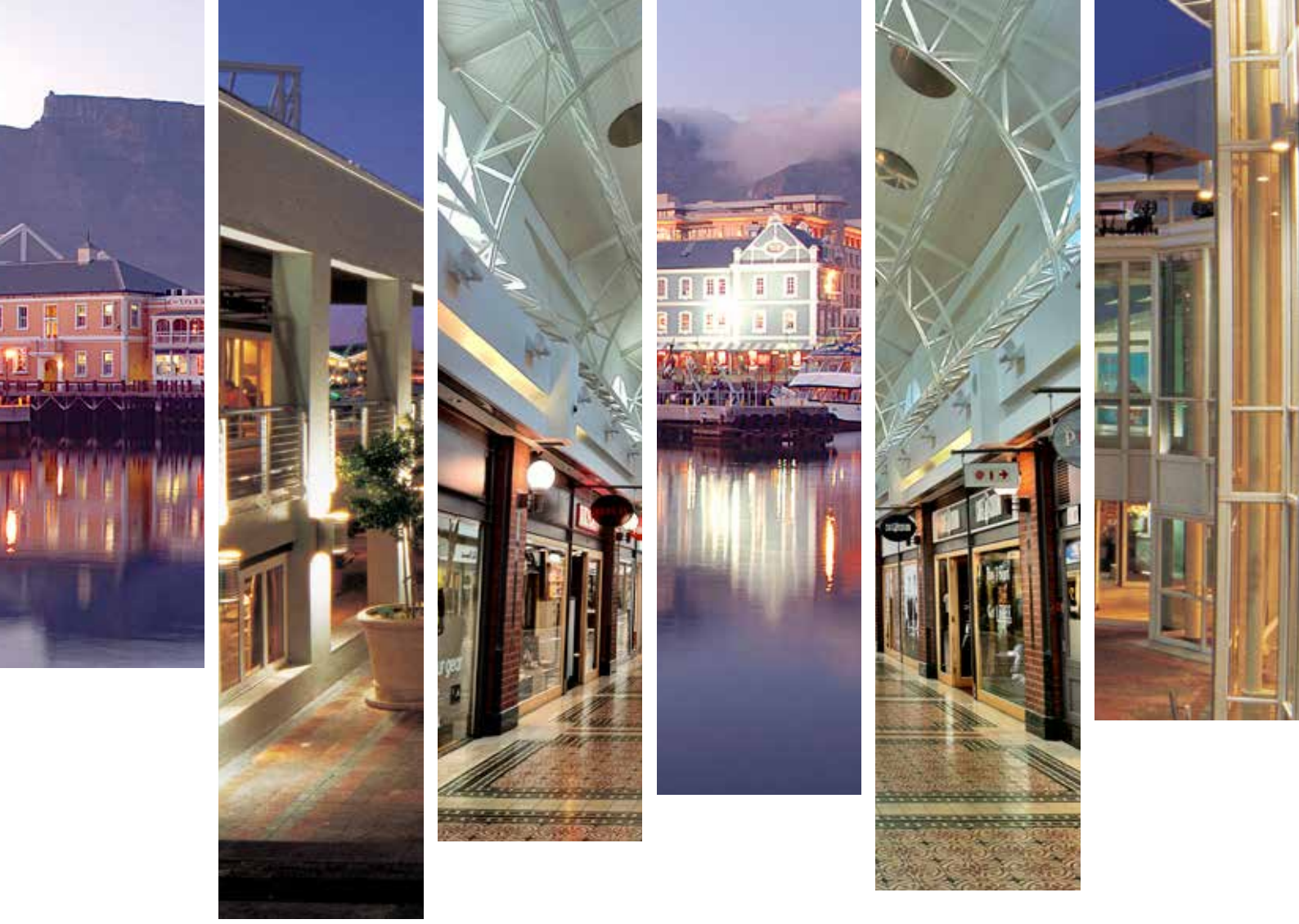

TECHNICAL MANUAL GREEN STAR SA

RETAIL CENTRE v1

Retail Centre Design / As Built v1

GREEN BUILDING COUNCIL SA

greenstar
Retail Centre v1
★★★★★★
GREEN BUILDING COUNCIL OF SOUTH AFRICA

On the cover: Victoria & Alfred Waterfront, Cape Town, South Africa
Images Courtesy of the Victoria & Alfred Waterfront

Green Building Council of South Africa
Green Star SA – Retail Centre Design & Retail Centre – As Built v1 2010
Technical Manual
First Edition April 2010

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Green Building Council of South Africa

TECHNICAL MANUAL GREEN STAR SA RETAIL CENTRE DESIGN & RETAIL CENTRE AS BUILT VERSION 1 2010

Table of Contents

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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The application of this Technical Manual to all Eligible Projects is encouraged to assess and improve their environmental attributes. No fee is payable to the GBCSA for such use of this Technical Manual. The GBCSA offers a formal certification process whereby persons may apply for a particular design or building to be assessed for compliance with the criteria specified in this Technical Manual upon payment of the relevant fee and execution of the required documentation by the applicant. The assessment of such compliance is carried out by the Assessors, and applicants are required to demonstrate achievement of all relevant credits by the provision of relevant documentary evidence. Only designs or buildings which achieve a Green Star SA rating of four or more stars entitle the applicant to use and display the 'Green Star SA™' trademark and to refer to the relevant Green Star SA rating. Any use of this Technical Manual other than in accordance with this procedure does not entitle the user or any other party to promote any rating applied for or achieved using this Technical Manual.

You are only authorised to proceed to use this Technical Manual on this basis.

Acknowledgements

GREEN STAR SA – RETAIL CENTRE V1

The Green Star SA – Retail Centre v1 rating tool provides for both Green Star SA – Retail Centre Design and Green Star SA – Retail Centre As Built ratings, through separate documentation paths. The tool has been adapted from the Australian Green Star – Retail Centre v1 tool and the South African Green Star SA – Office v1 tool, under license from the Green Building Council of Australia and the Green Building Council of South Africa. 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 – Retail Centre v1 rating tool.

SPONSORSHIP

Green Star SA - Retail Centre v1 tool sponsors South African Cities Network, Swiss Agency for Development and Cooperation, Liberty Properties and Pareto Limited provided much-needed financial support to develop the rating tool.

South African CitiesNetwork

LIBERTY PROPERTIES

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Pareto LIMITED

SUPPORT

The Green Building Council of South Africa acknowledges the tremendous support of the Green Building Council of Australia in providing their Green Star intellectual property and assisting the GBCSA in adapting it for the South African market. The GBCSA would particularly like to thank CEO Romily Madew, Green Star Executive Director Robin Mellon, Green Star Director Andrew Aitken and Technical Coordinator Adrienne Burega.

ADDITIONAL EXPERTISE

The GBCSA also thanks all the individuals and organisations who provided feedback and expertise to the technical development of the Green Star SA – Retail Centre v1 rating tool and Technical Manual. Their advice and guidance is greatly appreciated.

The following individuals deserve special acknowledgement:

Acknowledgements

Tool Development Consultant

Michelle Malanca - Michelle Malanca Sustainability Consulting

Technical Working Group Members

Gary Abrahamson – Standard Electric

Imraan Baatjies - Triocon Consulting

Greg Branfield – ERM Environmental Resources Management

Paul Cosgrove – Arup

Chris Davey - Old Mutual Investment Group Property Investments

Douw de Kock - Broll Property Group

Johan de Wet - Boogertman & Partners

Freek Eefting - Liberty Properties

Tom Esterhuizen - Tom Esterhuizen & Associates

Lee-Anne Fletcher – Bentel Associates

Jeremy Gibberd – Gauge, CSIR

Francois Joubert – Joubert Dekker Greenbuild Consultants

Donia Kamstra – Profica

Andy Kopelowitz – Arup

Melisa Lachenicht - Ezendalo Environmental Solutions

Michelle Ludwig – PJ Carew Consulting

Grant Ramsay - Group 5

Lisa Reynolds - Saint Gobain Construction Products

Sizo Sebake – CSIR

Errol Taylor – Growthpoint Properties

Tinus van der Westhuizen - Stauch Voster Architects

Carel van Graan - Pick n'Pay

Karen van Helsdingen - Organicarbon

Gerrit Venter - Jeffares & Green Consulting Engineers

Jonathan Yach - Colliers International

Acknowledgements

Technical Consultant, WSP Group Africa

With special thanks to Manfred Braune, Sean Doel, Grant Duncan, Dave Fleming, Warren Gray, Alison Groves, Graeme Page, Richard Palmer, Marloes Reinink, Harm Schreurs, Tex Westgate and Eden Wildy.

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Technical content and support provided by:

green building council australia

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.

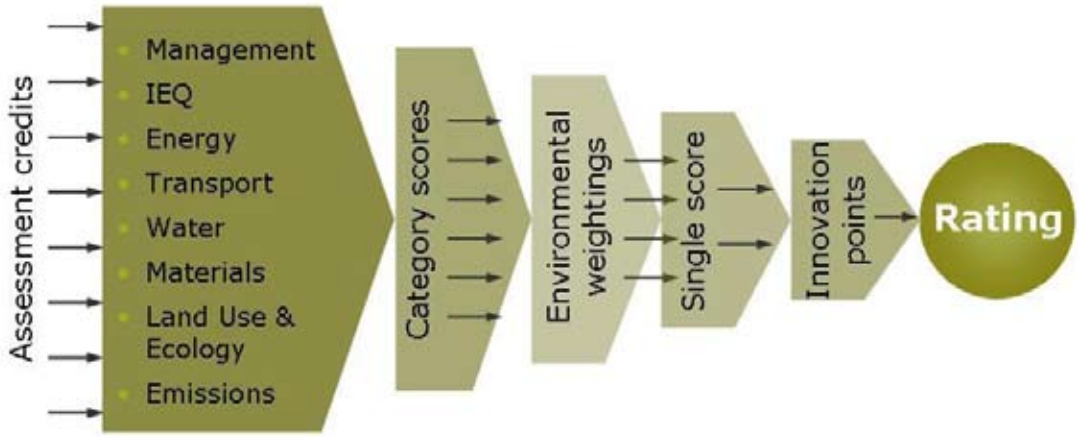

***Figure 1**: Structure of the Green Star SA rating system*

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[1].

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%.

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:

Weighted Category Score = Category Score (%) x Weighting Factor (%) x 100.

Using the example provided in the Category Score section above, the Weighted Category Score for Energy, with a weighting factor of 25%, is 0.38 x 0.25 x 100 = 9.5.

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.

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

[1] NOTE: 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.

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 – Retail Centre, 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 – Retail Centre Rating Tool

Green Star SA – Retail Centre validates the environmental initiatives of the design phase of new retail centre construction or base building refurbishment; or construction and procurement phase of a retail centre building.

Green Star SA – Retail Centre 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 enable the building to be better managed during operation);
- 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 retail centre development or base building refurbishment. The same Green Star SA - Retail Centre tool is used for both Design and As Built certifications, but different documentation is required by the project team. The Green Star SA – Retail Centre 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. Green Star SA – Retail Centre 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 the Green Star SA – Retail Centre Design and the Green Star SA – Retail Centre As Built is that the documentation required to verify environmental initiatives varies depending on whether the building is at the design phase or has been built/refurbished.

Green Star SA – Retail Centre addresses both the Green Star SA – Retail Centre Design and Green Star SA – Retail Centre As Built certification in one Technical Manual.

ASSESSMENT CREDITS

Green Star SA – Retail Centre 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;
- Background; and
- References.

Green Star SA – Retail Centre Rating Tool

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 can not be addressed and are not applicable to the project.

For example, a naturally ventilated building may have no need for refrigerants. In this case, it would be impossible to demonstrate that the building allows for an automatic refrigerant recovery system. In this instance, points awarded for including an automatic refrigerant recovery system would not be available to the project and would not contribute to the overall project weighted score.

CONDITIONAL REQUIREMENTS

Green Star SA – Retail Centre v1 has two criteria that must be achieved (known as 'Conditional Requirements') in order to obtain a Green Star SA – Retail Centre v1 Certified Rating. The Conditional Requirements fall within the Energy and Land Use and 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 – Retail Centre 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 design, project or building cannot publicly claim a Green Star SA rating unless the GBCSA has certified the rating. The GBCSA will commission one or more 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 – Retail Centre 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 all four provisions of the Green Star SA Eligibility Criteria detailed below.

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 (such as electrical, HVAC plant, water treatment etc.) or amenities (waste rooms, bicycle facilities, car parks etc.) 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 public infrastructure (e.g. transport hubs); 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).
- Multiple building developments (See 'Options for Multiple-Building Developments' 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.
2. The building extension is rated separately and will receive a Green Star SA – Retail Centre v1 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 — Retail Centre v1 BUILDING EXTENSION), and will not extend to the remainder of the building or any part thereof.
   - 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:

a. The extension has full functional independence from the initial building;

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

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

d. 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;

e. 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;

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

g. 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 1,000m^2 GFA.

Options for Multiple-Building Developments:

It is recognised that developments are commonly 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.

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

h. It consists of buildings individually eligible for assessment under the same Green Star SA tool;

i. It is under one ownership OR under single property management and control;

j. It is recognised by a distinct name;

k. It represents one project scope (even if buildings within that scope are completed at different times); and

l. 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 their website.

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:

Green Star SA Certification

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 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.

Green Star SA Certification

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

Retail centres with a minimum of 80% of GFA (measured to exclude internal car parks) comprised of retail usage (SABS 0400 occupancy class F1, F2 or F3) are eligible for assessment under Green Star SA – Retail Centre.

For the purposes of South Africa retail centres, the following SAPOA definitions shall be used as well as those defined in the glossary (GFA & UA):

- Rentable Area – The area dedicated to the use of the tenant (SAPOA clause 2.2.3)
- Primary Common Area – All building area that is not rentable area (SAPOA clause 2.2.5)
- Retail Area – Space containing shop units for the purpose of selling goods and services directly to the general public (SAPOA clause 2.3.1)

Retail centres with a minimum of 80% of the GFA classified as Retail space including Primary Common Area dedicated to the Retail space (as per the SAPOA definitions above) are eligible for a Green Star SA – Retail Centre v1 assessment.

For the purposes of this tool, retail centres are considered to be centres that include:

- More than one retail business/tenant;
- Common mall area(s); and
- Shared building infrastructure among tenancies

Retail tenancies and tenant fitouts are not eligible for assessment under Green Star SA - Retail Centre. Stand alone retail premises are also not eligible for assessment.

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 – Retail v1:

- Ene – 0 Conditional Requirement

  Refer to the energy category further details.

- Eco – 0 Conditional Requirement

  Refer to the Land Use and Ecology category for further details.

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.

CERTIFICATION PROCESS

Up to date information on the certification process is outlined in detail on the GBCSA website: http://www.gbcsa.org.za. Templates, forms and checklists are available on this website to guide projects through the process.

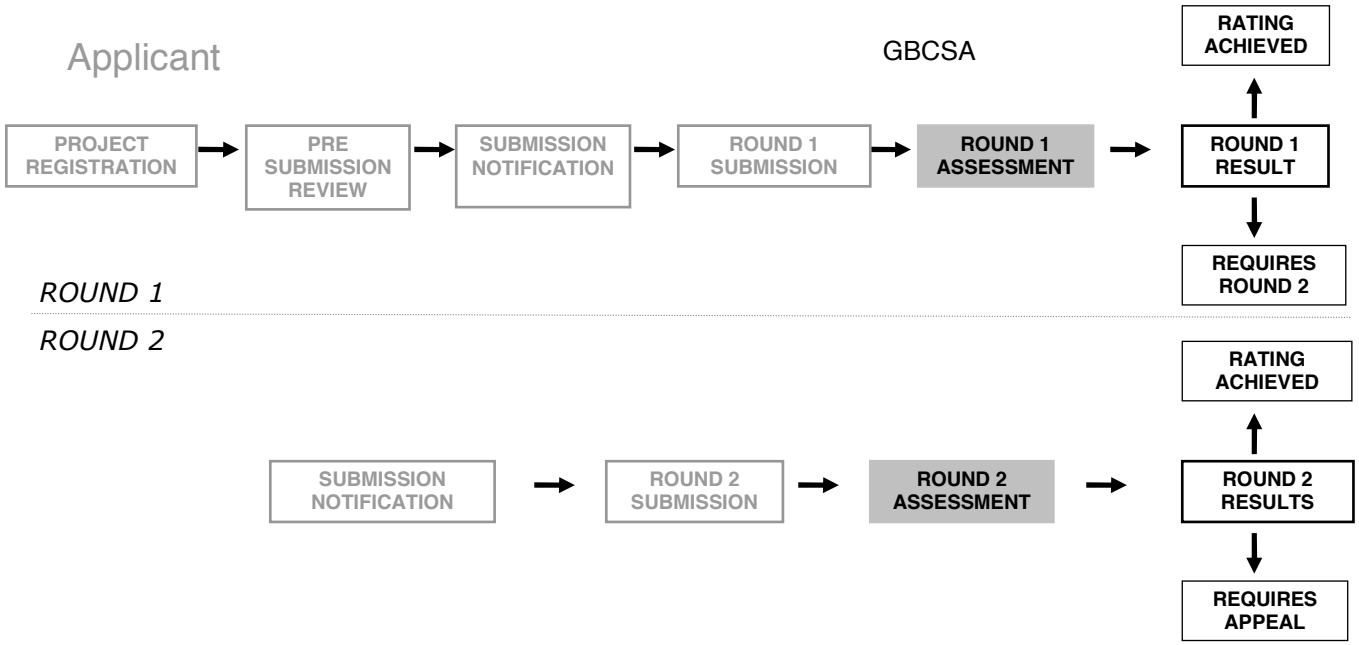

Figure 2: *Overview of certification process*

Registration

Registering a building project with the Green Building Council of South Africa 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) must be received by the GBCSA to finalise a project's registration. Details of the Certification

Green Star SA Certification

Fees can be found on the GBCSA website www.gbcsa.org.za. (Part two of the certification fee – the other 50% - is due when the project submits for certification.)

Please Note: 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 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 – Retail Centre v1 Technical Manual as there are only two rounds of Assessment and one opportunity for resubmission (Appeal) available.

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

To ensure receipt of the Round 1 assessment results within six weeks of the submission date, the project contact must inform the GBCSA of the date of submission at least two weeks prior to the anticipated submission date (see notification form on the GBCSA website). Due to the costs associated of arranging an Assessment Panel, any late submissions are subject to a minimum penalty fee of R 1000. Once an initial submission date has been forfeited, a new date must be scheduled with the GBCSA. The same conditions apply to the revised date.

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

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

The GBCSA reserves the right to conduct a pre-assessment review of a project submission prior to the commissioning of a review by the Assessors. A project may be required to resubmit if the pre-assessment review suggests that the quality of the submission would result in an excessive number of credits denied or credits 'To Be Confirmed'. There is no fee associated with this additional pre-assessment.

Round 1 Assessment

The Assessment Panel, containing one or more third-party Assessors and an Independent Chair, 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.

To ensure receipt of the Round 2 assessment results within four weeks of submission, the project contact must inform the GBCSA of the date of submission at least two weeks prior to submission (see notification form and any templates on the GBCSA website). Due to cost of arranging an Assessment Panel, late submissions are subject to a minimum penalty fee of R 1000.

Projects must also provide the 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 via an award letter.

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 see the GBCSA website 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 http://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.

Updating Green Star SA – Retail Centre

Green Star SA – Retail 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 – Retail Centre 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 (e.g. electro-magnetic radiation); 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 – RETAIL CENTRE V1

Ongoing Feedback

The GBCSA encourages feedback on all Green Star SA rating tools, including Green Star SA – Retail Centre 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 a one day 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 Solar Strategies
Mechanisms, such as photovoltaics, which are designed to actively collect the energy of sunlight and use it.*

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.*

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.

