise Guidelines (SANS 893 Legionnaires Disease) to prescribe testing and design methods pertaining to the prevention of Legionella.

REFERENCES & FURTHER INFORMATION

CIBSE TM13:2002 Minimising the risk of Legionnaires Disease National Environmental Health Forum South Australia (1996), Guidance for the control of Legionella
<http://enhealth.nphp.gov.au/council/pubs/pdf/legionel.pdf>

Centres for Disease Control and Prevention
http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Envio_guide_03.pdf p58

Standards Australia (2002), AS/NZS 3666.1:2002 Air-handling and water systems of buildings – Microbial Control – Design, installation and commissioning

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AVAILABLE **1**

<http://www.standards.com.au>

Standards Australia (2002), AS/NZS 3666.2:2002 Air-handling and water systems of buildings – Microbial Control – Operation and Maintenance
<http://www.standards.com.au>

Standards Australia (2002), AS/NZS 3666.2-2002: Air handling and water systems of buildings – Microbial control – Performance-based maintenance of cooling water systems,
<http://www.standards.com.au>

Department of Human Services, Public Health Division, Victoria (2001), Managing the Risk of Legionnaires Disease
<http://www.health.vic.gov.au/environment/downloads/supnoteshospitals.pdf>

Department of Human Services, Public Health Division, Victoria (2001), A Guide to Developing Risk Management Plans for Cooling Tower Systems,
<http://www.health.vic.gov.au/environment/downloads/fullrmp.pdf>

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), ASHRAE Guideline 12: Minimising the Risk of Legionellosis Associated with Building Water Systems
<http://www.ashrae.org>

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH), AS/NZ 3666 Air-handling and water systems of buildings – Microbial control – Operation and Maintenance
<http://www.airah.org.au/downloads/2002-03-F01.pdf>

General Electric Water & Process Technologies (2006), Chemical Water Treatment Recommendations for Reduction of Risks Associated with Legionella in Open Recirculating Cooling Water Systems
<http://www.gewater.com/pdf/tech73.pdf>

South African Bureau of Standards, Check latest developments on SANS 893 Legionnaires Disease on:
<http://www.sabs.co.za>

For State legislation regarding HVAC maintenance and cleaning management programmes, see

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH)
<http://www.airah.org.au/downloads/2002-03-F01.pdf>

Department of Human Services, Public Health Division, Victoria (2001), A Guide to Developing Risk Management Plans for Cooling Tower Systems,
<http://www.health.vic.gov.au/environment/downloads/fullrmp.pdf>

For Wet and Hybrid Cooling Towers at Power Plants,
<http://www.energy.ca.gov/2005publications/CEC-700-2006-025/CEC-700-2005-025.PDF>

Emi-8 Legionella

POINTS
AVAILABLE **1**

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE),
ASHRAE Guideline 12: Minimising the Risk of Legionellosis Associated with Building Water
Systems,
<http://www.ashrae.org>

Chartered Institute of Plumbing and Heating Engineering, Safe Hot Water Temperature,
<http://www.iphe.org.uk/databyte/legionella.pdf>

Emi-9 Boiler and Generator Emissions

POINTS AVAILABLE **1**

AIM OF CREDIT

To encourage and recognise the use of boilers and generators that minimise harmful emissions.

CREDIT CRITERIA

One point is awarded where:

- All gas boiler(s) greater than 15kW capacity have NOx emissions of less than 100 mg/kWh (at 0% excess O2);

AND

- All generator(s) comply with one of the following applicable emission standards:
 - Tier 3 Emissions Standards (United States EPA);
 - OR
 - Stage IIIA Emissions Standards (European Standard);
 - OR
 - TA Luft 2002 (German Standard).

Where no boilers or generators are installed, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Emissions Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report 2. Extract(s) from tender documentation Where credit claimed 'Not Applicable': 3. Short report	1. Short report 2. Manufacturer product datasheet(s) Where credit claimed 'Not Applicable': 3. Short report

Emi-9 Boiler and Generator Emissions

POINTS
AVAILABLE

1

Short Report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Detailing each boiler and giving its capacity in kW and the applicable NO_x emission rate in mg/kWh, with reference to supporting documentation (where applicable);
- Detailing each generator and confirming that it meets the Credit Criteria with reference to supporting documentation (where applicable).

Where credit claimed 'Not Applicable':

- Confirming that there are no generators or applicable boilers within the development.

Extract(s) from tender documentation where the requirements for the boilers/generators are specified, clearly demonstrating compliance with the Credit Criteria.

Manufacturer product datasheet(s) for each boiler and generator (as applicable) clearly indicating compliance with the Credit Criteria.

ADDITIONAL GUIDANCE

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

Refurbishment projects must demonstrate that the existing system(s) are compliant. Specifying the use of catalytic convertors alone will not suffice.