Building
The base building development seeking Green Star SA certification.

Glossary

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 (CO_2)
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.*

Computational Fluid Dynamics (CFD)
Numerical analysis of problems involving 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.

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 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.

Glossary

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.

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.

Contract Value
The 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 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 Retail Centre v1 tool the contract value excludes tenant allowances, even if these form part of the contract value.

Contractor
The main contractor or builder engaged to construct or refurbish the building.

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.

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

CSIRO
Australian Commonwealth Scientific and Research Organization – See http://www.csiro.au.

Credit Interpretation Request (CIR)
CIRs 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.

Glossary

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.

DEAT
South Africa Department of Water and Environmental Affairs – See http://www.deat.gov.za.

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.*

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

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.

DOH
South Africa Department of Health – See http://www.doh.gov.za.

DOT
South Africa Department of Transport – See http://www.dot.gov.za.

DWAF
South Africa Department of Water Affairs – See http://www.dwaf.gov.za.

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.*

Eligible Project

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

Embodied Energy
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.*

Glossary

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 (ETS)
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

FFL
Finished Floor Level.

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

FSC
Forest Stewardship Council – See http://www.fsc.org.

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

GFA
See Gross Floor Area.

Global Warming Potential (GWP)
GWP 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 Green Building 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.

Glossary

Green Building Council of South Africa (GBCSA)
The GBCSA is 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.*

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

Greywater
Waste water recovered from sinks, 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.

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. For the purposes of the Green Star SA submission, Gross Floor Area should be calculated as the building Construction Area (using SAPOA definition 1st Aug 2005) less the area of car parking.

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.*

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

Glossary

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.*

High Density Poly Ethylene Plastic (HDPE)
HDPE is 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.

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).

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.

Glossary

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. See http://www.ipcc.ch.

Interdependent Projects
Projects that share services and amenities.

IPCC
See Intergovernmental Panel on Climate Change.

ISO 14001:2004
An international standard which specifies requirements for an Environmental Management System (EMS).

Kyoto Protocol
The Kyoto Protocol is 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.

Life Cycle of a Product
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.

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

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.

Glossary

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'.

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
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 definition of the nominated area.

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.*

O&M Manual
Operations and Maintenance Manual.

ODP
See Ozone Depleting Potential.

OHS
Occupational Health and Safety.

Glossary

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 (ODP)
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 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.

Post-Consumer Recycled Content
A product composition that contains some percentage of material diverted from the product user's waste stream.

Glossary

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.

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).

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

Project/Contract 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
Polyvinyl chloride. 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.

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

Glossary

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.*

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 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.

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).*

Riparian Buffer Zone (RBZ)
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

Glossary

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.

Shell and Core
A shell and core installation includes finishes and fitout to common areas only with services capped off within the riser at each floor and tenant areas left as a structural shell.

Sick Building Syndrome (SBS)
(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.*

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).*

SRI
See Solar Reflectance Index

Standard Hours of Occupancy
8am to 6pm, Monday to Friday.

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

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

Glossary

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.

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).

UA
See Usable Area.

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

Usable Area (UA)
The floor area capable of exclusive occupation by the tenant (refer SAPOA definition 1st Aug 2005). Consists of the total area of the building enclosed by the Dominant face, adjusted by deducting all Common Areas and Major Vertical Penetrations. No deductions shall be made for columns.

VAV systems
Variable Air Volume air conditioning systems.

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

Virgin materials
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
Visual Light Transmittance, which refers to the amount of visual light a material allows to be transferred through itself.

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).

Glossary

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 Garden
A water-conserving garden or garden 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 garden 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).

A guide to the reader of the Technical Manual

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. This section is divided in two areas: project performance requirements and submission guidelines.

All projects must meet the performance and 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 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 as well as the general guidelines outlined in the Submission Requirements section on the GBCSA website. 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. Where applicable, 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 science and research; some of this research is provided as reference material in this section. The GBCSA recommends reading more about the issues in the credits; several interesting suggestions for further reading are provided in this section.

Credit Summary Table

CATEGORY	TITLE	CREDIT NO.	POINTS AVAILABLE
Management			
	Green Star SA Accredited Professional	Man - 1	2
	Commissioning Clauses	Man - 2	2
	Building Tuning	Man - 3	2
	Independent Commissioning Agent	Man - 4	1
	Building Guides	Man - 5	2
	Environmental Management	Man - 6	2
	Waste Management	Man - 7	3
	Waste and Recycling Management Plan	Man - 9	1
	Building Management Systems	Man - 10	1
	Green Lease	Man - 11	1
		TOTAL	**17**
Indoor Environment Quality			
	Ventilation Rates	IEQ - 1	3
	Air Change Effectiveness	IEQ - 2	2
	Carbon Dioxide Monitoring and Control	IEQ - 3	1
	Daylight	IEQ - 4	2
	Thermal Comfort	IEQ - 9	2
	Hazardous Materials	IEQ - 11	1
	Internal Noise Levels	IEQ - 12	1
	Volatile Organic Compounds	IEQ - 13	2
	Formaldehyde Minimisation	IEQ - 14	1
	Mould Prevention	IEQ - 15	1
	Places of Respite and Connection to Nature	IEQ - 18	1
		TOTAL	**17**
Energy			
	Conditional Requirement	Ene - 0	0
	Greenhouse Gas Emissions	Ene - 1	20
	Electrical Energy Sub-metering	Ene - 2	2
	Maximum Electrical Demand Reduction	Ene - 5	3
	Thermal Energy Sub-metering	Ene - 6	1
		TOTAL	**26**
Transport			
	Provision of Car Parking	Tra - 1	2
	Fuel-Efficient Transport	Tra - 2	1
	Cyclist Facilities	Tra - 3	3
	Commuting Mass Transport	Tra - 4	6
	Trip Reduction - Mixed-Use	Tra - 6	1
	Vehicle Operating Emissions	Tra - 7	2
		TOTAL	**15**

Credit Summary Table

Water			
	Occupant Amenity Water	Wat - 1	5
	Water Meters	Wat - 2	3
	Landscape Irrigation	Wat - 3	3
	Heat Rejection Water	Wat - 4	4
	Fire System Water Consumption	Wat - 5	1
		TOTAL	**16**
Materials			
	Recycling Waste Storage	Mat - 1	2
	Building Reuse	Mat - 2	5
	Recycled Content and Re-used Materials	Mat - 3	3
	Concrete	Mat - 5	3
	Steel	Mat - 6	3
	PVC Minimisation	Mat - 7	1
	Sustainable Timber	Mat - 8	2
	Design for Disassembly	Mat - 9	1
	Dematerialisation	Mat - 10	1
	Local Sourcing	Mat - 11	2
		TOTAL	**23**
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
		TOTAL	**11**
Emissions			
	Refrigerant / Gaseous ODP	Emi - 1	1
	Refrigerant GWP	Emi - 2	2
	Refrigerant Leaks	Emi - 3	2
	Insulant ODP	Emi - 4	1
	Watercourse Pollution	Emi - 5	3
	Discharge to Sewer	Emi - 6	5
	Light Pollution	Emi - 7	1
	Legionella	Emi - 8	1
	Boiler and Generator Emissions	Emi - 9	1
	Kitchen Exhaust Emissions	Emi - 10	1
		TOTAL	**18**
Innovation			
	Innovative Strategies & Technologies	Inn-1	2
	Exceeding Green Star SA Benchmarks	Inn-2	2
	Environmental Design Initiatives	Inn-3	1
		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 Professional

POINTS 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 principal participant in 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.

If the schematic design phase of the project was begun prior to 1 June, 2009, this credit may be marked 'Not Applicable' and be excluded from the points available, used to calculate the Management Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Proof of accreditation • Letter of appointment • Signed statement of involvement	• Proof of accreditation • Letter of appointment • Signed statement of involvement

Proof of Accreditation:

- 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, signed and dated by the project's Green Star SA Accredited Professional, with his/her name underlined.

Man-1 Green Star SA Accredited Professional

POINTS AVAILABLE 2

Letter of Appointment for the Green Star SA Accredited Professional, listing his or her scope of works.

Signed Statement of Involvement from the Green Star SA Accredited Professional stating that he or she has attended at least 50% of all project design meetings and 75% of all building services meetings.

ADDITIONAL GUIDANCE

To be deemed 'engaged', in line with the Aim of Credit, the Green Star SA Accredited Professional must contribute substantially, i.e. attend at least 50% of all project design meetings and 75% of all building services meetings.

Should the role of the Green Star SA Accredited Professional be fulfilled by different individuals throughout the project, the evidence listed under Documentation Requirements must be submitted for each Accredited Professional. As the value to the project must not be compromised by the handover, projects must also provide a description of the handover procedures for the roles of the initial Green Star SA Accredited Professional on the 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 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 Clauses

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 it is demonstrated that:

- Comprehensive pre-commissioning, commissioning and quality monitoring are contractually required to be performed for all building services (BMS, mechanical, electrical, hydraulic, and fire); 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.

An additional point is awarded where it is demonstrated that:

- The point above is achieved; and
- The design team and contractor are in a position to transfer project knowledge to the building owner/manager through all of the following:
  - Documented design intent;
  - As built drawings;
  - Operations and Maintenance Manual;
  - Commissioning Report; and
  - Training of building management staff.

Man-2 Commissioning Clauses

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Short report • Extract(s) from the specification(s) (1) • Project timeline/programme Where the additional point is claimed: • Short report • Extract(s) from the specification(s) (2)	Submit all the evidence and ensure it readily confirms compliance. • Short report • Extract(s) from the Commissioning Record(s) Where the additional point is claimed: • Short report • Confirmation from building owner • Details of training provided

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

- Identifying and describing each system that is to be pre-commissioned, commissioned and monitored;
- A simplified diagram of each system; and
- A description of its intended function, operation and conditions.

Where the additional point is claimed the short report must also include:

- An outline of the design intent: a description of initiatives intended to enhance energy efficient, minimise greenhouse gas emission, conserve water, improve indoor environment quality, etc. (The Man-5 Building Users' Guide section on 'Energy & Environmental Strategy' would satisfy this requirement);
- Energy & Environmental Strategy – Description of the building initiatives intended to enhance energy efficiency and minimise greenhouse gas emissions; and
- Building Services – description of basic function and operation of the following systems: ventilation, heating system, cooling system, electrical system, lighting and domestic hot water.

Extract(s) from the specification(s) (1) stipulating 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.

Man-2 Commissioning Clauses

POINTS AVAILABLE 2

Project timeline/programme demonstrating the inclusion of a commissioning period and relevant milestones, as well as their impact on the rest of the project activities. This is to try to avoid situations where the commissioning period is 'lost' in the rush to handover the building to the client.

Extract(s) from the specification(s) (2)

The specification must list the contractor's requirement to provide the owner with the following at building handover:

- Documented design intent;
- As built drawings;
- Operations and Maintenance Manual;
- Commissioning Report; and
- Training of building management staff.

Extract(s) from the Commissioning Record(s)

- Must demonstrate compliance for each relevant system that pre-commissioning, commissioning and quality monitoring were in exact accordance with CIBSE Commissioning Codes, or alternatively ASHRAE Guideline 1-1996 - The HVAC Commissioning Process for the mechanical services;
- Must include commissioning dates, records of all functional/commissioning testing undertaken, list any future seasonal testing, and include a written list of outstanding commissioning issues; and
- Must include the outcomes and changes made to the building as a result of the commissioning process, accounting for all of the recommendations.

Confirmation from the building owner stating that project knowledge was transferred to the building owner as per the documented design for each relevant system through:

- Documented design intent;
- As built drawings;
- Operations and Maintenance Manuals; and
- Commissioning Reports.

Evidence of document transmittals for each relevant document is to be demonstrated.

Details of training provided

Confirmation that sufficient training is or will be provided to each relevant system to ensure that the building managers or 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 control set up, programming, alarms and troubleshooting;
- Review of O&M Manuals;
- 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
- Obtaining and addressing occupant satisfaction feedback.

ADDITIONAL GUIDANCE

Where appropriate information transferred to the building owner may be in the form of a comprehensive Building Users Guide (see MAN-05 Building Guides)

Whilst this is not required by the referenced standards, project teams are strongly encouraged to consider the implications of commissioning on indoor air quality, e.g. through establishing an indoor air quality commissioning plan at the design stage with specific provisions for ensuring that this plan is met during and after commissioning.

Systems which are not specifically dealt with by individual CIBSE codes must still comply with CIBSE Commissioning Code M: Commissioning Management.

BACKGROUND

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.

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.

Man-2 Commissioning Clauses

POINTS AVAILABLE 2

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 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.

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.

Man-2 Commissioning Clauses

POINTS AVAILABLE 2

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 and energy efficient services performance throughout the year.

CREDIT CRITERIA

Two points are awarded where:

- After handover, the building owner implements tuning of all building systems;
- A relevant member of the design team is involved in the tuning process;
- Monthly monitoring is undertaken and the outcomes are reported to the building owner quarterly to allow corrective action to be taken;
- Full re-commissioning is undertaken 12 months after practical completion; and
- A Building Tuning Report on the outcomes of the tuning process will be provided to the building owner and made available to the design team.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Extract(s) from the specification(s) • Project timeline/programme	• Building tuning contract with contractor • Building tuning contract with relevant design team member

Extract(s) from the specification(s)

- Including a requirement for a minimum 12-month tuning process which includes no less than monthly monitoring, quarterly reviews and reporting, and a full re-commissioning service carried out 12 months after practical completion in accordance with design intent documentation from the design team, with a Building Tuning Report generated for the building owner; and
- Listing the roles and responsibilities of the various parties to be involved during this period.

Project timeline/programme

Demonstration of the inclusion of the building tuning period and milestones in the project timeline, and/or specifying dates for the monitoring and re-commissioning works.

Building tuning contract with the contractor must:

- Show the scope, timeframe, milestones, and deliverables of the building tuning process;
- Be signed by the building owner and the contractor; and
- Stipulate that a Building Tuning Report be generated by the building tuning team once the building tuning process has been finalised. This report must be reviewed by the relevant design team member and must subsequently be made available to the building owner and other project team members.

Building tuning contract with the relevant design team member

Stipulating that the design team member is required to review the Building Tuning Report as generated by the building tuning team.

ADDITIONAL GUIDANCE

This credit applies to all building systems, and not just mechanical systems. This includes, but is not limited to, ventilation, heating, cooling, electrical, lighting, domestic hot water systems and on-site recycled water systems (black, grey and rain water). This credit does not include fire and vertical transportation services.

The building tuning process must include:

- 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.

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.

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.

Man-3 Building Tuning

POINTS AVAILABLE 2

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 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.

The benefits of a 12-month commissioning period include:

- Verifying that systems are performing at their optimum efficiency during all climatic variations for the occupied building;
- Having an opportunity for the systems to be tuned to optimise time schedules to best match occupant needs and system performance; and
- Aligning a system's operations to the attributes of the built space it serves.

REFERENCES & FURTHER INFORMATION

Refer to Man-2 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 Agent

POINTS AVAILABLE 1

AIM OF CREDIT

To ensure buildings are designed with regard to future maintenance and are correctly commissioned before handover.

CREDIT CRITERIA

One point is awarded where an experienced person not part of the normal design team has been appointed to:

- Provide independent advice on commissioning & maintenance issues to the building owner and the design team;
- Produce input at preliminary design stage covering commissioning, maintenance and replacement of building services;
- Produce a short guide to commissioning/maintenance at detailed design stage, highlighting access issues and replacement of plant; and
- Monitor and verify the commissioning of all building systems.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• CV of the Independent Agent • Preliminary design stage input • Short guide to maintenance/ commissioning	• CV of the Independent Agent • Proof of Agent's involvement in project • Extracts from Commissioning report

CV of the Independent Agent

- Detailing the qualifications and experience relevant to the project.

Man-4 Independent Commissioning Agent

POINTS AVAILABLE 1

Preliminary design stage input from the Independent Agent. This could take the form of a short report or notes or comments on drawings if appropriate. Input must cover the following:

- Installation and replacement of large items of plant where this is not straightforward;
- Access provision to allow safe maintenance of plant, especially where roof mounted plant is envisaged; and
- Any unusual commissioning requirements.

Short guide to maintenance/commissioning written by the Independent Agent and covering the following topics:

- Installation and replacement of large items of plant;
- Access provision to allow safe maintenance of plant, especially where roof mounted plant is envisaged; and
- Commissioning requirements for the project.

Proof of the Independent Agent's involvement in the project could take the form of the 'preliminary design stage report' (see above) provided this is written by the Independent Agent. Alternatively the demonstration of the agent's involvement in meetings early on in the design process through the provision of copies of meeting minutes and attendees; or a list of correspondence and reporting provided by the Independent Agent to the design team.

Extract(s) from Commissioning Report

- Statement by the Independent Commissioning Agent that outlines the level of involvement in the project; and
- Summarising the major findings and recommendations of the commissioning process.

ADDITIONAL GUIDANCE

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 basis of design and 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;
- 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 quarterly fine-tuning process and the final re-commissioning of the building.

The role of Independent Commissioning Agent can be fulfilled by multiple people with different expertise, provided that the project team demonstrates that all other Credit Criteria are met, including involvement of the Commissioning Agent(s) from the beginning of schematic design.

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.

Man-4 Independent Commissioning Agent

POINTS AVAILABLE 1

REFERENCES & FURTHER INFORMATION

Refer to Man-2 for commissioning references.

Man-5 Building Guides

POINTS AVAILABLE 2

AIM OF CREDIT

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

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where:

- A simple and easy-to-use Building Users' Guide, which includes information relevant for the building users, occupants and tenants' representatives, is developed and made available to the building owner.

One point is awarded were:

- A Tenancy Fitout Guide is developed which, through practical recommendations, encourages the use of environmental design principles in tenancy design, fitout and operations

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the point for Building Users' Guide is claimed: • Draft Building Users' Guide Where the point for Tenancy Fitout Guide is claimed: • Draft Tenancy Fitout Guide	Where the point for Building Users' Guide is claimed: • Building Users' Guide Where the point for Tenancy Fitout Guide is claimed: • Tenancy Fitout Guide

Draft Building Users' Guide

A draft version of the Building Users' Guide which includes all the information outlined under the Additional Guidance must be provided for assessment.

Draft Tenancy Fitout Guide

A draft version of the Tenancy Fitout Guide which includes all the information outlined under the Additional Guidance must be provided for assessment.

Building Users' Guide

A complete Building Users' Guide which includes all the information outlined under the Additional Guidance must be provided for assessment.

Tenancy Fitout Guide

A Tenancy Fitout Guide which includes all the information outlined under the Additional Guidance must be provided for assessment.

ADDITIONAL GUIDANCE

If a Building Management System is installed, both the Building Users' Guide and the Tenant Fitout Guide must make clear reference to it.

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 the detailed specialist information required by building manager and staff/contractors.

Building Users' Guide

The Building Users' Guide must be a short and easily readable document, suitable for a lay person. It must not include detailed information on maintenance and spare parts, etc.; rather it must refer to the relevant O&M manuals for this information.

The Building Users' Guide must include the following information:

- Energy & Environmental Strategy

  Description of the building initiatives intended to enhance energy efficiency and minimise greenhouse gas emissions, including an overview of the potential savings, as stated for economic and environmental impact.

- Monitoring and Targeting

  Details on energy, water, indoor environment quality and waste targets and benchmarks for the building, such as W/m², and on the metering & sub-metering strategy.

- Building Services

  Description of basic function and operation of the following, with simplified system diagrams and an explanation of energy saving features:

  – Ventilation;
  – Heating system;
  – Cooling system;
  – Electrical systems;
  – Lighting; and
  – Domestic hot water.

- Transport Facilities

  Car parking requirements and provision of cyclist facilities, conditions of access, and appropriate use. Also provide, where applicable, local public transport information, maps and timetables, and details or links on alternative methods of transport to the workplace, such as carpooling.

- Materials & Waste Policy

  Include instructions on proper use for less common practices, such as composting, as well as information on recycling including:

  – What can be recycled;
  – Where the recycling storage areas are; and
  – Schedules for waste and recycling removal.

- Expansion/Re-fit Considerations

  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.

- References & Further Information

  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 environmentally friendly design features.

Simplified diagrams are aimed, and intended, for the use of the building occupants. Simplified diagrams 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 does not fall into the category of a simplified diagram. Accordingly, construction drawings are not considered to be simplified diagrams.

Tenancy Fitout Guide
The Tenancy Fitout Guide must be a short and easily readable document, suitable for tenants to deal with the fitout design and implementation of the retail centre. It must through practical recommendations, encourages the use of environmental design principles in tenancy design, fitout and operations

- Energy Efficiency

  Information on energy-efficiency potential of the base building and suggested strategies for maximising the tenancy's energy performance, such as information on ventilation, electric lighting levels and power density, and details on how to read, record and present meter readings.

- Occupant Comfort

  Recommendations on effectively achieving thermal comfort and occupant comfort control, desired noise levels (with implications for material specifications), and for utilising natural light and controlling glare from natural or electric light.

- Indoor Pollutants

  Recommendations on minimising VOCs, formaldehyde and mould within the tenancy.

- Water

  Recommendations on how to minimise potable water consumption from amenity use, maintenance/cleaning and refit works.

- Waste Policy

  Recommendations on minimising and recycling waste generated by tenant churn/refit.

- Specification Guidelines

  Recommendations on specifying, wherever appropriate, previously used, durable, modular and easily refurbished materials, and materials with product stewardship commitments from manufacturers, as well as minimising the overall amount of materials going into the tenancy.

- References and Further Information

  Websites, publications and professionals that can aid the tenancy if meeting the above recommendations.

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 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.

Man-5 Building Guides

POINTS AVAILABLE 2

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 of each other and as follows:

One point is awarded where it is demonstrated that:

- The contractor implements a comprehensive, project-specific Environmental Management Plan (EMP) for the works in accordance with Section 3 of the New South Wales (Australia) Environmental Management System guidelines 2007.

One point is awarded where it is demonstrated that:

- The Contractor has valid ISO14001 Environmental Management System (EMS) accreditation prior to and throughout the project.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
If claiming for EMP: • Short report • Environmental Management Plan If claiming for EMS accreditation: • Contractor ISO14001 certificate • Confirmation of subcontractor adherence to ISO14001 requirements	If claiming for EMP: • Short report • Environmental Management Plan If claiming for EMS accreditation: • Contractor ISO14001 certificate: • Confirmation of subcontractor adherence to ISO14001 requirements

Man-6 Environmental Management

POINTS AVAILABLE 2

Short report prepared by a relevant project team member that correlates the provisions of the EMP with Section 3 of the New South Wales (Australia) Environmental Management System guidelines 2007.

Environmental Management Plan: a comprehensive, project-specific EMP:

- Clearly demonstrating compliance with the requirements of Section 3 of the New South Wales (Australia) Environmental Management System guidelines 2007.
- Demonstrating that subcontractors must adhere to the provisions of the EMP.
- Outline 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.

Contractor's ISO14001 proof of certification that is current and valid, demonstrating that an appropriate EMS is operating within the company. The contractor must have a valid ISO14001 certification throughout the construction project.

Confirmation of subcontractor adherence to ISO14001 requirements: A letter of confirmation from the contractor stating that any subcontractors relevant to the project will/did adhere to applicable ISO14001 requirements.

ADDITIONAL GUIDANCE

Environmental Management Plan (EMP)

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 ongoing compliance during construction.

Environmental Management Systems (EMS) Certification

ISO 14001 is a requirement of the contractor and must be valid for the entire construction period.

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 ongoing. 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.

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.

REFERENCES & FURTHER INFORMATION

National Environmental Management Act No. 107 of 1998.

NEMA Regulations Government Notice R385 of 2006.

Listing Notice 1 Government Notice R386 of 2006.

Listing Notice 2 Government Notice R387 of 2006.

Department of Environment, Agriculture and Tourism (DEAT)
www.deat.gov.za.

Department of the Environment and Heritage Model Environmental Management System for Commonwealth Agencies:
http://www.environment.gov.au/settlements/publications/government/ems/model.html.

International Organization for Standardization ISO14001 – Environmental Management Systems
http://www.iso.org.

Department of Commerce Buildings and Infrastructure: Environmental Services
http://www.dpws.nsw.gov.au.

CSIR (2005) Guidelines for Environmental Management Plans, Western Cape
http://www.capegateway.gov.za/Text/2005/7/deadp_emp_guideline_june05_5.pdf.

NSW Environmental Management System (2007)
Word document available through internet search for 'NSW Environmental Management System Guidelines'

Man-7 Waste Management

POINTS AVAILABLE 3

AIM OF CREDIT

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

CREDIT CRITERIA

Up to three points are awarded where:

- The contractor implements a Waste Management Plan (WMP), retains waste records and issues quarterly reports to the building owner; AND
- A percentage (by mass or volume) of all demolition and construction waste is reused or recycled as follows:
  - One point for 30% of the waste;
  - Two points for 50% of waste; and
  - Three points for 70% of waste.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the principal building contract has not yet been awarded: • Extract(s) from the tender documentation Where the principal building contract has been awarded: • Extract(s) from the contract(s)	• Short report • Waste Management Plan

Extract(s) from the contract(s) of the contract conditions between the contractor and either the developer or the building owner stipulating the full criteria for reuse/recycling of the stated proportion of construction and demolition waste; The exact provisions of the Credit Criteria must be found in the body (rather than Appendices) of the document.

Extract(s) from the tender documentation requiring the recycling of the stated proportion of construction and demolition waste by the contractor and sub-contractors; The exact provisions of the Credit Criteria must be found in the body (rather than Appendices) of the document.

Short report from the contractor confirming compliance with the Credit Criteria by tabulating all categories of waste (wood, metal, concrete, general, etc.) with their corresponding quantities and indicating how they were reused/recycled. The reused/recycled quantities are to be summed to indicate the total diverted from landfill and divided by the total generated waste to indicate the diversion percentage to landfill. The short report must reference appended receipts and other appropriate records (e.g. evidence of reuse) stating the total amount (by mass or volume) of waste generated and the percentage reused/recycled.

Waste Management Plan used for the site, describing how all generated waste was monitored, which types of waste was collected for recycling or for reuse, how recycling occurred, and who was responsible for the various aspects of the plan. The waste management plan must include instructions to crew and sub-contractors on recycling and reuse procedure. The waste management plan had to be developed prior to construction start, and implemented for the entire duration of construction.

ADDITIONAL GUIDANCE

It must be clearly demonstrated that evidence accounts for all of the demolition and construction waste, that the stipulated proportion of waste has been reused or recycled, and that the owner will be informed of this process on a quarterly basis.

Measurement by volume or mass
The project must decide whether to demonstrate compliance with the Credit Criteria based on mass or volume, though the measurement method must be implemented consistently throughout the submission documentation (all mass or all volume).

Where conversion calculations are required (e.g. if some of the waste is measured in volumes rather than mass, or the other way around), the contractor must use the densities given in the table Man-7.1.

Solid Waste Type	Density (kg/m³)
Cardboard	60
Gypsum Wallboard	300
Rubble	830
Steel	600
Wood	180
Mixed waste	210

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

Man-7 Waste Management

POINTS AVAILABLE 3

For any materials which are not listed in Table Man-7.1 'Densities to be assumed for various solid waste types,' project teams may submit their own densities along with accompanying calculations in their Green Star SA submission. Project teams must demonstrate 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). Projects 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, clean fill, 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 landfill is not addressed by this credit, such as soil (from land clearing and excavation activities), land clearing debris or waste that legally must be withheld from general construction waste (such as asbestos). Quantities of hazardous waste, land clearing debris and soil are not considered demolition and construction waste and are not included in either the reused/recycled or total waste of the project.

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;

- 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 to 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

Department of Environmental Affairs and Tourism (2006) South Africa Environmental Outlook, A report on the state of the environment 2006
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

Man-8 Air-tightness Testing

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

Man-9 Waste and Recycling Management Plan

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise management systems and building infrastructure that facilitates the reduction of the overall operational waste generation and disposal.

CREDIT CRITERIA

One point is awarded where it is demonstrated that:

- There is a comprehensive Waste and Recycling Management Plan for the reduction in the amount, by weight, of the retail centre's overall operational waste.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Draft Waste and Recycling Management Plan • Confirmation from the building owner	• Short report • Waste and Recycling Management Plan • Tenant lease agreement

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

- Detailing how the Waste and Recycling Management Plan meets the Credit Criteria and the requirements set out in the Additional Guidance.

Draft Waste and Recycling Management Plan outlining the draft plan for reduction of the retail centre's overall operational waste (by weight). This document must be signed by the building owner.

Confirmation from the building owner confirming that the tenants will be required to adhere to the relevant provisions of the Waste and Recycling Management Plan.

Waste and Recycling Management Plan outlining the final plan for reduction of the retail centres overall operational waste (by weight). This document must be signed by the building owner.

Man-9 Waste and Recycling Management Plan

POINTS AVAILABLE 1

Tenant Lease Agreement
A copy of the section of the generic tenancy lease agreement that stipulates that the tenant is required to adhere to the relevant provisions of the Waste and Recycling Management Plan

ADDITIONAL GUIDANCE

The Waste and Recycling Management Plan must address all waste (recyclable and non-recyclable) generated in the centre (tenants, common areas and visitors). The plan must either:

- Set explicit annual operational waste reduction targets, for reduction in the amount (by weight) of the retail centre'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:

- Collection areas for the landlord, tenants and customers;
- Waste and recycling streams segregated within the retail centre;
- Transfer of material to common storage areas (amenity and access);
- Communal storage areas (access, amenity, and pollution prevention);
- Frequency of collection;
- Guidelines for tenant packaging;
- Signage and educational initiatives geared towards tenants and customers; and
- Monitoring and reporting requirements, minimum quarterly.

For the purposes of this credit, tenancies include all tenancies that share waste facilities and/or loading docks with the base building and minors.

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).

Man-9 Waste and Recycling Management Plan

POINTS AVAILABLE 1

Disposal of waste generally has negative impacts on the environment. These impacts include contamination of surface and ground water resources and soil; emissions (methane, CO_2 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).

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 in improved public relations and business continuity (Wasiluk, 2007).

REFERENCES & 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

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

Polokwane Declaration
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

Man-10 Building Management System

POINTS 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 it is demonstrated that:

An electronic building management system is integrated into the building to:

- Monitor and report on energy and water consumption; and
- Monitor and control building services systems.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Design	Green Star SA – Retail As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender schematic services drawing(s) • Tender BMS point schedule • Extract from the controls specification	• Short report • As built schematic services drawings • As built BMS point schedule • Extract from the Commissioning Report • Contract with the Facilities Manager

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

- Detailing the scope of the building management system;
- Outlining the systems that are controlled and monitored; and
- Referencing drawings and other documentation where appropriate.

Tender Schematic services drawings

- Showing the controls and connections as stipulated in the Additional Guidance.

Tender BMS point schedule

- Showing inputs from the sub-meters; and
- Detailing each of the points to be monitored and/or controlled.

Extract from the controls specification

- Clearly demonstrating that the BMS will monitor and control systems in line with the Additional Guidance.

As Built schematic services drawings

- Showing the controls and connections as stipulated in the Additional Guidance.

As Built BMS point schedule

- Showing inputs from the sub-meters and that they are connected; and
- Detailing each of the points monitored and/or controlled.

Extract from the Commissioning Report

- Demonstrating that the BMS has been commissioned and operates as designed.

Contract with the facilities manager

- To monitor energy and water consumption and their related alarms on the BMS; and
- To provide tenants with quarterly reports showing the energy and water consumption from each sub-meter.

ADDITIONAL GUIDANCE

It must be demonstrated that a Building Management System (BMS) is integrated into the building to monitor, at a minimum, the following systems (where present):

- Energy consumption from all sub-meters, which must provide at the whole building and individual meter level:
  - Instantaneous data; and
  - Historic records.
- Water consumption from all sub-meters, which must provide at the whole building and individual level:
  - Instantaneous data; and
  - Historic records.
- Air conditioning;

- Lighting;
- Energy generation;
- Maintenance activities;
- External temperature conditions;

AND to control the following systems (where present):

- Air conditioning, including the following:
  - On/off;
  - Time schedules;
  - Temperature set points; and
  - Fan/ pump speed;
- Lighting, including the following:
  - On/off and dim; and
  - Time schedules.
- The BMS must allow maintenance sub-contractors to schedule and record maintenance activities.

BACKGROUND

Building Management Systems are computer based control systems installed in buildings to control and monitor the building's mechanical and electrical equipment such as lighting, power systems, plumbing, fire services, air conditioning and security systems (Mustafa & Bansal). 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 BMSs 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 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 R500'000, 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

Australian institute of Refrigeration Air Conditioning and Heating (AIRAH).
http://www.airah.org.au/default.asp

Canbay, C. S., Hepbasili, A. & Gokcen, G. (2004), Evaluating performance indices of a shopping centre and implementing HVAC control principles to minimise energy usage, Energy and Buildings Journal, Vol 36, pp. 587-598.

Department of Energy Utilities and Sustainability (DEUS) (n.a.), Powering into the Future, Australian Gas Light Company, New South Wales Government Case Study.
http://www.energysmartcom.au/wes/images/pdf/AGL.pdf

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http://www.imaginedurban.org/docs/Case%20Studies%20of%20Electricity%20Savings%20in%the%20Commercial%20Sector.pdf

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Man-11 Green Lease

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise initiatives taken by the building owner to encourage improved environmental behaviour by tenants of the retail centre.

CREDIT CRITERIA

One point is awarded where the building owner/manager demonstrates that no less than 80% of the rentable area (per SAPOA definition) is committed to a tenancy lease agreement that requires the tenants to participate in the following environmental initiatives:

- Electrical energy monitoring & reporting (minimum quarterly) and have submitted an energy management plan at the beginning of each year;
- Water monitoring & reporting (minimum quarterly) and have submitted a water management plan at the beginning of each year;
- Waste reduction/recycling monitoring & reporting (minimum quarterly) and have submitted a waste management plan at the beginning of each year;
- The preparation of a procurement policy at the beginning of each year regarding the use of environmentally friendly consumables (cleaning products, toiletry products, paper and plastic consumable products).

AND

- The building owner is required to report back to the tenants on the buildings' performance relating to energy, water, waste and procurement policies on an annual basis.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Extract(s) from the standard leasing document(s) • Signed letter from the building owner	• Extract(s) from the signed leasing document(s) • Area schedule

Man-11 Green Lease

POINTS AVAILABLE 1

Extract(s) from the standard leasing document(s)

- Requiring tenants to submit management plans annually to the landlord for their energy, water and waste profile;
- Committing the tenant to monitor and report to the landlord quarterly on energy, water and waste usage;
- Committing the landlord to report back to tenants on energy, water and waste for the overall retail centre annually;
- Requiring the tenant to produce an annual procurement policy for the selection of environmentally friendly consumables (cleaning products, toiletry products, paper and plastic consumable products).

Signed letter from the building owner committing to sign lease agreements with tenants on green leases for at least 80% of the rentable area.

Extract(s) from the signed leasing document(s) representing 80% of the rentable area (SAPOA)

- Requiring tenants to submit management plans annually to the landlord for their energy, water and waste profile;
- Committing the tenant to monitor and report to the landlord quarterly on energy, water and waste usage;
- Committing the landlord to report back to tenants on energy, water and waste for the overall retail centre annually;
- Requiring the tenant to produce an annual procurement policy for the selection of environmentally friendly consumables (cleaning products, toiletry products, paper and plastic consumable products);
- Stating the area covered by the lease.

Area Schedule detailing the rentable area per tenant for all tenancies in the retail centre and indicating which of these are to be let under a green lease.

ADDITIONAL GUIDANCE

The measurement of area must include entire tenancies - portions of tenancies cannot be included in the measurement to achieve the required 80%.

The lease must require energy, water and waste management plans to include the following:

- Monthly, quarterly and annual targets for the tenancy (energy, water and waste)
- A process for addressing any abnormalities in energy and water consumption and waste production

Man-11 Green Lease

POINTS AVAILABLE 1

The lease must require that the procurement policy to include the following:

- Statement that the tenant will select environmentally friendly consumables for procurement
- Assessment of the available options for cleaning products, toiletry products, paper and plastic consumable products
- A final procurement schedule representing the most environmentally friendly options for each category of consumable

BACKGROUND

Traditionally base building rating tools have only somewhat considered the role tenants play in affecting the final performance of green buildings. There are a range of motivations for considering tenants from both commercial and environmental fronts.

The Green Lease credit is intended to begin the process of including tenants in the on-going management of the building performance and provide greater ability for the actual building to achieve its potential.

Green leases provide landlords with an avenue to realise the operational potential of their buildings by guiding tenant behaviour, a critical element in landlords getting a return on their investment into sustainable buildings.

Green leases also provide tenants with an avenue to create awareness of the ongoing performance of the shopping centre they occupy and hence any operational expenditure linked to the overall building performance.

Green leases are also intended to build a culture of environmental disclosure between tenants and landlords with mutual reporting on energy, water and waste performance. This reporting allows performance of all aspects of the shopping centre to be monitored and managed.

It would improve the efficiency of the ongoing environmental performance of a building if a project targets the following credits and relates these to the details contained in the green lease on that project:

- Man-9 Waste and Recycling Waste Management Plan;
- Ene-2 Electrical Energy Sub-metering;
- Ene-6 Thermal Energy Sub-metering;
- Wat-2 Water Sub-metering; and
- Mat-1 Recycling Waste Storage.

REFERENCES & FURTHER INFORMATION

Green Lease Guide – NSW department for Environment, Climate Change and Water (2006)
http://www.environment.nsw.gov.au/sustainbus/greenlease.htm

Man-11 Green Lease

POINTS AVAILABLE 1

Greener Buildings - additional information on green leases
http://www.greenerbuildings.com.au/leasing-green-building

California Sustainability Alliance Green Lease Toolkit
http://www.sustainca.org/green_leases_toolkit
Sustainable Property Rewards - additional information on green leases
http://www.sustainablepropertyrewards.info/SPRInitiative/Resources/GreenLeases/GreenLeases.html

The Real Property Association of Canada
http://www.realpac.ca

BOMA Green Lease Guide
http://www.shop.boma.org

London Development Agency Green Lease Tool Kit
http://www.lda.gov.uk/upload/pdf/BBP Green Lease Toolkit.PDF

Energy Efficiency Lease Guidance
http://www.cycle-7downloads/Downloads.html

EPA Environmentally Preferable Purchasing
http://www.epa.gov/epp

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 HVAC system, lighting, indoor air pollutants and some building attributes contribute to a good indoor environmental quality.

Comfort factors addressed within this category are external views, individual climate control and noise levels. Health issues such as minimisation of indoor Volatile Organic Compounds, asbestos and Formaldehyde emissions as well as mould prevention are also addressed in this category.