To claim the credit as 'Not Applicable', the project team must clearly document that the development is not served by any boilers or generators.

The emissions must be estimated under normal operating conditions (not standby).

'Boilers' include all heat generating equipment excluding electrically heated equipment, combined heat and power (CHP) and cogeneration systems (which must however meet the generator requirements).

Where heat is provided by more than one system, an average NO_x emission rate must be used, based on the ratio of power outputs from each source (i.e. multiply the emissions of each boiler by the percentage of heat demand it produces and total these values).

Boilers - NO_x conversion factors:

Manufacturers must be asked to supply dry NO_x emissions data in mg/kWh. Where this is not possible the applicant may use the following conversion factors to convert figures in ppm, mg/m³ or wet NO_x. It must be noted that these conversion factors assume worst case efficiencies and are likely to give conservative answers. This could have the effect of lowering the number of points achieved. See below for typical conversions;

Emi-9 Boiler and Generator Emissions

POINTS
AVAILABLE

1

- Figures in mg/m^3 must be multiplied by 0.857 in order to gain emissions in mg/kWh . A conversion may also be necessary for data not calculated at 0% excess oxygen (see below).
- Figures in parts per million (ppm) must be multiplied by 1.76 in order to obtain mg/kWh . A conversion may also be necessary for data not calculated at 0% excess oxygen (see below).
- The Green Star SA criteria are based on dry NO_x values – almost all manufacturers will quote emissions in dry NO_x . However if wet NO_x figures are supplied, these must be converted to dry NO_x . This can be done by multiplying the wet NO_x figure by 1.75.

Excess Oxygen Correction: If a NO_x emission rate is quoted by the manufacturer in mg/m^3 or ppm, then it must be established at what % excess oxygen this emission was made. The greater the amount of excess oxygen in the flue gases at the time of measurement, the more 'diluted' the NO_x . It is therefore important to convert any emission rate back to 0% excess oxygen. For the purpose of Green Star SA, use the following conversion factors for the most frequently used rates supplied by manufacturers:

% Excess O ₂	Conversion (c)
3 %	x 1.17
6%	x 1.40
15%	x 3.54

Table Emi-9.1: Conversion factors for Excess Oxygen

Conversion factor $c = 20.9 \div (20.9 - x)$

Where $x =$ % excess O₂ (NOT excess air) and 20.9 is the percentage of O₂ in the air.

Generators

Please refer to the latest tables for emissions requirements from the United States EPA Tier 3 Non-Road Engine Emission Requirements (see references). In cases where Tier 3 is not yet ratified (and not shown in their tables) for a particular size generator, the generator must comply with the Tier 2 standards given in the EPA tables.

As at December 2009, The European Stage IIIA standard is limited to generators below 560kW. Note that compliance with European Directive 2004/26/EC Stage IIIA is equivalent to compliance with the EPA Tier 3 standard.

The exhaust emissions limits stipulated in TA Luft 2002 meet or exceed the limits prescribed in both EPA Tier 3 and European Stage IIIA. The TA Luft 2002 emission standard, however, permits emission limit concessions to engine/generator systems which are deemed as emergency/back-up or that are used to reduced peak electrical infrastructure load for less than 300 hours per year. In this engine capacity scenario no limits apply to either carbon monoxide (CO) or nitrous oxide (NO_x). For the purposes of Green Star SA, the Project Team must demonstrate the generator(s) compliance with all applicable pollutant (i.e. CO, PM and NO_x)

Emi-9 Boiler and Generator Emissions

POINTS
AVAILABLE**1**

emission limits within the TA Luft 2002 emissions standard, irrespective of whether the engine is to be used as an emergency/back-up unit or for the purposes of minimising peak electrical infrastructure load for less than 300 hours per year.

BACKGROUND

Nitrogen Oxides (NO_x) emitted from the burning of fossil fuels contribute to the build-up of local ozone levels and cause local pollution. They may also contribute to more wide scale pollution problems through deposition in the form of acid rain. The major contributors to local emissions come from transport, (covered elsewhere in Green Star SA); however boiler plant and generators in buildings do emit substantial levels of NO_x through normal operation, and these emissions can be reduced through careful specification of systems.

With an increasing reliance expected on locally generated electricity in South Africa in the short to mid-term, it is important that electric generators are selected to minimize harmful emissions to the environment.

Use of mains electricity in buildings also leads to NO_x emissions at fossil-fuelled power stations, and due to the percentage of coal fired power stations, these are quite high in South Africa (averaged NO_x emissions 4300 mg/kWh from Eskom annual report 2007).