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 reducing the amount of fresh air delivered to occupants, 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 and many points towards a Green Star SA certification are available in this category. 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.

IEQ is also a critical element of healthy buildings. Poor IEQ is considered to be the principal cause of Sick Building Syndrome (SBS) which, according to scientific research, has a substantial price tag in lost productivity and even more in health sector costs.

It is well documented that health problems resulting from indoor air pollution have become one of the most acute environmental problems related to building activities. Indoor air quality, directly related to Sick Building Syndrome and productivity, is considered in the Performance Indicators for both commercial and residential buildings.

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

IEQ-1 Ventilation Rates

POINTS AVAILABLE 3

AIM OF CREDIT

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

CREDIT CRITERIA

Three points are available as follows:

Naturally ventilated spaces

Three points are awarded where it is demonstrated that 95% of the nominated area is naturally ventilated in accordance with SANS 10400-O (minimum 5% openable area).

Mechanically ventilated spaces

Up to three points are awarded where for 95% of the nominated area, outside air is provided at rates greater than the requirements of SANS 10400-O (5 litres/second/person for retail centres), as follows:

- One point for 50% improvement;
- Two points for 100% improvement; or
- Three points for 150% improvement.

Mixed-mode ventilated spaces

Both modes of operation must individually satisfy the relevant mechanical and natural ventilation criteria. The points awarded will be limited to the maximum points awarded under the mechanical ventilation criteria.

For the purposes of this credit, 'nominated area' is GLA and common areas (excluding open air mall areas, car parks and tenancies that provide their own air). If 'open air mall' areas make up more than 95% of the project's total common areas, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

IEQ-1 Ventilation Rates

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces • Opening Area Schedule For mechanically ventilated spaces • Short report • Extract(s) from specification(s) • Tender drawing(s) (1) Where the credit is not applicable • Tender drawing(s) (2) • Area Schedule	For naturally ventilated spaces • Opening Area Schedule For mechanically ventilated spaces • Short report • Extract(s) from O&M Manual(s) • As built drawing(s) (1) Where the credit is not applicable • As built drawing(s) (2) • Area Schedule

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Short report prepared by a mechanical engineer that describes how the Credit Criteria have been met by:

- Providing a schedule of all spaces within the building, indicating their ventilation mode(s) and areas as referenced in the tender drawings; and
- For mechanically ventilated spaces, indicating the AHU(s) or fans that serve each space, the minimum amount of outside-air rates supplied by each AHU or fan as evident in the commissioning and compared with the minimum requirements of SANS 10400-O and SANS 10173 (The installation, testing, and balancing of air conditioning duct work).

Extract(s) from the specification(s) where design occupant density is specified and design outside-air rates are nominated.

Tender drawings (1) for each typical mechanically air conditioned spaces, indicating their area and nominating the outside-air supply rates.

Tender drawings (2) indicating the open air mall area and the common area.

Area Schedule indicating the total open air mall area and the total common area, and the calculation proving compliance with the 'na' criteria.

Extract(s) from the O&M Manual(s) demonstrating that the HVAC systems of the building have been commissioned and operate as intended by the design, and indicating the minimum outside-air rates supplied by each AHU.

As built drawings (1) for each typical mechanically ventilated space, indicating its area and nominating the outside-air supply rates.

As built drawings (2) indicating the open air mall area and the common area.

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 project must operate and deliver the air to the occupied space whenever the air conditioning system is in operation (as per the Credit Criteria provided). Enabling tenants 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.

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 and that these minimum outside air rates are clearly documented in the project design; and
- 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.

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 (CO_2) 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 CO_2 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:

- 800 PPM for 50% increase;
- 700 PPM for 100% increase; and
- 640 PPM for 150% increase.

Inclusion of supplementary outside air systems in IEQ may have a detrimental impact on other Green Star SA credits, such as Thermal Comfort (IEQ-5/IEQ-9). The Assessors are required to assess the coordination between these credits.

BACKGROUND

SANS 10400-O sets minimum permissible ventilation rates, giving consideration to health and ventilation amenity. It does not cover other requirements associated with comfort such as temperature, humidity, air movement or noise. The minimum ventilation rates specified are intended to maintain general contaminants (e.g. body odours, volatile organic compounds, etc.) at concentrations below exposures that have potential to cause adverse health effects to a substantial majority of occupants.

A comparison between different international standards for recommended fresh air levels is as follows:

- SANS 10400-O Lighting & Ventilation table 2 gives 7.5 litres/second/person (l/s/p) (smoking) and 5 l/s/p (filtered/non smoking).
- CIBSE A Guide (2006) gives 10 l/s/p (assumes no smoking)
- ASHRAE 62 (2007) 2.5 l/s/p plus 0.3 l/s/m² which typically gives around 5.5 to 8.5 l/s/p

- Higher rates (e.g. 12 l/s/p) are now relatively common in Europe and America, due to concerns about 'sick building syndrome'. The Green Star SA rate of 150% increase corresponds to 12.5 l/s/p.

The World Health Organisation estimates that up to 30% of new and remodelled buildings worldwide may be subject to excessive complaints related to indoor air quality. Employers, building owners, product manufacturers, engineers, architects and builders are all at risk of litigation arising from claims based on indoor air pollution and poor indoor environment quality.

Clearly there is a balance to be struck between providing adequate outside air in recirculation systems to dilute contaminants and the loss/gain of heat with the resulting increased energy consumption needed to maintain comfort levels.

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 2

AIM OF CREDIT

To encourage and recognise systems that effectively deliver optimum air quality to any occupant throughout the occupied area.

CREDIT CRITERIA

Two points are awarded where it is demonstrated that the Air Change Effectiveness (ACE) for at least 95% of the nominated area meets the following criteria:

Naturally Ventilated Spaces

A distribution and laminar flow pattern for at least 95% of the nominated area of each space in the direction of air flow for not less than 95% of standard hours of occupancy is demonstrated.

Mechanically Air-Conditioned and Mechanically Assisted Naturally Ventilated Spaces

The ventilation systems are designed to achieve an Air Change Effectiveness (ACE) of >0.95 for at least 95% of the nominated area when measured in accordance with ASHRAE 129 1997: 'Measuring Air Change Effectiveness'; and

ACE must be measured 1.6 m above finished floor level.

Mixed-Mode Ventilated Spaces

Both the above requirements for Naturally Ventilated and Mechanically Air-conditioned Spaces are achieved.

For the purposes of this credit, 'nominated area' is GLA and common areas (excluding open air mall areas, car parks and tenancies that provide their own air). If 'open air mall' areas make up more than 95% of the project's total common areas, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

IEQ-2 Air Change Effectiveness

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: • Short report • Opening Area Schedule • Tender drawing(s) (1) • Airflow simulation report For mechanically ventilated spaces: • Short report • Tender drawing(s) (1) • Tender schematic mechanical drawing(s) • CFD report Where the credit is not applicable • Tender drawing(s) (2) • Area Schedule	For naturally ventilated spaces: • Short report • Opening Area Schedule • As built drawing(s) (1) • Airflow simulation report For mechanically ventilated spaces: • Short report • As built drawing(s) (1) • As built schematic mechanical drawing(s) AND • CFD Report or Extract(s) from the Commissioning Records Where the credit is not applicable • As built drawing(s) (2) • Area Schedule

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

- Describing the system; and
- Including a tabulated summary table that identifies all spaces in the building and their area, nominates compliant spaces, indicates their ventilation mode and how compliance is achieved and confirms that compliant spaces jointly account for at least the stipulated proportion of the nominated area.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

IEQ-2 Air Change Effectiveness

POINTS AVAILABLE 2

Tender drawing(s) (1) of each typical space indicating floor area, ventilation system and key elements of the ventilation or air conditioning system. For naturally ventilated spaces, indicate each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly highlighted and dimensioned.

Airflow simulation report prepared by a suitably qualified professional and referencing attached evidence:

- Summarising the simulation analysis and results;
- Indicating inlets and outlets; and
- Providing a graphical illustration of air flow patterns (to scale) which demonstrate a distribution and laminar flow pattern for at least 95% of each space in the direction of air flow for not less than 95% of standard hours of occupancy.

Tender schematic mechanical drawing(s) of the proposed HVAC system, marked up to clearly indicate key elements of the system.

CFD report prepared by a suitable qualified professional and referencing attached evidence:

- Summarising the CFD analysis and modelling results;
- Demonstrating that the design provides an Air Change Effectiveness of >0.95 calculated in accordance with the ASHRAE Standard 129-1997: Measuring Air Change Effectiveness for 95% of the nominated area with minimum turn-down rates; and
- Providing the CFD modelling results and demonstrating that the computerised model reflects the documented design.

The key summary from either the airflow simulation report (for naturally ventilated spaces) or the CFD report (for mechanically ventilated spaces) can be submitted instead of the short report, provided that the key summary has been prepared by a suitable professional and describes how the Credit Criteria has been met by:

- Describing the proposed system;
- Including a tabulated summary table that identifies all spaces in the building and their area, nominates compliant spaces, indicates their ventilation mode and how compliance is achieved and confirms that compliant spaces jointly account for at least the stipulated proportion of the nominated area; and
- For naturally ventilated spaces, referencing either the schedule of openings, the empirical calculations or the computer modelling report and demonstrating that the building is designed as a naturally ventilated space in accordance with SANS 10400-O, and describing the key elements of the natural ventilation system and the sequence of operations, which must be clearly shown in easy to read diagrams or sketches.

Tender drawings (2) indicating the open air mall area and the common area.

Area Schedule indicating the total open air mall area and the total common area, and the calculation proving compliance with the ‘na’ criteria.

IEQ-2 Air Change Effectiveness

As built drawing(s) (1) of each typical space indicating floor area, ventilation system and key elements of the ventilation or air conditioning system. For naturally ventilated spaces, indicate each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly highlighted and dimensioned.

As built schematic mechanical drawing(s) of the installed HVAC system, marked up to clearly indicate key elements of the system.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned, outlining the commissioning process to confirm testing was undertaken on typical layouts that jointly account for at least 95% of the NOMINATED AREA; and providing test results to confirm that the as installed system complies with the Credit Criteria.

As built drawings (2) indicating the open air mall area and the common area.

ADDITIONAL GUIDANCE

Each typical floor must be modelled in its entirety; modelling single diffusers or components of any floor is not sufficient. The only time that modelling a component of a floor will be acceptable is if there is substantial geometric symmetry (including zones as well as supply and intake air positions) between the modelled section and the rest of the floor. Justification of all modelling assumptions must be included.

All internal temperatures must be calculated by the thermal modelling software (and can be extracted once the model has run all the inputs). Actual occupant density and occupancy hours must be used.

All systems

The areas identified as ‘naturally ventilated’, ‘mechanically ventilated’ or ‘mixed-mode’ must be clearly identified, documented consistently throughout the submission, and their areas nominated.

Natural ventilated spaces

It must be clearly demonstrated that:

- The airflow effectiveness of the natural ventilation system has been modelled using a Computational Fluid Dynamics (CFD) analysis for each relevant space for at least 95% of standard occupancy hours;
- That the inlets and outlets have been clearly identified in all relevant spaces to demonstrate laminar flow through those spaces; and
- That no one opening has to serve as both an inlet and an outlet.

The submission must also demonstrate that the natural ventilation system was designed to achieve an air change effectiveness of at least 0.95.

IEQ-2 Air Change Effectiveness

POINTS AVAILABLE 2

Mechanically ventilated spaces

Points for mechanical ventilation require that the supply and exhaust points are clearly documented.

Displacement ventilated spaces

The supply and exhaust points must be clearly documented on drawings.

Air Change Effectiveness

Air Change Effectiveness relates to how efficiently the supply/outside air is distributed through an occupied space.

ASHRAE Standard 129-1997: 'Measuring Air Change Effectiveness' provides a method for measuring Air Change Effectiveness (E) in mechanically ventilated buildings and spaces using a tracer gas procedure to determine the age of air in ventilated spaces. The age of air is the average amount of time that has elapsed since a sample of air molecules at a specific location entered the building.

Air Change Effectiveness compares the age of air in the occupied portions of the building to the age of air if perfect mixing of the ventilation air existed. If E=1 then the ventilation air within a space is perfectly mixed and the outdoor airflow rate to the ventilated space is to be to the same as the required rate of outdoor airflow. If E>1, the air that is breathed is cleaner than that which is exhausted from the space. However, since ASHRAE 129-1997 is a measurement procedure for existing buildings, and Green Star SA – Retail Centre is a pre-occupancy assessment tool, the Credit Criteria relates to a design and construction approach that will lead to increased Air Change Effectiveness and prevent short-circuiting of airflow delivery. The aim of the credit is to achieve equivalence to E≥0.95.

Well designed ceiling air diffusion systems achieve an ACE of near unity (between 0.8 and 1.2) at design air flow rates. A displacement ventilation system typically achieves an ACE of > 1.2.

It is understood that due to limitations of software predictions of systems with recirculated air will not be as accurate as systems with 100% outside air.

BACKGROUND

By increasing Air Change Effectiveness, provision of supply air to a building's users is improved. Poor provision of clean air in buildings has negative impacts on occupant health and productivity. Effective delivery of clean supply air is particularly important in minimising the impact of pollutants that are generated within the workspace upon building users. Examples of pollutants generated within the workspace include Volatile Organic Compounds (VOCs) released from furnishings and finishes and emissions from office equipment such as photocopiers and laser printers.

IEQ-2 Air Change Effectiveness

POINTS AVAILABLE 2

REFERENCES & FURTHER INFORMATION

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.) (1997), ASHRAE Fundamentals Handbook 1997 – Chapter 25 (ASHRAE F25-1997).
http://www.ashrae.org

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, U.S.) (1997), ASHRAE Standard 129-1997.
http://www.ashrae.org

National Institute of Standards and Technology (U.S.) (1994). Air Change Effectiveness Measurements in Two Modern Office Buildings. Denmark.
http://www.fire.nist.gov/bfrlpubs/build94/PDF/b94024.pdf

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

- 95% of the nominated area is naturally ventilated in accordance with SANS 10400-O; AND
- Carbon Dioxide monitoring is provided for every 1000m2 to provide an alarm on the building facility staff's control system if CO_2 levels rise above 1,000ppm; AND
- In back of house areas ventilation rates are directly controlled by occupants.

Mechanically ventilated spaces

- A carbon dioxide (CO_2) monitoring and control system with a minimum of one CO_2 sensor per zone, to a maximum of 1000 m^2, in 95% of the nominated area, is provided to facilitate continuous monitoring and adjustment of outside air ventilation rates to each level, to ensure independent control of ventilation rates to achieve outside air requirements; OR
- HVAC systems provide 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 GLA and common areas (excluding open air mall areas, car parks and tenancies that provide their own air). If 'open air mall' areas make up more than 95% of the project's total common areas, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: • Using IEQ-1 Ventilation Rates compliance ▪ Compliance note ▪ Tender drawing(s) (1) OR • Using alternative compliance ▪ Short Report ▪ Opening Area Schedule ▪ Tender drawing(s) (1) For mechanically ventilated spaces with Carbon Dioxide sensors: • Short Report • Extract(s) from the specification(s) • Tender schematic mechanical drawing(s) For systems that provide 100% outside air: • Short Report • Extract(s) from the specification(s) • Tender schematic mechanical drawing(s) Where the credit is not applicable • Tender drawing(s) (2) • Area Schedule	For naturally ventilated spaces: • Using IEQ-1 Ventilation Rates compliance ▪ Compliance note ▪ As built drawing(s) (1) OR • Using alternative compliance ▪ Short Report ▪ Opening Area Schedule ▪ As built drawing(s) (1) For mechanically ventilated spaces with Carbon Dioxide sensors: • Short Report • As built schematic mechanical drawing(s) • As built point schedule • Extract(s) from the O&M Manual For systems that provide 100% outside air: • Short Report • As built schematic mechanical drawing(s) Where the credit is not applicable • As built drawing(s) (2) • Area Schedule

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS AVAILABLE 1

Short Report prepared by a mechanical engineer that describes how the Credit Criteria have been met by:

- For naturally ventilated spaces, either referencing that IEQ-1 full points are being claimed, or referring to the schedule of openings and confirming that the minimum requirements of SANS 10400-0 have been met for 95% of the nominated area.
- For mechanically ventilated spaces, describing the configuration of each ventilation system and its method of operation, and providing a schedule confirming the minimum outside air rate supplied by each AHU together with the nominated area of each zone served by each AHU.

Compliance note indicating that full points have been achieved for the IEQ-1 Ventilation Rates credit.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Extract(s) from the specification(s) that identify the proposed HVAC system(s) and outline its requirements and operation.

Tender drawing(s) (1) for each typical naturally ventilated space, with CO_2 sensors and ventilation openings clearly indicated and dimensioned.

Tender schematic mechanical drawing(s) of the HVAC system(s) for each typical mechanically ventilated space, indicating the mechanical system, its configuration, location of all key elements (such as AHUs or CO_2 sensors), the area served by each AHU/ CO_2 sensor, and nominating the outside-air supply rates. Where the system supplies 100% outside air with no recirculation component, the drawings must identify the AHU and clearly demonstrate that no return air ducts are installed.

Tender drawings (2) indicating the open air mall area and the common area.

Area Schedule indicating the total open air mall area and the total common area, and the calculation proving compliance with the 'na' criteria.

As built drawing(s) (1) for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

As built schematic mechanical drawing(s) of the HVAC system(s) for each typical space, indicating their configuration, location of all key elements (such as ventilation openings, AHUs and CO_2 sensors), the area served by each AHU/ CO_2 sensor, and nominating the outside-air supply rates. Where the system supplies 100% outside air with no recirculation component, it must be clear that the system does not have any air recirculation capacity.

As built point schedule indicating the connection and control strategy between the CO_2 sensors and the automated monitoring system.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS AVAILABLE 1

Extract(s) from the O&M Manual describing the on-going operation and maintenance requirements of the CO_2 sensors.

As built drawings (2) indicating the open air mall area and the common area.

ADDITIONAL GUIDANCE

For naturally ventilated projects

Locations of the carbon dioxide sensors must be clearly shown on drawings.

Mechanically ventilated spaces

Systems must have the capability to supply the necessary quantity of outside air at all times.

Two types of system can qualify for the credit:

1) Systems where the fan speed is controlled using Carbon Dioxide (CO_2) 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 is only required within return ducts and return risers; and
- Be linked to an automated monitoring system (e.g. BMS) or equivalent to ensure continuous adjustment of the outside air rates.

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).
- The AHU(s) must be controlled at fixed speed rather than variable volume.

If the Carbon Dioxide (CO_2) monitoring system is designed to decrease the outside air rates to below those used to achieve points in IEQ-1 'Ventilation Rates' then the points achieved in IEQ-1 'Ventilation Rates' shall be reduced to reflect the minimum ventilation rates set by the CO_2 monitoring and control system. If credit is claimed under IEQ-1 'Ventilation Rates', the minimum threshold must correlate to the rate claimed in IEQ-1 'Ventilation Rates'. 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 Rates':

- 800 PPM for 50% increase;
- 700 PPM for 100% increase; and
- 640 PPM for 150% increase.

IEQ-3 Carbon Dioxide Monitoring & Control

POINTS AVAILABLE 1

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.

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 Daylight

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise designs that provide good levels of daylight for building users.

CREDIT CRITERIA

Up to two points are awarded:

One point is awarded where it is demonstrated that:

- 30% of the nominated area has a Daylight Factor (DF) of at least 2.5% or Daylight Illuminance of at least 300 lux as measured at the floor level under a uniform design sky.

Two points are awarded where it is demonstrated that:

- 60% of the nominated area has a Daylight Factor of at least 2.5% or Daylight Illuminance of at least 300 lux as measured at the floor level under a uniform design sky.

For the purposes of this credit, 'nominated area' is defined as internal public common area where there are tenants on two sides of common space, uncovered or covered, and the area is considered a mall area (excluding car parks).

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	**Green Star SA – Retail Centre As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Daylight modelling report • OR • Short Report • Façade drawings • Roof drawings • Architectural plan drawings • Site plan extending to surrounding areas • Extract(s) from the specification(s)	• Daylight modelling report • OR • Short Report • As built façade drawings • As built roof drawings • As built plan drawings • As built site plan extending to surrounding areas • Final glazing schedule • Manufacturer's data sheet(s)

Daylight modelling report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Describing the methodology and/or modelling software used to calculate the DF or DI;
- Describing the building model including values of reflectance and transmittance used for each relevant material/glazing;
- Showing legible floor plan outputs from the daylight modelling for each plan area claimed to have a DF of not less than 2.5%, or a DI of not less than 300 lux;
- Providing a summary table that identifies all spaces within the building's Nominated Area, nominates spaces that comply and their area, identifies the DF or DI value within those spaces, and provides calculations to confirm that compliant areas jointly contribute to the claimed percentage of the nominated area;
- Describing the design sky used for the daylight model; and
- Where compliance is on the basis of DI, confirming the calculation method is as described in the Additional Guidance section.

Short Report prepared by a relevant project team member and supported by the design and referencing drawings that describes how the Credit Criteria has been met using hand calculations:

- Identifying all spaces within the building;
- Nominating the spaces where the Credit Criteria has been met, and their area;
- Providing calculations for the DF within each compliant space; and
- Providing a summary table to demonstrate that compliant spaces jointly account for the stipulated proportion of the Nominated Area.

Façade drawings identifying the façade materials in the design (drawings must preferably be isometric, not 3D).

Roof drawings identifying the materials in the design (drawings must preferably be isometric, not 3D).

Architectural plan drawings clearly identifying those areas considered to have a DF of 2.5%, or a DI of at least 300 lux, with the Nominated Area of each section clearly shown.

Site plan extending to surrounding areas identifying heights and location of surrounding buildings and average reflectance for those buildings.

Extract(s) from the specification(s) where all glazing properties and minimum visual transmittance levels are nominated.

As built façade drawings identifying the façade materials in the design (drawings must preferably be isometric, not 3D).

As built roof drawings identifying the materials in the design (drawings must preferably be isometric, not 3D).

As built plan drawings clearly identifying those areas considered to have a DF of 2.5%, or a DI of at least 300 lux, with the Nominated Area of each section clearly shown.

As built site plan drawings extending to surrounding areas showing heights and location of surrounding buildings and indicting average reflectance for those buildings.

Final glazing schedule identifying all glazing within the project by application, properties, supplier and quantity.

Manufacturer's data sheet(s) (or equivalent) indicating the type and properties such as the minimum visual transmittance of the glass or glazing products supplied to the project.

ADDITIONAL GUIDANCE

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); and
- 0.8 for ceilings (assumes white paint).

The daylight modelling report must include all information required in 'Additional Guidance' and the daylight modelling 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.

Compliance for this credit cannot be demonstrated by measurement of actual daylight levels in the building.

Overshadowing

Overshadowing must be taken into account in calculations. A nearby building or feature (such as a cliff face) 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.

Calculation Grid

All software calculates Daylight Factor at points on a plan. Some systems calculate the Daylight Factor for an almost infinite number of points, providing very accurate results. Other modelling programs request the user to identify the points matrix on the floor plan. If using computer modelling to calculate the Daylight Factor, it must be calculated for at least 1 point for each square metre of floor area, to be positioned at floor level.

IEQ-4 Daylight

POINTS AVAILABLE 2

A maximum 1m² grid must be overlaid over the floor plan to determine these points and at all perimeters, each 1m² must begin at the façade. Daylight Factor is then calculated in the centre point for each box in the grid.

1) Compliance using Daylight Factor

The Daylight Factor describes the proportion of internal illuminance over external illuminance, expressed as a percentage.

Daylight Factor = Internal Illuminance (lux) / External Horizontal Illuminance (lux) x 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 (DF) is most commonly calculated using a CIE (Commission International de l'Eclairage) overcast sky. However, Green Star SA recommends the use of a uniform design sky because it allows easier comparison with the Daylight Iluminance method. Calculation using a CIE overcast sky is acceptable, but note that this method will usually give lower results than that calculated using a uniform sky. Note that if software does not have a preset option for a uniform design sky, it can often be set up manually as follows:

Design sky values must be derived from a statistical analysis of outdoor illuminance levels for the particular project location, representing a horizontal illuminance level that is exceeded 85% of the time between the hours of 8am and 6pm throughout the working year. Thus they also represent a worst-case scenario that a building can be designed to and ensure it will meet the desired light levels at least 85% of the time.

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.

2) Compliance using Daylight Illuminance

As an alternative method of compliance, light levels inside the building must be simulated at 12 noon on the equinox (21st March/September). A clear sky must be assumed. The simulation must be carried out on a 1m calculation grid (see above) and areas where the light level calculated at floor level is above 300 lux can count towards the credit.

3) Hand Calculation for Daylight Factor

While daylight modelling is encouraged because it gives much better information on the spread of daylight within the space, the manual calculation method described in BS 8206 Part 2 is accepted as an alternative. To use this method, there must be limited overshadowing of glazed areas and separate calculations must be provided for every occupied space.

The daylight factor D is estimated using equation:

$$D = \frac{T\ Aw\ \theta}{A\ (1-R^2)}$$

Where:

T = the diffuse light transmittance of the glazing, including a correction factor for the effect of dirt (see below);

Aw = the glazed area of the window in m², including a correction factor for the effect of the frame (see below);

θ = the angle subtended by the visible sky (degrees). It is measured in a vertical plane normal to the glass, from the window reference point which is at the centre of the window as illustrated below;

A = the total area of the ceiling, floor and walls, including windows, in m²; and

R = the area-weighted average reflectance of the interior surfaces (A). In initial calculations for rooms with white ceilings and mid-reflectance walls, this may be taken as 0.5.

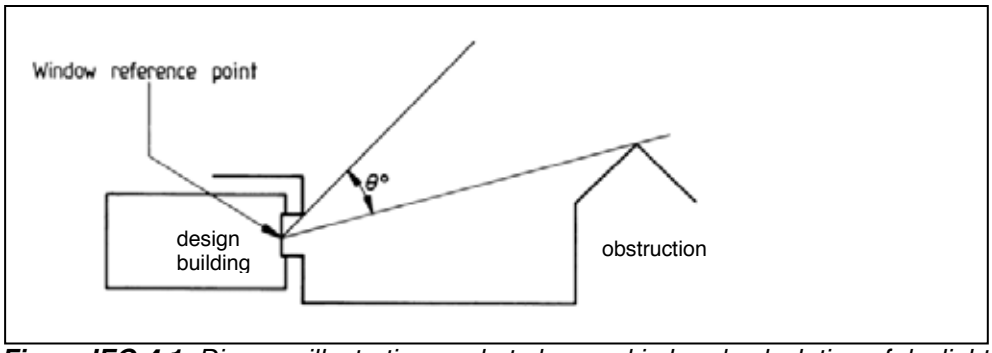

Figure IEQ-4.1: *Diagram illustrating angle to be used in hand calculation of daylight factor.*

Glazing orientation	vertical	sloping	horizontal
Dirt correction factor	0.9	0.8	0.7

Table IEQ-4.1: *Dirt correction factor to be used in hand daylight calculations*

Frame type	**metal frame (patent glazing)**	**metal frame**	**wood frame**
Framing correction factor	0.9	0.8	0.7

Table IEQ-4.2: *Default framing factors to be used if actual window framing factor is not known.*

IEQ-4 Daylight

POINTS AVAILABLE 2

When two or more windows in a room face in different directions or have different obstructions, the daylight factor for each window must be calculated individually and the results summed.

Hand calculations must be provided for all rooms and must be summarised in a list clearly demonstrating that a daylight factor of 2.5% is achieved for the relevant percentage of Nominated Area claimed.

BACKGROUND

General Guidance

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. Whilst this has not been studied to the full effect in commercial retail buildings, 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 case studies 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 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 improvements measured in students are likely to not only improve occupant health and wellbeing, but also productivity. These benefits can be readily transferred to a retail environment and are likely to provide financial as well as health and wellbeing improvements.

Design Sky

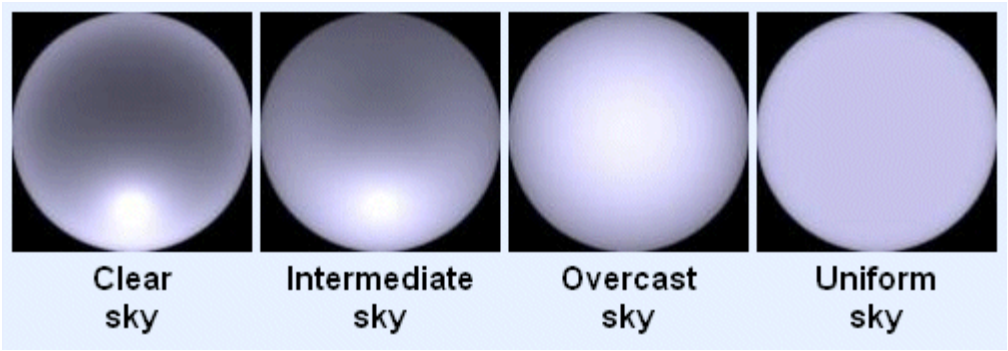

Figure IEQ-4.2: *Illustration of the different CIE (Commission International de l'Eclairage) design skies.*

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

IEQ-5 Daylight Glare Control

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-6 High Frequency Ballasts

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-7 Electric Lighting Levels

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-8 External Views

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-9 Thermal Comfort

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise buildings that achieve a high level of thermal comfort.

CREDIT CRITERIA

A total of two points are available as follows:

One point is awarded where:

- A high level of thermal comfort is achieved for 95% of the tenant areas within the nominated area through any combination of the following:

  Naturally Ventilated and Mechanically Assisted Naturally Ventilated Spaces:

  - Where the Acceptability Limits of ASHRAE Standard 55 2004 are achieved during Standard Operating Hours of Occupancy for 98% of the year:
  - One point is awarded for internal temperatures within 80% of Acceptability Limit 1.

  Mechanically Air-Conditioned Spaces:

  - Where Predicted Mean Vote (PMV) levels, calculated in accordance with ISO7730, are achieved during Standard Operating Hours of Occupancy for 98% of the year using standard clothing and metabolic rate values:
  - One point is awarded for PMV levels between -1.5 and +1.5, inclusive.

  Mixed-Mode Ventilated Spaces:

  For mixed-mode buildings, the above mechanical and natural ventilation thermal comfort criteria must be met.

A second point is awarded where the first point has been achieved AND:

- The deemed to satisfy conditions for the mall spaces within the nominated area are met.

For the purposes of this credit, 'nominated area' is GLA and common areas (excluding open air mall areas, car parks and tenancies that provide their own air). If 'open air mall' areas make up more than 95% of the project's total common areas, the second point is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool. If no conditioning is provided to any tenant spaces within the nominated area, the first point is not applicable. If conditioning is provided, and the first point is not met, the second point in mall spaces cannot be targeted, i.e. the first point is a prerequisite to meeting the second point of this credit.

Deemed-to-satisfy criteria

Modelling is not required where projects can meet the following deemed-to-satisfy criteria:

IEQ-9 Thermal Comfort

POINTS AVAILABLE 2

- For a fully mechanically air conditioned building the first point for tenant spaces is automatically awarded without the requirement for thermal modelling where all of the following design criteria are met and clearly demonstrated for tenant spaces that form part of the nominated area:
  - Dry Bulb Temperature within range of 20°C to 24°C;
  - Shading is provided to limit direct sunlight to not more than 1.5m from any shopfront measured at floor level between 9am and 5pm throughout the year;
  - Relative Humidity within range of 40% to 60%;
  - Air velocity not more than 0.2m/s at occupant level with no supply directed at occupants (unless they have direct control of the air flow e.g. displacement grilles, task air nozzles); and
  - The HVAC system can consist of one zone if it is an internal zone, and not affected by solar exposure.
  - The HVAC system must have a separate internal and perimeter zones if the space is exposed to direct solar radiation. The zones must provide independent heating, cooling and air volumes and meet the following criteria:
    - No individual perimeter zone can exceed 50m²;
    - A perimeter zone can serve no more than one façade orientation unless the second orientation is negligible (i.e. perimeter length is not to exceed four meters); and
    - Each zone must have a thermostat or temperature sensor located in that zone, which controls the temperature of that zone.
- For mall areas (open or enclosed, conditioned or naturally ventilated):
  - 30% of the mall area needs to be:
    - under shade as at 12 midday on 21 December; and
    - protected from the elements – rain and wind (via roof cover, with protection provided from all four sides).

If no conditioning is provide to any tenant spaces, the first point becomes not applicable. If conditioning is provided, and the first point is not met, the second point in mall spaces cannot be targeted, i.e. the first point is a prerequisite to meeting the second point of this credit.

IEQ-9 Thermal Comfort

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Thermal comfort report • Tender drawing(s) (1) • Extract(s) from specifications Where compliance is via the deemed-to-satisfy criteria: • Short Report • Tender drawing(s) (1) Where the credit is not applicable • Tender drawing(s) (2) • Area Schedule	Submit all the evidence and ensure it readily confirms compliance. • Thermal comfort report • As built drawing(s) (1) • Extract(s) from the Commissioning Records Where compliance is via the deemed-to-satisfy criteria : • Short Report • As built drawing(s) (1) • Extracts(s) from the Commissioning Records Where the credit is not applicable • As built drawing(s) (2) • Area Schedule

Thermal comfort report prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Referencing specification(s) and drawings;
- For naturally ventilated buildings, summarising the thermal comfort calculations for the project design and aligning them with ASHRAE Standard 55-2004; and referencing and appending any evidence to justify that the system will operate as designed; and
- For mechanically ventilated spaces, summarising thermal comfort calculations for the project design and demonstrating that the PMV targets are achieved. The Thermal Comfort Report must include:
  - Thermal modelling simulation output including hourly PMV levels for each day of the year that the space is occupied;
  - A summary of mean radiant temperatures, air temperatures and humidity from the simulation and details of the weather data used;
  - A description of the HVAC system and drawings showing how the building layout has been zoned for the thermal comfort analysis;
  - A description of the methodology and software package used for determining the thermal comfort levels;

– The clothing, metabolic rate and air movement values used (see standard variable values below);
– A summary of the hourly thermal comfort results, mean radiant temperatures, air temperatures and humidity for each zone; and
– A description of the year's worth of weather data used.

Tender drawing(s) (1)

- 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 specifications where the thermal properties of all materials that are used as inputs for demonstrating compliance are nominated.

Short Report prepared by a relevant project team member that demonstrates that the Deemed to Satisfy criteria have been met, addressing all of the HVAC Design and Building Fabric Performance criteria of the Deemed-to-Satisfy approach, and referencing and appending any justification, tender drawings and evidence necessary.

Tender drawings (2) indicating the open air mall area and the common area.

Area Schedule indicating the total open air mall area and the total common area, and the calculation proving compliance with the 'na' criteria.

As built drawing(s) (1)

- 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 the Commissioning Records demonstrating via commissioning results that the building has been commissioned and operates as intended by the design.

As built drawings (2) indicating the open air mall area and the common area.

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 – Retail Design assessment) or by the as built evidence (for Green Star SA – Retail As Built assessment).

IEQ-9 Thermal Comfort

Note that for Green Star SA – Retail As Built, on-site thermal comfort measurement is not an acceptable way to demonstrate compliance with the Credit Criteria.

Naturally ventilated buildings

Adaptive Comfort Standard (ACS) is used as defined in ASHRAE Standard 55-2004. The analysis must show that for 98% of occupied hours during a year, the operative temperature in the space is within the 80% or 90% acceptability limits as defined in the standard (also refer Additional Guidance).

Mechanically ventilated spaces:

Thermal comfort modelling must use default values for clothing, metabolic rate and air velocity as outlined in Additional Guidance.

Mixed-mode spaces

For mixed-mode buildings, thermal comfort criteria must be carried out on the basis of the assumed operation of the systems (i.e. it can be assumed that the air conditioning system will be in operation on the warmest days). The same mode of operation must also be used in the Ene-1 Greenhouse Gas Emissions credit.

All fixed shading devices and automated blinds must be included in thermal modelling estimations; manual blinds must be excluded. Overshadowing from adjacent buildings must also be accounted for where relevant.

Projects may choose to input the design criteria into simple PMV calculator software programs and/or do hand calculations for mean radiant temperature.

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 internal temp (80% acceptability) °C	Min internal temp (90% acceptability) °C	Max internal temp (90% acceptability) °C	Max internal temp (80% acceptability) °C
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.

Internal loads

Internal loads shall be assigned as defined in the Green Star SA – Retail v1 Energy Calculator & Modelling Protocol Guide.

Zone distribution

Perimeter zones of less than four meters shall be modelled independently to prevent averaging of heat fluxes and temperatures from invalidating the results (i.e. the comfort predictions shall be measured two metres from the internal face of the façade). The thermal comfort result is
to be calculated on an area weighted average between perimeter zones and centre zones.

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 as defined in the Green Star SA – Retail v1 Energy Calculator & Modelling Protocol Guide.

The following CLO, MET and Air Velocity constants shall be used:

For Air Conditioned and Mixed Mode Retail centres:

- Default values are not prescribed for air velocity for mechanically-ventilated spaces/buildings, as those values are highly dependent on the systems installed. For naturally ventilated retail centres:
- For determining the frequency of PMV >1.5:
  - CLO = 0.6
  - MET = 1.2 or 69.8 W/m^2
  - Air Velocity = 0.30m/s
- For determining the frequency of PMV < -1.5:
  - CLO = 0.95
  - MET = 1.2 or 69.8 W/m^2
  - Air Velocity = 0.15m/s

These standard values were based on values published in ISO7730 (International Thermal Comfort Code). In addition to being conducted in accordance with ISO7730, thermal modelling must account for the effects of direct sunlight. The default air velocity above must be used unless the system has clearly been designed for different air velocity limits.

IEQ-9 Thermal Comfort

POINTS 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 retail centre; 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.

The purpose of the ISO7730 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 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 –1.5 and +1.5 corresponds to a Predicted Percent Dissatisfied (PPD) of no more than 52% (i.e. 52% of people are dissatisfied or uncomfortable). 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.

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

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-11 Hazardous Materials

POINTS 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 materials survey has been carried out on the project site, as defined by the South African Occupational Health and Safety Act (OH&S) and/or other relevant legislation; and
- Whenever asbestos, lead or polychlorinated biphenyls (PCBs) were found, they have been removed in accordance with the standards listed under Table IEQ-11.1.

For new developments or developments in which none of the above hazardous materials were found in the survey, this credit is 'Not Applicable' and is excluded from the points available, used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Short report (1) • Hazardous materials survey (1) Where asbestos, lead or polychlorinated biphenyls were found, the following supplementary documentation is also required, once materials have been removed: • Hazardous materials survey (2) or contractual commitment Where the credit is not applicable • Short report (2) • Hazardous materials survey (1)	Submit all the evidence and ensure it readily confirms compliance. • Short report (1) • Hazardous materials survey (2) Where asbestos, lead or polychlorinated biphenyls were found, the following supplementary documentation is also required: • Disposal receipts Where the credit is not applicable • Short report (2) • Hazardous materials survey (1)

Short report (1) prepared by a suitable professional that describes how the Credit Criteria have been met.