REFERENCES & FURTHER INFORMATION

British Standards EN 297:1994. A1:1995, A2:1996, A3:1996, A5:1998 and A6:2003 Gas fired central heating boilers, page 42, table 14, section 3.6.2

US Environmental Protection Agency
<http://www.epa.gov/nonroad-diesel/>

European Directive 2004/26/EC amending Directive 97/68/EC
<http://www.dieselnet.com/standards/us/nonroad.php>

Emi-10 Kitchen Exhaust Emissions

POINTS
AVAILABLE

This credit is not relevant to the Green Star SA - Public & Education Building v1 tool.

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6****AIM OF CREDIT**

To encourage and recognise the avoidance of substances that contribute to the deterioration and long-term alteration of the Earth's atmosphere.

CREDIT CRITERIA

Up to six points are awarded independently as follows:

Ozone Depleting Potential (ODP)

Two points are awarded where:

- All refrigerants within qualifying HVAC equipment and gases within applicable fire suppression systems used have an Ozone Depletion Potential (ODP) of zero;
- AND
- All applicable insulation materials used within the project avoids, both the manufacture and composition, ozone depleting substances.

Global Warming Potential (GWP)

Up to two points are awarded where:

- The minimum percentage (by mass) of the total refrigerant charge of qualifying equipment that have a Global Warming Potential (GWP100) of 10 or less, is awarded as follows;
 - 50% (by mass) for one point;
 - OR
 - 100% (by mass) for two points

Refrigerant Fugitive Emission Management

Up to two points are awarded as follows:

One point is awarded where:

- HVAC systems containing refrigerants are;
 - Contained in a moderately air tight enclosure;
 - AND
 - Are provided with a refrigerant leak detection system to cover high-risk parts of the plant;
- OR

Emi-11 Atmospheric Deterioration Avoidance

POINTS AVAILABLE

6

- An automatic permanent refrigerant leak detection system is specified, which is NOT based on the principle of detecting or measuring the concentration of refrigerant in air.

An additional point is awarded where:

- The point above is achieved;
AND
- A refrigerant recovery system is installed that is:
 - Equipped with an automated pump-down system;
AND
 - Sized to effectively and safely capture, isolate, and store 95% (by weight) of the maximum refrigerant charge.

Where no refrigerants are used in the project, OR if all refrigerants have an ODP of zero and a GWP of 10 or less, the two points for refrigerant fugitive emission management are 'Not Applicable' and are excluded from the points available, used to calculate the Emissions Category score.

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms.
<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from tender documentation Additionally where refrigerants/gases specified: <ol style="list-style-type: none"> 3. Evidence of properties Additionally where refrigerant fugitive emission management claimed: <ol style="list-style-type: none"> 4. Tender drawing(s) 	<ol style="list-style-type: none"> 1. Short report 2. Extract(s) from Commissioning Report(s) 3. Manufacturer product datasheet(s) 4. Evidence of properties 5. Statement of confirmation

Short report prepared by a suitably qualified professional that describes how the Credit Criteria have been met by:

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6**

- Providing a tabulated summary of each qualifying equipment within the development, and the type and mass of refrigerant/gas charge in each;
- *Additionally where ODP and/or GWP claimed:* Confirming the compliance of refrigerants/gases (ODP/GWP as applicable);
- Where no qualifying equipment provided; confirming that no qualifying equipment is provided, with details of the alternative equipment (where applicable);
- Listing all insulation applications proposed within the development, confirming for each application that the Credit Criteria is met with reference to the supporting documentation;
 - *Additionally where refrigerant fugitive emission management claimed:*
- Outlining the design and intended operation of the refrigerant leak detection system(s) and if the additional point is claimed, of the refrigerant recovery system(s);
- Where a refrigerant recovery system provided; describing the refrigerant recovery system;

Extract(s) from tender documentation clearly demonstrating the contractual requirement;

- *Where ODP and/or GWP claimed:*
- That any qualifying equipment provided to only contain refrigerant/gas with an ODP of zero and/or a GWP of 10 or less.
- For all insulants to not contain in either manufacture or composition, ozone-depleting substances.
 - *Where refrigerant fugitive emission management claimed:*
- For the installation of the refrigerant leak detection system(s) as detailed within the short report;
- Where the additional point is claimed, the chiller and refrigerant recovery characteristics as per the Credit Criteria.

Evidence of properties of the refrigerant/gas clearly demonstrating for each refrigerant/gas referenced in the short report, the generally accepted ODP/GWP as published within reputable sources (see References).

Tender / As Built drawing(s) of the HVAC system(s), indicating location and type of all elements containing refrigerant and if applicable showing the enclosure around each of the HVAC systems containing refrigerants, with the location, size and intended operation of the sensors and openings identified.

Extract(s) from Commissioning Report(s) demonstrating that qualifying equipment has been installed, commissioned and operate as intended by the design.