Hazardous materials survey (1) that has been carried out in the existing building.

- Where hazardous materials were found, a new survey must be carried out showing that hazardous materials have been removed and disposed of according to the standards listed under Table IEQ-11.1, or a contractual commitment to remove hazardous materials in accordance with the standards and legislation listed in Table IEQ-11.1.

Hazardous materials survey (2) detailing asbestos, lead and polychlorinated biphenyls report from a suitably qualified person.

Disposal receipts from the contractor (or suitable sub-contractor(s)) confirming that the asbestos, lead and polychlorinated biphenyls have been removed and disposed in accordance with the standards listed under Table IEQ-11.1.

Short report (2) prepared by a suitable professional that describes how the credit is not applicable.

ADDITIONAL GUIDANCE

It must be clear from the submitted documentation that the following hazardous materials will be removed as per the relevant standards or legislation.

Hazardous Materials	Relevant Standards or Legislation
Asbestos	Occupational Health and Safety Act, Waste Act and associated regulations.
Lead	Occupational Health and Safety Act, Waste Act and associated regulations.
PCBs	Occupational Health and Safety Act, Waste Act and associated regulations.

Table IEQ-11.1: *List of relevant legislation and standards*

Where hazardous materials have been found on site, either a contractual commitment to remove hazardous materials, or evidence that hazardous materials have been removed are acceptable methods of meeting the hazardous materials requirements for Green Star SA - Retail Design (not Green Star SA – Retail As Built).

IEQ-11 Hazardous Materials

POINTS AVAILABLE 1

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 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 strong fibres, which are long and silky in appearance. When it is processed, many very small fibres are created. Because they are very fine, they can become airborne. Once in the air, the fibres are easily inhaled or swallowed. If they are inhaled, they can cause mesothelioma, asbestosis, lung cancer and pleural diseases. These effects can take up to 40 years to develop.

When the asbestos fibres are inhaled into the lung, the lung's defence cells try to destroy the fibres; however the defence mechanisms cannot break down asbestos. This results in the asbestos fibres remaining in the lungs and causing scarring; the inflammation continues for decades. Thickening and scarring prevents oxygen and CO_2 from travelling between the tiny air sacs of the lungs and into the blood stream; breathing becomes much less efficient.

The inflammatory process (once started) continues to progress, fuelled by the indestructible asbestos fibres even after the exposure to asbestos has ceased. Mesothelioma is a form of malignancy that arises from the cells which line the chest wall or the abdominal cavity, or cover the lung and cover the bowel in the abdominal cavity.

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. 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.

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 abortion 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.

PCBs are most commonly found in the ballasts of fluorescent light fixtures. Wherever found, it must be removed in accordance with the Waste Act and associated regulations.

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.

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.

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%.

These facts about Lead are taken from the Australian Federal Government Department of Environment and Heritage's Fact Sheet on Lead.

Lead is most commonly found in paints. Wherever found, it must be removed in accordance with the Occupational Health and Safety Act and the Waste Act and associated regulations.

IEQ-11 Hazardous Materials

POINTS AVAILABLE 1

REFERENCES & 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

ANZECC Guidelines Polychlorinated Biphenyls Management Plan
http://www.environment.gov.au/settlements/publications/chemicals/scheduled-waste/pubs/biphenyls.pdf

IEQ-12 Internal Noise Levels

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level.

CREDIT CRITERIA

One point is awarded where it is demonstrated that:

For 95% of the project's nominated area, noise from the building services does not exceed 55 dB(A)eq.

For the purposes of this credit, 'nominated area' is GLA and common areas (excluding open air mall areas, car parks, back of house areas and tenancies that provide their own air).

If 'open air mall' areas make up more than 95% of the project's total common areas, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Acoustic report (1) Where the credit is not applicable • Tender drawing(s) • Area Schedule	• Acoustic report (2) • Survey of internal noise levels • Extracts of the Commissioning Report Where the credit is not applicable • Tender drawing(s) • Area Schedule

IEQ-12 Internal Noise Levels

Acoustic report (1) prepared by a qualified acoustic consultant that describes how Credit Criteria have been met by describing:

- All relevant internal and external noise sources from building services of the project;
- The design features required to demonstrate that the Credit Criteria has been achieved, including reference to any relevant drawings;
- Stating that the design features have been included in the tender documentation, referencing any relevant drawings;

Tender drawings indicating the open air mall area and the common area.

Area Schedule indicating the total open air mall area and the total common area, and the calculation proving compliance with the 'na' criteria.

Acoustic report (2) prepared by a qualified acoustic consultant that describes how Credit Criteria have been met by describing:

- All relevant internal and external noise sources from building services of the project;
- The design features required to demonstrate that the Credit Criteria has been achieved, including reference to any relevant drawings;

Survey of internal noise levels confirming average internal noise levels.

Extract(s) from the Commissioning Report which must show that the relevant engineer was present at the time of the acoustic testing, and state that the plant was in full operation when the tests were carried out, and comply with the required standards.

As built drawings indicating the open air mall area and the common area.

ADDITIONAL GUIDANCE

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.

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 standard, with reference to relevant drawings.

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. The acoustic consultant is to provide comment on low frequency noise if applicable to the building and confirm that this has been considered in the design.

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/room is unoccupied, but with all the base building services running as for normal operation of the building. If natural ventilation or mixed mode ventilation is used in the building, the windows must be open as necessary for normal operation of these systems.

Occupants and equipment

Noise from occupants and equipment (e.g. computers) must not be included in the analysis or measurements.

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 is 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.

- 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.

REFERENCES & FURTHER INFORMATION

ASHRAE HVAC Applications Volume (2003) – 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 11690-2:1996 – Acoustics – Recommended practice for the design of low noise workplaces containing machinery

IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 2

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 two points are awarded where the various finishes used in the project meet the benchmarks as follows:

Paints

One point where

- at least 95% of all painted surfaces 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
- where no paint is used in the project.

Adhesives and sealants

- One point where 95% of all adhesives and sealants meet the TVOC Content Limits outlined in Table IEQ-13.2 or where no adhesives or sealants are used.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from specification(s)	• Short Report • Confirmation from contractor • VOC datasheet(s) • Signed letter(s) from paint manufacturer

IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 2

Short Report prepared by a suitable professional that describes how Credit Criteria have been met by:

- Summarising how the products used meet the Credit Criteria;
- Listing and referencing all the products within the relevant category used in the project;
- Nominating the ones that meet the Credit Criteria; and
- As Built compliance: Referencing the appropriate VOC datasheet.

Extract(s) from the specification(s):

- Nominating the VOC limits for each product within the relevant category type;
- Stating that the contractor is required to obtain approval of the design team or client before substituting the finishes listed in the schedule;
- Requiring that at the end of construction works, the contractor undertakes a final audit to ensure that the correct products have been used; and
- Where the project has no products from a particular category, showing where it is stipulated that no paint or adhesive/sealant is to be used in the project.

Confirmation from the contractor:

- That compliant low VOC products were used by all subcontractors and relevant trades wherever specified, to meet the Credit Criteria by describing the application, amount, type and supplier of paint, sealants and adhesives (whichever relevant) used throughout the project;

VOC datasheet(s) provided by manufacturer/supplier:

- For every compliant product nominated;
- For every datasheet provided, the compliant VOC levels must be highlighted and referenced in the short report;
- Stating the calculation method followed to determine TVOC levels of each specified product.

Signed letter(s) from paint manufacturer for each paint product, stating that the paint does not contain any added lead.

ADDITIONAL 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.

The specifications given to contractors must 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 – Retail Centre Credit Criteria,

even if the Additional Guidance are included as an Appendix to the specification, will not be acceptable for demonstrating compliance.

The contractor is required to obtain approval of the design team or client before substituting the finishes listed in the specifications.

A final audit must be carried out by the contractor ensuring that the correct products have been used once the project has been completed.

VOC datasheet

For the purposes of Green Star SA, Paints and Adhesives/Sealants, a VOC datasheet is defined as:

- 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.

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. The appropriate test methods are listed later in this section.

OR

- Manufacturer prepared VOC data sheets – Product VOC data sheets that have been prepared by the manufacturer to demonstrate TVOC must be 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 later in this section.

Theoretical TVOC calculations prepared by manufacturers may be submitted as evidence for compliance with the credit. Project teams must submit a signed letter from the manufacturer containing the following:

- Numerical TVOC results expressed in g/litre of product;
- 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.

Definition of VOCs

'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.

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 degrees C). The GBCSA deems this definition applicable to paints, adhesives and sealants.

IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 2

Paints

Paints are defined as any liquid applied finishes. Any paint used in an internal application, and applied on site, must meet the TVOC Content Limits outlined in Table IEQ-13.1. This includes exterior-grade and solvent-based paints must they happen to be used in an interior application. Values must reflect the final product as mixed and ready to use, inclusive of tints.

Paints used in internal car parks and for exterior applications are excluded from this credit.

Calculations must be made based on whole paint (water and tinters 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

- 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).

IEQ-13 Volatile Organic Compounds

POINTS AVAILABLE 2

The product(s) must comply with the following table:

Product Type/Sub Category	Max TVOC content (g/L of ready-to-use product)
Ceilings - interior flat	14
Walls and ceilings - interior flat washable	16
Walls and ceilings - interior low sheen	16
Walls and ceilings - interior 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*

Adhesives and Sealants

Any adhesive and sealant product(s) used in an internal application, and applied on site, must meet the TVOC Content Limits outlined in Table IEQ-13.2. This includes both exposed and concealed applications. Internal applications are defined as any within the external vapour barrier. Sealants and adhesives used in internal car parks and for exterior applications are excluded from this credit and do not require documentation.

Any sealants/adhesives used in an internal application (non-occupied areas included) must meet the VOC limit criteria outlined below; this includes exterior-grade and solvent-based sealants/adhesives, must they be employed in internal applications.

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).

The product(s) must comply with the maximum TVOC limits in the following table:

Product Type	**Max TVOC content* (g/litre of product)**
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and Laminate adhesive	100
Rubber 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*

BACKGROUND

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 Rates').

In both new and existing buildings it is common to find 50 or more of these compounds at average concentrations of 200 parts per billion (ppb) in existing buildings and 1,000ppb in new buildings. In new buildings concentration levels of 5,000ppb have been measured. Outdoor levels are typically 10 to 20ppb. Sources of VOCs in buildings include:

- New buildings – paints, adhesives, carpets, sealants, reconstituted wood products, new furniture, etc; and

- Established buildings – cleaning products, printed materials, office equipment, consumer products, dry-cleaned clothing, car exhaust, etc.

Due to the large number of compounds, indoor air concentrations are typically based on total VOC (TVOC) concentrations, and are essentially the sum of the individual concentrations.

The health implications of exposure to VOCs are consistent with 'sick building syndrome' effects including eye, nose and skin irritation, headache and lethargy. The indoor air quality goals have been set to limit exposures to much lower levels (in Australia, the past NHMRC level of concern was 500µg/m^3).

Measurement standards

For Green Star SA purposes, the two primary and internationally-accepted ways to measure the impacts of TVOCs on indoor environment quality (IEQ) include:

- Measurement by 'rate' of emission – typically reported in g or mg/m^2/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 ($PbCrO_4$ 'Chrome yellow' or $PbCO_3$ '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 Labour 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 intends to be more stringent than the proposed South African legislation which limits lead to a maximum of 600ppm.

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

Europa summaries of EU legislation
http://europa.eu/legislation_summaries/environment/air_pollution/l28029b_en.htm

IEQ-14 Formaldehyde Minimisation

POINTS 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 (including exposed and concealed applications) either:

- Have low formaldehyde emissions;

  OR

- Contain no formaldehyde.

If no composite wood products are used within the project, this credit is 'Not Applicable' and excluded from the total number of Points Available, used calculate the Indoor Environment Quality (IEQ) Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Short report • Extract(s) from specification(s) Where the credit is being claimed as 'Not Applicable': • Extract(s) from the specification(s)	Submit all the evidence and ensure it readily confirms compliance. • Short report • Confirmation from contractor For every product nominated, the following must be provided: • Product datasheet(s) Where the credit is being claimed as 'Not Applicable': • Confirmation from contractor

IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

Short report prepared by a suitable professional that describes how Credit Criteria have been met by:

- Summarising how the products used meet the Credit Criteria;
- Listing and referencing all the composite wood products used in the project;
- Nominating the ones that meet the Credit Criteria;
- For As Built compliance: Referencing the appropriate manufacturers formaldehyde emissions report or datasheet with the compliant emissions values highlighted.

Extract(s) from the specification(s) stipulating

- The formaldehyde content or emissions standard for all composite wood products used in the project (excepting excluded applications);
- The contractor is required to obtain the approval of the design team or client before substituting the composite wood products listed in the schedule;
- Where no composite wood products are being used, an extract from the specifications must be provided showing that no composite wood products (excepting excluded applications) are to be used in the project.

Confirmation from the contractor

- Describing the application, amount, type and supplier of composite wood products used throughout the project;
- Demonstrating that compliant low-formaldehyde products were used wherever specified, to meet the Credit Criteria;
- Where the point for formaldehyde minimisation is claimed as 'Not Applicable', stating that no composite wood products were used in the project (excepting excluded applications);
- For As Built compliance: Confirmation from the contractor that the materials installed were as per the short report.

Product datasheet(s) provided by manufacturer:

- Quoting the formaldehyde emission level of each composite wood product used in the project (excepting excluded applications);
- Highlighting the compliant emission values in the data sheet(s) for clarity of submission purposes.

ADDITIONAL GUIDANCE

Composite wood products include, but are not limited to, particleboard, plywood, veneer, MDF and decorative overlaid wood panels. 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.

IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

The emission levels must be established by a NATA or ISO/IEC 17025 registered laboratory as per the testing methodologies provided in Table IEQ-14.1.

The following applications are excluded from this credit and do not require documentation:

- Any composite wood products used in exterior applications (e.g. decorative façade);
- Formwork;
- Internal car park applications;
- Reused composite wood products; and
- Raw timber.

Emission Requirements

Products made from wood and other natural products that contain formaldehyde-based additives, shall be subject to the following air emission limits for formaldehyde as measured using the Air Chamber, Desiccator or Perforator test methods.

Composite wood products (e.g. particleboard, MDF, decorative overlaid wood panels) must conform to formaldehyde testing outlined in AS 4266.16 (2004) Method 16: Formaldehyde emission-Desiccator method. Composite wood products shall demonstrate a level equivalent to or below E1 limit values provided in Table IEQ-14.1.

Veneer and plywood must conform to formaldehyde testing outlined in Australian Standard – AS/NZS 2098.11 (2005) Method 11: Methods of test for veneer and plywood – Determination of formaldehyde emissions for plywood. These panels shall demonstrate a level equivalent to or below E1 limit values provided in Table IEQ-14.1.

Other internationally accepted test methods may be accepted as outlined in Table IEQ-14.1.

IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

Test method	Limit Value[1,2,3]		
	E1	E0	Super E0
AS 4266.16 for particle board for MDF	< 1.0 mg/L <1.5 mg/L	< 0.5 mg/L	< 0.3 mg/L
JIS A1460 not applicable to plywood	< 1.0 mg/L	< 0.5 mg/L	< 0.3 mg/L
JAS 233 for plywood	< 1.5 mg/L	< 0.5 mg/L	< 0.3 mg/L
EN 120 for particle board and MDF For plywood	< 9 mg/(100g) < 6 mg/(100g)	< 6 mg/(100g) < 4mg/(100g)	< 2.8 mg/(100g) < 2.4 mg/(100g)
DIN EN 717-1	< 0.12 mg/m³h	< 0.08 mg/ m^3h	< 0.04 mg/m³h
DIN EN 717-2 not applicable to MDF	< 0.12 mg/m³h	< 0.08 mg/ m^3h	-

Note 1: Values from Good Environmental Choice Australia Standard No: GECA 04-2007 Panel Boards section 3.2.1.5 Emissions Requirements

Note 2: Values from Good Environmental Choice Australia Standard No: GECA 41-2007 Toys and Childcare Products section 3.2.1.5 Formaldehyde Emissions

Note 3: Values from Good Environmental Choice Australia Guidance Note October 2007 – Formaldehyde Testing v0.1 Table 1

Table IEQ-14.1: *Formaldehyde emission limit values for different testing methods*

The comparability Table IEQ-14.1 must not be misunderstood to mean that 'E1 board according to EN 120' allows more formaldehyde than 'E1 board according to AS 4266.16'. This is not the case as the levels provided in the table are equivalent results for the same board tested with different procedures. Refer to 'Background' for more information on the comparisons and differences between testing methodologies.

BACKGROUND

Formaldehyde is a widely used industrial chemical (generally as a solution in water) and is a gas at room temperature. 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 an ongoing debate within the industry regarding the approach of testing for formaldehyde emissions in products, with the principle approaches being industrial production testing and performance testing, outlined below. The distinction between these two opinions is based on how formaldehyde emissions are considered in green building situations and addresses two key issues; the indoor environmental quality (IEQ) 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 IEQ 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 (IEQ). 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 v0.1. 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 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.

IEQ-14 Formaldehyde Minimisation

POINTS AVAILABLE 1

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 Prevention

POINTS 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 95% of the nominated area:

- The mechanically air-conditioned ventilation system maintains humidity levels at no more than 60% relative humidity in the space and no more than 80% relative humidity in the supply ductwork;

  OR

- The building is naturally ventilated

For the purposes of this credit, 'nominated area' is GLA and common areas (excluding open air mall areas, car parks and tenancies that provide their own air). If 'open air mall' areas make up more than 95% of the project's total common areas, this credit is 'Not Applicable' and is excluded from the points available used to calculate the Indoor Environment Quality Category Score. Type 'na' in appropriate 'Number of Points Achieved' column of the rating tool.

IEQ-15 Mould Prevention

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated spaces: • Compliance note • OR • Short report • Opening area schedule For mechanically air conditioned spaces: • Short report • Extract(s) from the specification(s) • Tender mechanical drawing(s) Where the credit is not applicable • Tender drawing(s) • Area Schedule	For naturally ventilated spaces: • Compliance note • OR • Short report • Opening area schedule For mechanically air conditioned spaces: • Short report • As built mechanical drawing(s) • BMS point schedule • Extract(s) from the Commissioning Record(s) Where the credit is not applicable • As built drawing(s) • Area Schedule

Compliance note indicating that full points have been achieved for the IEQ-1 Ventilation Rates credit.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Short report prepared by a mechanical engineer that describes how the Credit Criteria have been met.

Extract(s) from the specification(s) where the system design parameters in terms of design conditions, humidity and temperature, and humidity control parameters are stipulated.

Tender mechanical drawing(s) for each mechanically ventilated space highlighting and showing the active humidity control systems.

IEQ-15 Mould Prevention

POINTS AVAILABLE 1

Tender drawings indicating the open air mall area and the common area.

Area Schedule indicating the total open air mall area and the total common area, and the calculation proving compliance with the 'na' criteria.

As built mechanical drawing(s) showing humidity sensors installed in the ductwork.

BMS point schedule showing humidity sensors installed in the ductwork.

Extract(s) from the Commissioning Record(s) showing the humidity levels in the ducts and in the occupied space for all modes of operation.

As built drawings indicating the open air mall area and the common area.

ADDITIONAL GUIDANCE

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.

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.

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation Rates' 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 Rates', 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.

IEQ-15 Mould Prevention

POINTS AVAILABLE 1

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 duct work and in the occupied space for all modes of operation.