Manufacturer product datasheet(s) for

- Each qualifying equipment as referenced in the short report, clearly identifying the equipment, the type and mass of refrigerant/gas charge; and/or

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6**

- Each applicable (i.e. non-woven) insulation product referenced in the short report, clearly demonstrating that the product is free of ozone-depleting substances in both manufacture and composition.

Statement of confirmation from the Contractor, in the form of signed correspondence, confirming the installation of all qualifying equipment with the applicable refrigerants, the refrigerant fugitive emission management system and all insulants as referenced in the short report (as applicable).

ADDITIONAL GUIDANCE**Ozone Depleting Potential & Global Warming Potential**

Qualifying equipment is considered as refrigerant-based refrigeration and heat-pump equipment, and gaseous fire suppression equipment provided within the scope of the main contract of the development, and includes, but is not limited to;

- Air conditioning equipment (including reverse-cycle heat pumps), unitary or otherwise;
- Heat-pumps for domestic hot water generation; and,
- Fire suppression equipment.

It must be clear from the documentation that all qualifying equipment has been accounted for, the refrigerant/gas type(s) identified and quantified, and the refrigerants/gases demonstrated as compliant with the Credit Criteria.

Where qualifying equipment is not provided, the short report must describe the alternative equipment provided (e.g. domestic hot water heat-pump is not provided as heating provided by gas boilers), or explain that no alternatives are provided (e.g. building is naturally ventilated).

Hand-held fire extinguishers are excluded from the scope of the Credit Criteria.

For refurbishments and redevelopments, existing equipment which is to be reused must comply with the Credit Criteria.

Table Emi-1.1 (over page) provides ODP & GWP for some commonly used refrigerants and gases.

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6**

Refrigerant/Gas	Global Warming Potential (GWP100)	Ozone Depletion Potential (ODP)
R11	4000	1.0
R12	8500	0.83
R22	1700	0.05
R134a	1300	0
R407c	1600	0
R410a	1900	0
R290 (propane)	3	0
R600 (butane)	3	0
R1270 (propene)	3	0
Ammonia	<1	0
Halon 1211	1300	3
HFC227ea (FM200)	2900	0
IG541	0	0
CO ₂	1	0
Air	0	0
Water	<1	0

Table Emi-1.1: ODP & GWP of some common refrigerants and gases

Currently there are no Chlorofluorocarbon (CFC) and Hydrochlorofluorocarbon (HCFC) refrigerants available which meet the ODP requirements of this credit. The points can, however, be achieved through the use of Hydrofluorocarbons (HFCs) or hydrocarbon-based refrigerants within qualifying equipment.

The 100-year Global Warming Potential is considered for the purpose of the Green Star SA – Public & Education Building rating tool. The GWP provides a measure of the potential for damage that a chemical has relative to 1 unit of carbon dioxide. GWP is used to describe Global Warming Potential over 100 years and is used by the UN Intergovernmental Panel on Climate Change (IPCC).

Examples of achieving the 50% replacement may include replacing the refrigerant in either the secondary loop or the compressor of a split or variable refrigerant flow system, but not in a chilled water system (as the secondary refrigerant is commonly water). Rewarding partial change replacement encourages the uptake of natural refrigerants in a wider range of circumstances.

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6**

The primary refrigerant is the refrigerant in the compressor (or the only refrigerant in a packaged system). A secondary refrigerant is one that transfers the heat from the conditioned space to the compressor.

Where no refrigerants are used within the development, full points may be claimed for the ODP and GWP components of the credit.

The scope of the Credit Criteria addresses insulants manufactured using blowing agents only (e.g. rigid polystyrene, rigid polyurethane, polyolefins etc.).

Fibre-based woven insulation products (e.g. glass fibre, mineral wool, polyester etc.) and foil insulation are not within the scope of the Credit Criteria as these products are not manufactured using blowing agents. As such, manufacturer product datasheets are not required for fibre-based woven insulation nor foil insulation products.

Common applications of applicable insulation include, but are not limited to;

- Thermal insulation;
 - Chilled/hot water pipework;
 - Refrigerant pipework;
 - Ductwork;
 - Thermal storage vessels;
 - Fabric applications (walls, roofs, floors);
- Acoustic insulation.

Electrical conductivity insulation (e.g. wire or cable sheathing) is excluded from the scope of the Credit Criteria.

All common applications of insulation should be nominated within the short report and the type of insulation used nominated.

The tender documentation must clearly stipulate all insulation to be free of ozone-depleting substances in both manufacture and composition.

Refrigerant Fugitive Emission Management

If a number of different systems are installed on a project, the documentation must account for and describe all systems within the project.

Plant rooms must be ventilated to comply with the South African building regulations, and this requirement must continue to be met in buildings with refrigerant leak detection systems.

The Credit Criteria for refrigerant leak detection is applicable to negative-pressure refrigerants, as the Aim of Credit is to detect any leaks of refrigerant from the vessel at any time, including those that occur when the system is not in operation.

High-risk parts of the plant include plant rooms containing chillers and other equipment with refrigerants but do not include evaporator or condenser coils.

Method based on air-sensing of refrigerant leak

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6**

The equipment must be in a moderately air-tight enclosure to allow the concentration of leaked refrigerant to build up to a detectable level. The documentation must demonstrate that the location, size and intended operation of the sensors and openings within the enclosure will enable effective operation of the leak detection system, and will not prevent small refrigerant leaks being detected.

Method based on alternative detection of refrigerant leak

Full details must be provided of how the system will automatically detect a refrigerant leak, while not triggering an alarm due to normal variations in pressure etc. Such systems (for example based on sensing the presence of refrigerant vapour in liquid-carrying pipes) are now commercially available. Systems based on monitoring pressure drops within the pipe work are not necessarily compliant with the Green Star SA requirements. There are natural fluctuations to the pressure of the refrigerant due to changes in volume and temperature of the system, and to the ambient temperature of the surroundings. Low pressure and high pressure switches, which are standard equipment on refrigerant plant, are therefore not sufficient to award the credit.

Refrigerant detectors

For a new building, permanently installed multi-point sensing detectors are to be specified. Various types are available including corona discharge (hand held only and as such does not comply with the Green Star SA requirements unless a regular {at least once a week} monitoring system is confirmed), infrared, and semi-conductor.

Indicator dyes

Fluorescent or coloured dyes can be added to the refrigerant to show leakage sites. The use of the dye must be approved by the compressor manufacturer.

Halide torch detectors

This type of detection is only appropriate for chlorine-based substances such as CFCs and HCFCs. Compounds which do not contain chlorine (e.g. HFCs) cannot be detected by this method. Non-ozone-depleting refrigerants do not register on a halide torch leak detector.

Pump down

'Pump down' is the process of removing refrigerants from a refrigeration unit, and is usually undertaken to allow maintenance or repair of the unit. Automatic pump-down to either a separate storage tank or into the heat exchanger is acceptable but only where isolation valves are fitted to contain it once fully pumped down.

The provision of manual storage cylinders or any other system which is reliant on the diligence of the maintenance staff on site is not acceptable to achieve this credit.

Small packaged units

Small packaged units do not need to be fitted out with a leak detection system or a refrigerant recovery system as per the Credit Criteria for this credit if the total sum of refrigerants for these units is not more than 5% of the total refrigerant volume of the project. Where the exclusion is being claimed, a tabulated summary demonstrating that 100% of all refrigerants in the project have been accounted for must be provided at the time of submission. Small packaged units must still comply with the ODP & GWP requirements.

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6****BACKGROUND****Ozone Depleting Potential & Global Warming Potential**

Building services have an impact on the amount of damage done to the ozone layer from Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs). These substances are used as refrigerants and have been known to cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun.

The ODP data provides a measure of the potential for damage that a chemical has relative to that of the refrigerant type CFC11. CFC11 has an ODP of 1 and is the most damaging of the CFCs. The ODP is defined as the total change in ozone, per unit mass, when the substance has reached a steady state in the atmosphere. HCFCs are ozone-depleting but have a much lower ozone depletion potential than CFCs, and are considered a transitional chemical to aid the CFC phase out. They are commonly used as refrigerants, solvents, and blowing agents for plastic foam manufacture, and are scheduled to be completely phased out by 2030 according to the US Environmental Protection Agency and the Montreal Protocol.

The use of Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) as refrigerants has been addressed under the International Montreal Protocol, and subsequent phase-out programs have resulted in the removal of these substances from the market. However, the replacements currently favoured by the industry are Hydrofluorocarbons (HFCs) which have a high global warming potential (GWP).

The GWP provides a measure of the potential for damage that a chemical has relative to one unit of Carbon Dioxide, the primary greenhouse gas. Figures in excess of 3000 times are not uncommon amongst some refrigerants currently specified. Their long half-life is a major contributory factor in this.

Hydrocarbons and ammonia-based refrigerants have low or zero GWP. As such they are preferable long-term options. These refrigerants are gradually becoming available and are valid alternatives to HFCs.

Note that if using Ammonia refrigerant, a Health & Safety risk assessment must be carried out since it is corrosive and hazardous if released in large quantities. However, due to its pungent smell, leaks are normally detected before they reach hazardous concentrations.

Some insulants are manufactured with blowing agents that can cause long term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. Ozone depletion is measured as the Ozone Depleting Potential (ODP) of a product, and is dependent on its chlorine content, plus factors such as molecular durability.