Mixed-mode ventilated space

Mixed-mode ventilated spaces must comply with the criteria for mechanically air conditioned spaces.

BACKGROUND

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, recently commented that 'mould is where asbestos was thirty years ago'.

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 Tenant Exhaust Riser

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-17 Environmental Tobacco Smoke (ETS) Avoidance

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

IEQ-18 Places of Respite and Connection to Nature

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise developments that create appropriately designed areas where retail centre staff and visitors can relax in a place of respite which has a connection to nature.

CREDIT CRITERIA

One point is awarded where it is demonstrated that at least one designated place of respite with direct physical and visual connection to the natural environment is provided for staff and visitors in accordance with all of the following criteria:

- The combined area of all places of respite is equivalent to no less than 0.1% of the Retail GFA, or a minimum of 50 m^2;
- Each place of respite is designed to be a universally accessible, well lit, well ventilated, and is located to avoid noise, odour and air pollution;
- The places of respite are located in a walkable distance to any part of the centre, and must either be central or spread across the centre for ease of access;
- A minimum of 20% of the area of the place of respite is soft landscaping – horizontal or vertical or a combination;
- Seating areas are provided to a minimum of two seating spaces per 7.5 m^2.
- Ambient sound level of the place of respite will be maintained at a maximum of 55dBA.

AND

- Where the place of respite is outdoors it must be shown that, in addition, the space:
  - Has a low noise exposure (from traffic and building services);
  - Has shading to at least 35% of its area;
  - Is screened from significant prevailing winds.

AND

- Where the place of respite is indoors it must be shown that, in addition, the space:
  - Has a Daylight Factor (DF) of at least 2.5%;
  - Provides a 50% improvement on outside air rates as required by SANS 10-400-0 (if it is not an open air space or naturally ventilated).

IEQ-18 Places of Respite and Connection to Nature

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Short report • Tender drawing(s)	• Short report • As built drawing(s)

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

- Detailing how each of the Credit Criteria have been met;
- Referencing the general architectural layouts in the submission indicating the location of the place(s) of respite
- Confirming how the daylight modelling for the area has been done in accordance with the methodology described under IEQ-4.

Tender drawings showing the location and details complying with the Credit Criteria of the place(s) of respite.

As built drawings showing the location and details complying with the Credit Criteria of the place(s) of respite.

ADDITIONAL GUIDANCE

Where this credit is targeted, a place of respite must not be further than 200 m walking distance from any mall facing shopfront.

The low noise exposure for outdoor places of respite must be proven by indicating what activity occurs within a 15m radius of the place of respite, and how the ambient sound level of the place of respite will be maintained at a maximum of 55dBA.

The same methodology as described under the daylight credit (IEQ-4) must be used for proving the daylight factor or equivalent daylight illuminance of the indoor places of respite – if the place of respite area falls within the nominated area modelled under the daylight credit and meets the criteria, reference can simply be made to the IEQ-4 documentation.

The soft landscaping in places of respite can be via potted plants or plant beds, but may not be via synthetic plants. This landscaped area forms part of the building's overall landscaped area, which must be included under the landscape irrigation credit (WAT-3).

IEQ-18 Places of Respite and Connection to Nature

POINTS AVAILABLE 1

BACKGROUND

According to many research studies, people and nature are intertwined, with people's need for a connection to nature having a strong link to their psychological and bodily well being. In retail centres, adding places of respite with a connection to nature could be seen in some ways like adding parks in urban areas – the logic is quite similar. In busy urbanised areas it was found that parks and green spaces are places where people can break away from the bustle of the city, by connecting with nature, ultimately facilitating healthier lifestyles. In a similar way, retail centres are often very busy, noisy places because of their transient occupancy, which can add to the stress and exhaustion experienced by staff and visitors to a centre. Daylight, a connection to nature and fresh air are important aspects to include in such areas, as they are all proven to enhance the indoor environment quality in the built environment, and can contribute towards healthier living. Studies have also been done specifically around the health benefit of giving children regular access to nature, which is very relevant in a retail context, where many parents visit centres with their children and enjoy resting for a moment in a suitable area. The same places of respite can be used by staff working at the retail centre, who during breaks are able to get out of their busy working environment and find a moment to relax in a pleasant environment.

REFERENCES & FURTHER INFORMATION

Ergonomics of the City: Green Infrastructure and Social Benefits, Dr Kathleen L. Wolf (2003)

The experience of Nature: A Psychological Perspective, Stephen Kaplan & Rachel Kaplan, New York, Cambridge University Press (1989)

Healthy Communities through Nature: Linking Quality of Life to managing the Natural Environment. Taylor, Dr. Robert, and Karen Gowanlock. Unpublished Discussion Paper – Ontario Ministry of Natural Resources. January 2003.

The Psychological Benefits of Wilderness, Duncan Garrett, Ecopsychology on-line 1998-09 no. 6 (2006)

Last Child in the Woods: Saving our Children from Nature Deficit Disorder, Richard Luov (2005)

Energy

The credits within the Energy Category target an overall reduction in energy consumption. Such reduction has an impact upon greenhouse gas and other emissions associated with energy generation from fossil fuels. Reductions in energy consumption can be achieved through more efficient use of energy in buildings. Reductions in emissions and capacity may also be achieved through generation of energy from alternative sources.

If 'upstream' emissions from heat and electricity are included, emissions from buildings account for 20% of global greenhouse gas emissions, according to the 2006 Stern Review on the Economics of Climate Change.

South Africa contributed carbon emissions of around 9.2 tonnes of CO_2 per capita in 2004, making it the 41st worst polluter from 206 countries. This figure is much higher than neighbouring countries (Botswana 2.4 tonnes, Namibia 1.2 tonnes, Swaziland 0.9 tonnes, and Mozambique 0.1 tonnes).This is not simply due to its larger economy; the emissions in relation to GDP are also higher at 2.0 metric tonnes of CO_2 per $1,000 GDP (Botswana 0.44 tonnes, Namibia 0.44 tonnes, Swaziland 0.40 tonnes, and Mozambique 0.37 tonnes). According to the City of Cape Town Smart Living Handbook, 2007, South Africa produces approximately 8 tonnes of CO_2 per capita – twice the global average of 4 tonnes, and nearly eight times the African average of 1.1 tonnes.

Production of South Africa's energy is largely from incineration of non-renewable fossil fuels and is the country's greatest contributor of greenhouse gas emissions. Energy efficient design of buildings is essential to realise the environmental improvement potential that exists. There is potential for substantial environmental savings through energy efficiency measures in South African retail centre buildings.

For example, CO_2 emissions can be reduced by around one tonne per year by monitoring and adjusting heating, ventilation and air conditioning (HVAC) systems by allowing just two degrees of variance. Greater efficiency of energy use, energy demand reduction methods and generation of energy from alternative sources are all means of addressing this urgent issue.

With the current shortfall in electrical generation capacity in South Africa, reducing buildings' electrical energy usage has the added benefit of reducing strain on the infrastructure and minimizing the need for load shedding.

Ene-0 Conditional Requirement

AIM OF CREDIT

To encourage and recognise designs that minimise the greenhouse gas emissions associated with operational energy consumption, and maximise potential operational energy efficiency of the base building.

CONDITIONAL REQUIREMENT CRITERIA

Two compliance routes are available:

Compliance Route 1 - Energy modelling route

Predicted carbon emissions of the actual building are less than or equal to the predicted carbon emissions of the notional building in the same location, based on the requirements of the Green Star SA - Retail Centre v1 Energy Calculator and Modelling Protocol Guide.

Compliance Route 2 - ASHRAE deemed to satisfy route

The design must fully comply with ASHRAE Advanced Energy Design Guide for Small Retail Buildings. This route is only available for retail centres with GFA < 2,200 m².

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Compliance Route 1 – Energy modelling • Documentation required as for Ene-1 credit, compliance route 1	**Compliance Route 1 – Energy modelling** • Documentation required as for Ene-1 credit, compliance route 1
Compliance Route 2 – ASHRAE deemed to satisfy route • Documentation required as for Ene-1 credit, compliance route 2	**Compliance Route 2 – ASHRAE deemed to satisfy route** • Documentation required as for Ene-1 credit, compliance route 2

Ene-0 Conditional Requirement

ADDITIONAL GUIDANCE

Modelling and supporting documentation

Refer to the Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide for more information. It is available on the Retail Centre page of the GBCSA website **(www.gbcsa.org.za).**

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 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 (SOx) and nitrous oxide (NOx) 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.

Ene-0 Conditional Requirement

REFERENCES & FURTHER INFORMATION

Contact SABS to purchase a copy of the SANS 204:1 2008 guideline documents.
http://www.sabs.co.za

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.saee.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-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 twenty points are awarded where it is demonstrated that the building's predicted greenhouse gas emissions have been reduced according to either of the two options:

Compliance Route 1 - Energy modelling route (maximum 20 points available)

The building is to be modelled using the criteria in the Green Star SA - Retail Centre v1 Energy Calculator and Modelling Protocol Guide, and the predicted carbon emissions compared with those of the notional building in the same location constructed to the requirements of the same Retail Centre Energy Calculator and Modelling Protocol Guide. Points are then 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.

Compliance Route 2 - ASHRAE deemed to satisfy route (2 points available)

If the project has a retail GFA of less than 2200 m^2, then the project may prove compliance by fully complying with the ASHRAE Advanced Energy Design Guide for Small Retail Buildings.

The points in both cases are determined by the Green Star SA - Retail Centre v1 Energy Calculator.

Ene-1 Greenhouse Gas Emissions

POINTS AVAILABLE 20

DOCUMENTATION REQUIREMENTS

Compliance Route 1 – Energy Modelling

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Energy modelling report • Copy of the completed Green Star SA Retail Centre v1 SA Energy Calculator • Extract(s) from the specification(s) • Tender drawing(s) Additionally for naturally ventilated buildings: • Compliance Note OR • Natural Ventilation Report	• Energy modelling report • Copy of the completed Green Star SA Retail Centre v1 Energy Calculator • Extract(s) from the Commissioning Report(s) • As built drawing(s) Additionally for naturally ventilated buildings: • Compliance Note OR • Natural Ventilation Report

Energy modelling report in accordance with the Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide.

- Following the structure defined in the Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide; and
- Clearly identifying all assumptions made for tenant and other loads (e.g. occupant density); and
- Clearly identifying all of the design-driven inputs and referencing drawings; and
- Clearly corresponding to the design.

Whenever assumptions are used, they must be justified and conservative.

If the same report is submitted for the As Built rating as was submitted for the Design rating, then the same points will not be guaranteed unless it is clearly evident that it accurately reflects the as built/as installed design. The project team may wish to provide a short report correlating the original report to the as built design.

Copy of the completed Green Star SA Retail Centre v1 Energy Calculator to show what energy values have been entered for the actual and notional building.

Extract(s) from the specification(s) demonstrating that all the inputs used in the energy simulation are reflected in the current design.

Tender drawing(s) demonstrating that all the inputs used in the energy simulation are reflected in the current design.

Extract(s) from the Commissioning Report(s) demonstrating (through supporting evidence) that the building has been commissioned and operates as intended by the design.

As built drawing(s) demonstrating that all the inputs used in the energy simulation are reflected in the completed building, as described in the energy modelling report.

Compliance Note indicating that full points have been achieved for the IEQ-9 Thermal Comfort credit.

Natural Ventilation Report prepared by a mechanical engineer that describes how the building has been designed to be naturally ventilated and confirms that analysis has been carried out to check that internal conditions will be acceptable to the occupants. This is to avoid rewarding buildings which will overheat or be uncomfortable and require air conditioning to be retrofitted. The report must include:

a. Opening Area Schedule of openings room by room, showing that each naturally ventilated space has an opening of area at least 5% of floor area (as required by SANS 10400-O).

b. Thermal Analysis of all typical tenant spaces in the building, using hourly weather data to show that internal conditions meet the following criteria: internal operative temperatures are within the 80% Acceptability Limits given in ASHRAE Standard 55-2004 for 90% of occupied hours in the year;

c. Evidence of compliance to the thermal comfort deemed-to-satisfy criteria for the mall spaces within the nominated area as described in IEQ-9 Thermal Comfort – this can either be done by making reference to the documentation submission if the IEQ-9 point is achieved via the deemed-to-satisfy route or by submitting the Documentation Requirements as per IEQ-9 Documentation Requirements for the deemed-to-satisfy route.

The report must clearly show the geometry and materials of the model, and list all assumptions made such as clothing levels, etc. Occupancy times, equipment and lighting heat gains must be modelled using the same assumptions as the Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide. The report must include a summary of the mean radiant temperatures and air temperature results from the simulation and details of the weather data used. Refer to credit IEQ-9 for more details of calculation method.

Note that if a naturally ventilated building fails to achieve the above criteria, it can still be entered for Green Star SA – Retail Centre assessment, but the energy modelling must include a notional air conditioning system in the actual building (refer to Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide for more details). This is because with such a building there is a significant risk that future occupants will retrofit air conditioning systems).

Ene-1 Greenhouse Gas Emissions

POINTS AVAILABLE 20

Compliance Route 2 – ASHRAE Deemed-to-Satisfy Route

Green Star SA – Retail Design	Green Star SA – Retail As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Report • Tender architectural drawings • Extract(s) from the mechanical and electrical specification(s)	• Report • As built architectural drawings • Confirmation(s) from the contractor

Report written in the same format as the ASHRAE Advanced Energy Design Guide for Small Retail Buildings Climate Zone X Recommendation Table detailing each component (e.g. roof insulation), the ASHRAE recommendation, and the achieved performance level in the design.

Tender architectural drawings (plans, elevations and typical details) demonstrating 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 Retail Buildings..

Extract(s) from mechanical and electrical specifications demonstrating that the mechanical and electrical systems meet the efficiency and other requirements of the ASHRAE Advanced Energy Design Guide for Small Retail Buildings.

As built architectural drawings (plans, elevations and typical details) demonstrating 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 Retail Buildings.

Confirmation(s) from the contractor that the insulation, glazing and other thermal envelope components supplied to the project are as per the specification on which the above report is based. Additionally, confirmation that the HVAC and electrical installations are as per the specification on which the above report is based.

ADDITIONAL GUIDANCE

Compliance Route 1 – Energy Modelling

The energy modelling must be carried out in accordance with the latest available version of the Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide. The guide is available on the Retail Centre page of the GBCSA website (www.gbcsa.org.za).

Each variable in the Energy Modelling Report (e.g. building form, materials and air conditioning system(s)) must be referenced consistently throughout the rest of the submission (i.e. in related credits such as IEQ-1 ‘Ventilation Rates’ or Ene-7 ‘Peak Energy Demand Reduction’) and must be clearly justified by the documented design (for Green Star SA – Retail Centre

Design v1 assessment) or by the as built evidence (for Green Star SA – Retail Centre As Built v1 assessment).

Software must comply with the requirements and verification methods detailed in the Energy Calculator & Modelling Protocol Guide.

ASHRAE Advanced Energy Design Guide for Small Retail Buildings

The building retail GFA must be under 2200 m² to use this compliance route. To achieve this credit, the project must comply with all recommendations established in the Advanced Energy Design Guide for the climate zone in which the building is located. Points are not awarded for partial compliance.

This guide provides an effective means of limiting building energy usage and documenting improved building energy performance without the need for a building energy simulation. The recommendations in the guide must be incorporated into the project early in the building design in order to optimise building performance with minimum impact on capital cost.

The project team must identify which of the eight US climate zones is appropriate for the project location in South Africa and use the corresponding criteria from the guide. This allocation is done by using the method explained in the 2006 International Energy Conservation Code (IECC) by firstly establishing whether it is a 'Marine' climate or not and then calculating the number of heating degree days HDD (relative to 18°C) and cooling degree days CDD (relative to 10°C):

Zone	Criteria	Example in South Africa
Zone 1	CDD > 5000	Beitbridge
Zone 2	CDD between 3500 - 5000	Upington, Durban
Zone 3AB	CDD between 2500 - 3500 and HDD < 3000	Pretoria
Zone 3C (Marine)	HDD < 2000	Cape Town
Zone 4AB	CDD < 2500 and HDD < 3000	Johannesburg
Zone 4C (Marine)	HDD between 2000 and 3000	-
Zone 5	HDD between 3000 and 4000	-
Zone 6	HDD between 4000 and 5000	-
Zone 7	HDD between 5000 and 7000	-
Zone 8	HDD > 7000	-

Table Ene-1.1: *Classification of Climate Zones for use with ASHRAE design guide*

The guide includes recommendations for roofs, walls, floors, slabs, vertical glazing, skylights, interior lighting, ventilation ducts, energy recovery and service water heating. The measures in

the guide are expected to reduce a building's energy consumption significantly compared to a baseline ASHRAE 90.1-1999 standard retail centre.

Modelling and supporting documentation

Refer to the Green Star SA – Retail Centre v1 Energy Calculator & Modelling Protocol Guide for details of how to carry out the modelling.

Renewable energy, off-sets and carbon credits

Where the building produces its own energy on site, this production can be included within the energy modelling; any greenhouse gas-neutral energy will directly reduce the building's predicted greenhouse gas emissions.

Carbon credits, off-sets and commitments to purchase renewable or 'green' power from an electricity supplier are an operational matter, rather than an inherent building attribute; as a result 'green' power generated off-site cannot be included in energy modelling. In addition mitigation measures such as planting trees are not considered in this credit.

Lighting

In contrast to previous Green Star SA rating tools, energy consumed directly by lighting is now rewarded in this credit. See the Retail Centre v1 Calculator and Energy Modelling Guide for more information.

BACKGROUND

Refer to Ene-0 Conditional Requirement.

REFERENCES & FURTHER INFORMATION

ASHRAE Advanced Energy Design Guide for Small Retail 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

International Energy Conservation Code, 2006 edition
http://www.iccsafe.org

Ene-2 Electrical Energy Sub-metering

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise the installation of electrical energy sub-metering to facilitate ongoing management of electrical energy consumption.

CREDIT CRITERIA

Two points are awarded where:

- It is demonstrated that electrical sub-metering is provided for substantive energy uses within the building (i.e. all electrical energy uses of 100kVA or greater) including separate meters for all tenancies;
- There is an effective automated mechanism for monitoring electrical energy consumption data; AND
- A metering and verification strategy is developed for the project.

DOCUMENTATION REQUIREMENTS

Green Star SA – Office Design	Green Star SA – Office As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Tender schematic electrical drawings • Tender BMS/monitoring system point schedule • Copy of the metering and verification strategy	• Short report • As built schematic electrical drawings • As built BMS/monitoring system point schedule • Copy of the metering and verification strategy

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

- Providing a summary table of all separately metered spaces in the building;
- Describing how the energy consumption data will be effectively monitored during the building's operation.

Ene-2 Electrical Energy Sub-metering

POINTS AVAILABLE 2

Extract(s) from the specification(s) describing the installation requirements for electrical sub-meters that meet the Credit Criteria (see 'Additional Guidance').

Tender schematic electrical drawings with all uses and loads clearly indicated and with the location of all sub-meters clearly marked.

As built schematic electrical drawings with all uses and loads clearly indicated and with the location of all sub-meters clearly marked.

Tender BMS/monitoring system point schedule showing inputs from the sub-meters.

Metering and verification strategy describing in not more than one A4 page a summary of the overall metering and verification strategy for the project. Proof of the building owner / landlord's approval of the strategy must be provided with this submission.

As built BMS/monitoring system point schedule showing inputs from the sub-meters and that they are duly connected.