Following the Montreal Protocol the production of CFCs are now banned. HCFCs are ozone-depleting but have a much lower ozone depletion potential than CFCs, and are considered a transitional chemical to aid the CFC phase out. CFCs are commonly used as refrigerants, solvents and blowing agents for plastic foam manufacture, and are scheduled to be phased out by 2020.

Emi-11 Atmospheric Deterioration AvoidancePOINTS
AVAILABLE**6**

Hydrofluorocarbons (HFCs), are used as blowing agents and have the advantage of being non-ozone-depleting (since they don't contain chlorine or bromine), but they are significant greenhouse gases. Most HFCs are also expensive to manufacture. An alternative is a hydrocarbon blowing agent, usually pentane.

Refrigerant Fugitive Emission Management

It is common practice during the maintenance of HVAC systems containing refrigerants to dispose of the refrigerants in the system, where an automatic system of refrigerant containment is not included in the system design. This large release of refrigerants to the atmosphere can cause significant environmental damage, particularly if the refrigerants have a high ozone depletion or global warming potential.

Refrigerants with an ozone depletion potential (ODP) of zero can still cause considerable damage to the environment in terms of accelerating global warming. The specification of automatic refrigerant pump down in addition to leak detection can further limit potential losses and damage to the environment, and can also have subsequent economic benefits to the building owner.

REFERENCES & FURTHER INFORMATION

Guidance note 1 New CFC's, HCFCs, HFC's and halons, Professional and practical guidance on substances that deplete the ozone layer, CIBSE, 2000.

Code of practice for the minimisation of refrigerant emissions from refrigerating systems, Institute of Refrigeration, Institute of Refrigeration, 1995.

Thermal Guidelines for Data Processing Environments, ASHRAE, 2004.

BS EN378-1:2000 Refrigerating systems and heat pumps – Safety and environmental requirements – Part 1: Basic requirements, definitions, classification and selection criteria, BSI, 2000.

Institute of Refrigeration
<http://www.ior.org.uk>

F-gas regulations
<http://ww2.defra.gov.uk/environment/quality/air/fgas/>

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), Refrigerant Selection Guide 2003. Melbourne.
<http://www.airah.org.au>

United Nations Environmental Program, Ozone Secretariat.
www.unep.org/ozone

US Environmental Protection Agency
<http://www.epa.gov/ozone/>

Emi-11 Atmospheric Deterioration Avoidance

POINTS
AVAILABLE

6

Innovation

POINTS
AVAILABLE

The Innovation Category is included within the Green Star SA – Public & Education Building v1 rating tool as a way of encouraging, recognising and rewarding the spread of innovative technologies, designs and processes for commercial building applications that impact upon environmental performance.

The Innovation category encourages the demonstration of efforts to apply sustainable development principles to the wider process of designing & procuring buildings (such as collaborative working practices), as well as any positive environmental influence brought to bear on the wider geographic area in which the project is located. These efforts are recognised over and above any credit obtained in other categories.

Innovation points are awarded at the discretion of the Green Building Council of South Africa. Any single initiative will only be awarded to three projects under the same rating tool (e.g. Public & Education Building) before no longer being considered 'innovative' and rewarded within this category; a database of innovative initiatives from certified projects will be accessible from the GBCSA website for projects to check before submission of documentation.

There is a maximum of five points available in total within the Innovation Category. By way of demonstration: It is possible for the same initiative to gain 4 points (a global 'first' innovation, resulting in a restorative environmental impact of greater than 5%) – note this by definition exceeds a current Green Star SA benchmark and hence cannot be outside the scope of the current Green Star SA tool. Thus it is not possible for a single initiative to obtain the full 5 points. It is possible for up to 5 initiatives to each gain a single point, for a total of 5 points within the category. These 5 initiatives could all be for eliminating the negative environmental impact targeted by an existing credit, for example. Combinations of initiatives are welcomed. A maximum of 5 initiatives can be used to claim the innovation credits, and the same initiative can be awarded in both Design and As Built certifications for the same project.

Inn-1 Innovative Strategies and TechnologiesPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise pioneering initiatives in sustainable design, process or advocacy.

CREDIT CRITERIA

Up to two points are awarded for an innovation initiative where:

- The initiative is a technology or process that is considered a 'first' in South Africa or in the World;

OR

- The project substantially contributes to the broader market transformation towards sustainable development in South Africa or in the World.

Points are awarded as follows:

- One point is awarded when either of the above is true for the South African market;

OR

- Two points are awarded when either of the above is true for the Global market

Up to five innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than two points in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is five (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report	1. Short report

Inn-1 Innovative Strategies and Technologies

POINTS
AVAILABLE**2**

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Articulating the nature and magnitude of the environmental benefit achieved by the initiative(s);
- Referencing evidence and calculations, wherever appropriate, that support all claims. and
- Including any evidence necessary to demonstrate that the innovation claimed is first in the world or in South Africa (must be in the form of extracts from a peer-reviewed publication or other research acknowledgement).

ADDITIONAL GUIDANCE

Innovation points are reviewed by the Assessors, awarded entirely at the discretion of the GBCSA, and any decision is final.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The report must distinctly justify (and quantify whenever relevant) the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data will not be awarded Innovation points.

In reviewing the submission, the Assessors and GBCSA will consider the environmental benefit of the innovative initiative relative to existing Green Star SA – Public & Education Building V1 credits where relevant.

The metric used to demonstrate environmental benefit must, where possible, be the same as the metrics used in Green Star SA.

Information provided within the Innovation Credit applications may be used by the GBCSA to review the existing credits and/or develop new credits.

BACKGROUND

Compared to peer nations in North America and Europe, less is spent on building research and innovation in South Africa. This credit recognises the value that changes in design and technology can have, in terms of increasing occupant comfort and safety, and consuming fewer resources, and aims to reward organisations that seek to improve the built environment in a unique way.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
<http://www.bre.co.uk/innovationden>

The South African Government Department of Environmental Affairs & Tourism
<http://www.environment.gov.za>

The South African Government Department of Science & Technology (Research & Development Tax incentives)
<http://www.dst.gov.za/r-d>

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
<http://www.earthlife.org.za/>

The Sustainable Energy Society Southern Africa
<http://www.sessa.org.za/>

Inn-2 Exceeding Green Star SA BenchmarksPOINTS
AVAILABLE**2****AIM OF CREDIT**

To encourage and recognise projects that achieve environmental benefits in excess of the current Green Star SA benchmarks.

CREDIT CRITERIA

Up to two points are awarded where there has been a substantial improvement on an existing Green Star SA credit, as follows:

- One point for a solution that results in the elimination of the specific negative environmental impact of the project targeted by an existing credit; and
- Two points for a solution that results in a substantial (e.g. 5% or greater above 'neutral') restorative environmental impact targeted by an existing credit.

Up to five innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than two points in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is five (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report	1. Short report

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative;
- Identifying the credit for which the project claims to exceed the Green Star SA benchmark;
- Substantiating why exceeding the top benchmark has a positive environmental impact;

Inn-2 Exceeding Green Star SA BenchmarksPOINTS
AVAILABLE**2**

- Quantifying, consistent with the approach of the credit with the initial benchmark, the margin by which the benchmark is exceeded; and
- Referencing evidence and calculations, wherever appropriate, that support all claims.

ADDITIONAL GUIDANCE

Innovation points are reviewed by the Assessors, awarded entirely at the discretion of the GBCSA, and any decision is final.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The reports must distinctly justify (and quantify whenever relevant) the environmental or advocacy benefits of the initiative. Submissions that are purely qualitative or unsupported by documented data will not be awarded Innovation points.

The metric used to demonstrate environmental benefit must, wherever possible, be the same metric as the one used in the Green Star SA – Public & Education Building V1 credit that is being exceeded. For example if the building significantly reduced potable water consumption the metric used would be 'in L/person/day'.

In reviewing the submission, the GBCSA will consider how many points are awarded for the credit being exceeded, the relative environmental benefits and relative score as compared to other Green Star SA – Public & Education Building V1 credits. Category environmental weightings will also be taken into account.

This innovation credit applies to:

- Existing Green Star SA credits with numeric benchmarks;
- Credits where the highest threshold within the credit is set below 95%; and
- Credits where exceeding the current Green Star SA benchmark would have an environmental benefit (e.g. a larger recycling waste storage area may not have additional benefit).

BACKGROUND

The Green Star SA benchmarks were in a large part based on the capacity for a four star Green Star SA certified rating to be achieved by buildings within the top 25% of the industry, based on environmental performance.

The Innovation Credit is therefore designed to encourage and recognise environmental initiatives which go beyond existing benchmarks.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
<http://www.bre.co.uk/innovationden>

The South African Government Department of Environmental Affairs & Tourism
<http://www.environment.gov.za>

The South African Government Department of Science & Technology (Research & Development Tax incentives)
<http://www.dst.gov.za/r-d>

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
<http://www.earthlife.org.za/>

The Sustainable Energy Society Southern Africa
<http://www.sessa.org.za/>

Inn-3 Environmental Design Initiatives

POINTS
AVAILABLE

1

AIM OF CREDIT

To encourage and recognise sustainable building initiatives that are currently outside of the scope of this Green Star SA rating tool but which have a substantial or significant environmental benefit.

CREDIT CRITERIA

One point is awarded where:

- An initiative in the project viably addresses a valid environmental concern outside of the current scope of this Green Star SA tool.

Up to five innovation initiatives can be awarded points under this credit, but no individual initiative can achieve more than one point in this credit. Qualifying initiatives may achieve additional points in other Innovation Credits, however the maximum points available for any one building assessment under Inn-1, Inn-2 and Inn-3 is five (in total).

DOCUMENTATION REQUIREMENTS

Green Star SA – Public & Education Building v1 Design	Green Star SA – Public & Education Building v1 As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
1. Short report	1. Short report

Short report prepared by a suitably qualified professional which describes how the Credit Criteria have been met by:

- Including a detailed description of each innovation initiative and proposed credit;
- Demonstrating that the proposed credit requirements have been met by the project;
- Justifying how this credit would be different to other existing Green Star SA credits, and why it deserves to be included in Green Star SA;
- Articulating the nature and quantifying the environmental benefit achieved by the initiative(s);

Inn-3 Environmental Design Initiatives

POINTS
AVAILABLE**1**

- Referencing evidence and calculations, wherever appropriate, that support all claims; and
- Following the format set out in the Green Star SA credits to:
 - Identify the category that would hold this credit;
 - Propose the Aim of the Credit; and
 - Establish Credit Criteria and outline Documentation Requirements, based on research and comparison with other credits within that category, which would be sufficient for demonstrating compliance.

ADDITIONAL GUIDANCE

Innovation points are reviewed by the Assessors, awarded entirely at the discretion of the GBCSA, and any decision is final.

The significance of the environmental benefit of the nominated innovation must be calculated and clearly conveyed in the submission. This credit is aimed at initiatives that provide an environmental benefit and have not been addressed by existing Green Star SA – Public & Education Building V1 Credit Criteria.

An Innovation submission must be a concise report that clearly articulates the nature and magnitude of the environmental benefit achieved by proposed initiative(s). The reports must distinctly justify (and quantify whenever relevant) the environmental benefits of the initiative.

In essence, the report for this credit must advocate that the initiative(s) claimed for this credit be addressed by a new credit within Green Star SA.

It must be demonstrated that there is a quantified significant environmental benefit associated with the nominated innovation initiative and that it is clearly documented and integrated into the project.

Where this credit is claimed, projects must justify how this innovation initiative differs from other existing Green Star SA credits, and why it deserves to be included in Green Star SA. To do this, the initiative must meet the following criteria, at a minimum:

- Address a valid environmental concern;
- Be at or beyond 'best practice' for the current South African context;
- Be quantifiable and capable of being assessed without subjective interpretation;
- Be related to attributes, not operations; and
- Be robust.

Inn-3 Environmental Design Initiatives

POINTS
AVAILABLE**1**

BACKGROUND

All Green Star SA rating tools recognise initiatives that have the potential to reduce the environmental impact of the development. Some project initiatives will provide significant environmental benefits that are not currently addressed by Green Star SA – Public & Education Building V1 credits.

This credit is designed to recognise such innovative initiatives.

REFERENCES & FURTHER INFORMATION

The Building Research Establishment Innovation Den
<http://www.bre.co.uk/innovationden>

The South African Government Department of Environmental Affairs & Tourism
<http://www.environment.gov.za>

The South African Government Department of Science & Technology (Research & Development Tax incentives)
<http://www.dst.gov.za/r-d>

The Council for Scientific & Industrial Research
http://www.csir.co.za/Built_environment/

Earthlife Africa
<http://www.earthlife.org.za/>

The Sustainable Energy Society Southern Africa
<http://www.sessa.org.za/>

APPENDIX A – Weightings

A rating tool that provides a single score must include some assumptions regarding the relative importance or environmental impact of different building features. Green Star SA uses the framework adopted by Green Star Australia which in turn is used by BREEAM (Building Research Establishment's Environmental Assessment Method) to provide more flexibility in the approach to weightings by providing a two-tiered weighting structure as follows:

- Each credit category (e.g. Energy, Indoor Environment Quality etc.) has an environmental weighting
- The number of points allocated to each issue (e.g. daylight and noise in IEQ category) is effectively a weighting among issues within the credit category.

This approach also means that if a credit is deemed to be 'not applicable' to a particular project, the credit can simply be removed from the scoring.

CATEGORY WEIGHTING

The Green Building Council of Australia (GBCA) investigated the weightings used by LEED and BREEAM and conducted their own national survey in the formulation of Green Star's initial weightings.

In South Africa, the weightings were derived through consultation with industry experts considering the South African Office Tool weightings and deliberating on the relative importance of issues in the South African public building context.

The following table summarises the weightings for the South African Office and South African Public & Education Building V1 tools.

	South African Green Star SA – Office v1	South African Green Star SA – Public & Education Building V1
Management	9	11
Indoor Environment Quality	15	15
Energy	25	25
Transport	9	11
Water	14	12
Materials	13	12
Ecology	7	7
Emissions	8	7
	100	100

Table App-A.1: Comparison of Weightings with different Environmental Rating tools