ADDITIONAL GUIDANCE

The documentation must account for all of the electrical energy consumption loads in the building, and clearly identify (through highlighting or similar means) the location, number and respective loads of all sub-meters. It must be clear that the sub-metering is provided by the base building owner/developer.

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 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), but do not necessarily take the form of a traditional BMS system. Wherever such systems are present to monitor the energy consumption data, the energy sub-meters must be linked to them.

If there is a Building Management 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 BMS and data must be provided to confirm the metering capability of the system.

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.

For a typical retail centre building, the following will have loads of 100kVA or greater and must be sub-metered:

- Car parks;
- Chillers;
- Air handling fans;

- Lifts;
- Common area lighting;
- Common area power; 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.

Sub-metering must measure energy in kWh and need not measure kVA or other electrical parameters.

Tenancy meters

Meters must be installed by the landlord to all tenancies in the retail centre to be awarded this credit.

Metering and verification strategy

The metering and verification strategy must highlight the frequency and methodology of meter reading, data collection and storage, verification and reporting. The frequency of readings must be a minimum of once a month. This document must be based on what the actual methodology will be that the retail centre will adopt for their metering and verification whilst the building is in operation, and must be developed in conjunction with the building owner / landlord, signed off by the landlord.

BACKGROUND

Consumption of electricity is the biggest contributor of greenhouse gas emissions arising from the built environment. 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, and also enables landlords to better manage tenant electrical consumption.

Measuring the energy use by all tenants within a building can highlight differences in energy use and allow facilities 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

Ene-2 Electrical Energy Sub-metering

POINTS AVAILABLE 2

International Performance Measurement & Verification Protocol
http://www.ipmvp.org

Ene-3 Lighting Power Density

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

Ene-4 Lighting Zoning

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

Ene-5 Maximum Electrical Demand Reduction

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise designs that reduces 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 Reduction

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where credit claimed for reduction in peak electrical demand: • Short report • Extract(s) from the specification(s) • Tender schematic electrical drawings Where credit claimed for flatter electrical demand curve: • Short report • Evidence of system viability •	Where credit claimed for reduction in peak electrical demand: • Short report • Extract(s) from the Commissioning Report • As built schematic electrical drawings Where credit claimed for flatter electrical demand curve: • Short report • Evidence of system viability •

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

- Where compliance is demonstrated through reduction of peak electrical demand:
  - 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 compliance is demonstrated through a flatter electrical demand curve:
  - 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 the specification(s) where the proposed solution(s) are described.

Ene-5 Maximum Electrical Demand Reduction

POINTS AVAILABLE 3

Extract(s) from the Commissioning Report demonstrating that the solution(s) have been commissioned and operate as intended by the design, appending relevant test data, and referencing the Operations and Maintenance (O&M) Manual.

Tender schematic electrical drawings clearly indicating the type, location and details of the proposed solution(s).

As built schematic electrical drawings of the installed solution(s).

Evidence of system viability showing any evidence that may be necessary to demonstrate that the intended solution(s) meets the Credit Criteria.

ADDITIONAL GUIDANCE

Peak electrical energy demand

The peak demand is expected to occur during regular occupancy hours.

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 – Retail v1 Energy Calculator & Modelling Protocol Guide for details):
  - Peak electrical demand must been calculated for the actual building; and
  - Peak electrical demand must been calculated for a notional building of the same size without the peak energy demand measures
- 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
- 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 notional and actual building used under Ene-1 may be used to do these calculations.

The graphs below illustrate the two Credit Criteria options given.

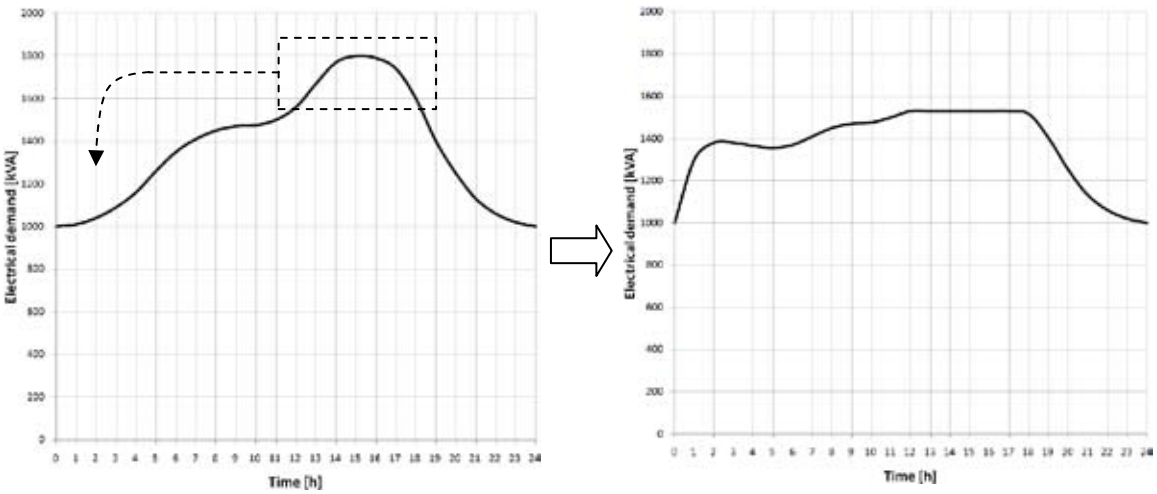

Figure Ene-5.1 *Graphs indicating how the peak demand can be shifted into another period of the day to result in a reduced overall peak*

Ene-5 Maximum Electrical Demand Reduction

POINTS AVAILABLE 3

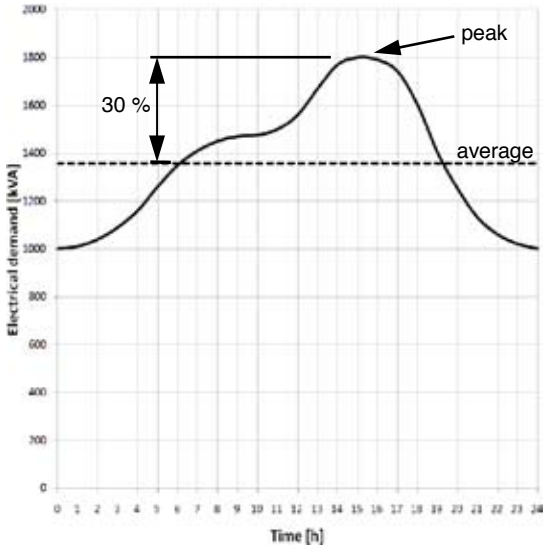

Figure Ene-5.2 *Graph indicating the percentage difference between the peak and the average of the annual demand curve.*

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 (with battery storage);
- Fuel cells;
- Energy and thermal storage systems;
- Batteries;
- Ice storage; and
- Phase change materials.

It is expected that where compliance is achieved using an active, rather than a passive, system, a significant amount of time and detail would be required to ensure the correct design and commissioning of such a system. 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.

Ene-5 Maximum Electrical Demand Reduction

POINTS AVAILABLE 3

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 draws 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.

Where the building produces its own energy on site, such energy can be included in modelling.

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.

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 1

AIM OF CREDIT

To encourage and recognise the installation of thermal energy sub-metering to facilitate ongoing management of thermal energy consumption.

CREDIT CRITERIA

One point is awarded where:

- For landlord centralised space heating or cooling reticulation systems, it is demonstrated that sub-metering is provided for all substantive thermal energy uses where flow temperatures, return temperatures, and mass flow rate are measured AND;
- There is an effective automated mechanism for measurement and verification of thermal energy consumption data AND;
- A measurement & verification strategy is developed for the project.

If centralised space heating or cooling reticulation systems are not under the landlord/developer's control and not included within the base-build, this credit 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.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Tender schematic drawing(s) • Tender BMS/monitoring system point schedule • Copy of the metering and verification strategy	• Short report • As built schematic drawing(s) • As built BMS/monitoring system point schedule • Copy of the metering and verification strategy

Ene-6 Thermal Energy Sub-metering

POINTS AVAILABLE 1

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

- Providing a summary table of all separately metered thermal energy users in the building;
- Describing how the thermal energy consumption data will be effectively monitored during the building's operation; and
- Describing a measurement and verification strategy for the project

Extract(s) from the specification(s) describing the installation requirements for thermal sub-meters that meet the Credit Criteria.

Tender schematic drawing(s) with all tenancies clearly indicated and with the location of all thermal sub-meters clearly marked.

Tender BMS point schedule showing inputs from the thermal sub-meters.

Copy of the metering and verification strategy describing in not more than one A4 page a summary of the overall metering and verification strategy for the project. Proof of the building owner / landlord's approval of the strategy must be provided with this submission.

As built schematic drawing(s) with all tenancies clearly indicated and with the location of all thermal sub-meters clearly marked.

As built BMS point schedule showing inputs from the thermal sub-meters and that they are duly connected.

ADDITIONAL GUIDANCE

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 cooling requirement or greater
- all landlord 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).

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 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). Wherever such systems are present to monitor the energy consumption data, the thermal energy sub-meters must be linked to them. If there is a Building Management 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 BMS and data must be provided to confirm the thermal metering capability of the system.

Ene-6 Thermal Energy Sub-metering

POINTS AVAILABLE 1

It must be clear that the sub-metering is provided by the base building owner/developer.

Metering and verification strategy

The metering and verification strategy must highlight the frequency and methodology of meter reading, data collection and storage, verification and reporting. The frequency of readings must be a minimum of once a month. The thermal metering strategy for measurement and verification must be clearly presented, including calibration requirements. This document must be based on what the actual methodology will be that the retail centre will adopt for their metering and verification whilst the building is in operation, and must be developed in conjunction with the building owner / landlord, signed off by the landlord.

BACKGROUND

Consumption of energy is the biggest contributor of greenhouse gas emissions arising from retail buildings and the energy consumption of HVAC systems within retail tenancies is typically one of the largest functional uses of energy within a shopping centre.

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 thermal energy use by all tenants within a retail centre can highlight differences in energy use and allow facilities charges to be linked to levels of energy consumption, thus providing a financial incentive for organisations to reduce energy consumption.

Domestic hot water of tenancies is specifically excluded from this credit due to the South African retail centre scenario where tenants typically provide power to their own domestic hot water supply from their own electrical distribution board which will already be metered via the tenant's electrical meter, which is an appropriate means of energy metering.

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

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 the use of private cars in particular, are responsible for many forms of pollution. Global warming is directly affected by motor vehicle use due to the high amounts of energy required to build cars and supporting infrastructure and services, as well as the fuels that in turn 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, water-based transport such as ferries, 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 sectors. **(http://www.wcapeenergy.net/energy_profile.htm)** This translates into more than 22% of carbon emissions for the province – a higher proportion than some other countries, such as Australia where the transport sector accounted for 13.5% of greenhouse gas emissions in 2004. **(http://www.environment.gov.au/soe/2006/publications/report/pubs/soe-2006-report.pdf)**

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 Tourism. **(www.environment.gov.za/HotIssues/2008/LTMS/A%20LTMS%20Scenarios%20for%20SA.pdf)** Many commuters are in a position to make such a switch, particularly where the building's design, facilities and location deliberately support alternative transport modes.

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 transportation for commuting to work.

CREDIT CRITERIA

Up to two points are awarded as follows:

One point is awarded where the number of car parking spaces is:

- At least 25% lower than the maximum local planning allowances applicable to the project;

  OR

- Not exceeding the minimum DOT guidelines or not exceeding the local planning minimum allowances, whichever is lower.

Two points are awarded where the number of car parking spaces is:

- At least 50% lower than the maximum local planning allowances applicable to the project;

  OR

- As least 25% lower than the minimum DOT guidelines or the minimum local planning allowances, which ever is lower.

Where car parking is not permitted in the local planning scheme, this credit is 'Not Applicable' and is excluded from the Points Available, used calculate the Transport Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Tra-1 Provision of Car Parking

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Design	Green Star SA – Retail As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the local, provincial or national authority planning allowances • Tender drawings	• Short report • Extract(s) from the local, provincial or national authority planning allowances • As built drawings
Where the credit is claimed as 'Not Applicable': • Extract(s) from the local, provincial or national authority planning allowances OR • Development Approval certificate	Where the credit is claimed as 'Not Applicable': • Extract(s) from the local, provincial or national authority planning allowances OR • Development Approval certificate

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by stating how the development satisfies the Credit Criteria, 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.

Extract(s) from the local, provincial or national authority planning allowances where:

- The car parking allowances for the site or region are nominated;
- It is indicated where the allowances are mandatory or otherwise; and
- The date and issuing authority are identified.

Tender drawings of all car parking provisions for the site showing the number of car parking spaces in the project.

As built drawings of all car parking provisions for the site showing the number of car parking spaces in the project.

Development Approval certificate from the relevant authorities stating that no car parking is permitted in the project.

Tra-1 Provision of Car Parking

POINTS AVAILABLE 2

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. Whenever such allowances do not exist at all, or are optional, please refer to the alternative requirements section below.

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.

Alternative requirements

Whenever mandatory car parking requirements exist, either within the planning allowances or Development Approval requirements for the project, they must be used. 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; but the City of Johannesburg, for example, recently prepared a set of parking maximums. However, when the mandatory requirements do not exist at all or are optional (or recommended), the project has the following two options:

- Clearly demonstrate that car parking is not provided in excess of 6 car parking spaces per 100 m² of GFA to achieve one point or 4.5 parking spaces per 100 m² to achieve two points;

  OR

- Submit a Credit Interpretation Request (CIR) to substantiate equivalent yet alternative compliance with the Credit Criteria.

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').

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 CO_2 emissions in the country. The majority of the transport emissions come from road transport, including cars, trucks and buses (DEAT, 2006).

Tra-1 Provision of Car Parking

POINTS AVAILABLE 2

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 care 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 the air pollutants as detailed in the table below.

Carbon Monoxide (CO)	**Hydrocarbons (HC)**	**Oxides of Nitrogen (NOx)**	**Particulates (PM)**
70-95%	40-50%	70-80%	10-50%

Table Tra-1.1: *Contribution (%) of Motor Vehicles to Air Emissions in Major Australian Cities (source: Coffey Partners 1996)*

The New South Wales EPA State of the Environment Report (2000) states that motor vehicles contribute over half of the volatile organic compounds (VOCs) in Sydney's air and are by far the biggest contributors of carbon monoxide.

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.

REFERENCES & 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

Tra-2 Fuel-Efficient Transport

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of more fuel efficient vehicles for work commuting.

CREDIT CRITERIA

One point is awarded where:

- A minimum of 5% or 5 parking spaces (whichever is the greater) are designed and labelled for mopeds, scooters and/or motorbikes, and all of these must be located in preferred parking locations.

If 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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawings • If the credit is claimed as 'Not Applicable': • Tender drawings OR • Extract(s) from the local authority planning allowances OR • Development Approval • Confirmation from the building owner	• Short report • As built drawings • If the credit is claimed as 'Not Applicable': • As built drawings OR • Extract(s) from the local authority planning allowances OR • Development Approval • Confirmation from the building owner

Tra-2 Fuel-Efficient Transport

POINTS AVAILABLE 1

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

- Indicating the number of parking spaces provided for scooters, mopeds, and/or motorbikes, and total number of parking spaces being provided, and referencing the site plans when necessary; and

Tender drawings indicating the total number of parking spaces (or lack thereof, if the credit is claimed as 'Not Applicable'), as well as the number of designated parking spaces for mopeds/scooters/motorbikes, with spaces clearly marked and dimensioned.

As built drawings indicating the total number of parking spaces (or lack thereof, if the credit is claimed as 'Not Applicable'), as well as the number of designated parking spaces for mopeds/scooters/motorbikes, with spaces clearly marked and dimensioned.

Extract(s) from the local authority planning allowances indicating that no car parking is permitted in the project.

Development Approval from the relevant authorities stating that no car parking is permitted in the project.

Confirmation from the building owner stating that no car parking spaces are provided in the project.

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.

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.

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 to 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).

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 carbon emissions from the typical petrol based passenger vehicle are approximately 60% greater than the emissions from a motorcycle **(http://www.zerocarbonco.com/).** Choosing a two-wheeled vehicle can help to reduce air pollution, as well as minimise greenhouse gas emissions, thereby helping to combat the overall effects of climate change.

REFERENCES & 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 Bureau of Statistics
http://www.abs.gov.au

Greenhouse Gas Emissions Calculator
http://www.greenhouse.gov.au/fuelguide/environment.html

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

Standards Australia, AS2890.1-1993 Parking Facilities – Off-street Car Parking
http://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 facilitates the use of bicycles by occupants and customers.

CREDIT CRITERIA

Provided it can be demonstrated that safe, convenient cycling routes are provided between the retail centre development and the adjacent street network, up to three points are awarded as follows:

- One point is awarded where cyclist facilities are provided for 3% of building staff; and
- Two points are awarded where cyclist facilities are provided for 6% of the building staff.
- An additional point (independent of the first two) is awarded where visitor bicycle storage is provided as outlined below. Bicycle storage must be provided in an accessible location, signposted and within 50m of, a major public entrance to the building.
  - One space per 500m^2 of nominated area or part thereof for centres under 25,000m^2;

  OR

  - One space per 750m^2 of nominated area or part thereof for centres between 25,000m2 and 50,000m2;

  OR

  - One space per 1000m^2 of nominated area or part thereof for centres between 50,000m2 and 100,000m^2;

  OR

  - One space per 1250m^2 of nominated area or part thereof for centres over 100,000m^2.

For the purposes of this credit 'nominated area' is GLA.

Tra-3 Cyclist Facilities

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Tender drawing(s)	• Short report • As built drawing(s) • Confirmation from the contractor

Short report prepared by a suitable professional that describes how the Credit Criteria have been met by

- Indicating the calculation of percentage of staff members and number of visitors served;
- Describing the location and provision of the cyclist facilities and referencing the cyclist facilities drawings;
- Demonstrating that the spaces are weather protected and have good natural surveillance (or are in a secured area);
- Stating how access is provided, to each bicycle space, shower and locker facilities; and
- Where the visitor point is being claimed
  - Describing the number and location of visitor cyclist facilities;
  - Showing that the spaces provided are signposted in an accessible location near a major public entrance; and
  - Demonstrating that the visitor spaces are provided with good natural surveillance and weather protection.

Extract(s) from the specification(s) stipulating

- The number of showers, lockers and storage/parking spaces provided;
- That storage/parking spaces must comply with municipal or other relevant design standards and with Additional Guidance for this credit; and
- The criteria that the showers, lockers and changing facilities must meet.

Tra-3 Cyclist Facilities

POINTS AVAILABLE 3

Tender drawing(s) of the cyclist facilities showing

- The number and location of bicycle racks/rails/storage facilities;
- The number and location of shower and locker facilities;
- 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; and
- Where the visitor point is being claimed, the number and location of visitor bicycle parking spaces.

As built drawing(s) of the cyclist facilities showing

- The number and location of bicycle racks/rails/storage facilities;
- The number and location of shower and locker facilities;
- 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; and
- Where the visitor point is being claimed, the number and location of visitor bicycle parking spaces.

Confirmation from the contractor of

- The location, type and number of the secure bicycle storage spaces installed; and
- Where the visitor point is being claimed, confirmation of the location, type and number of the visitor bicycle parking units installed.

ADDITIONAL GUIDANCE

For the purpose of the Transport credits, a major public entrance is defined as a public entrance to the building that is accessible from a public plaza, main street or avenue (e.g. not the entrance from a side street unless the side street entrance is the only public entrance to the building). Furthermore, the entrance to a multi-storey carpark will also be considered to be a major public entrance if the visitors' cyclist facilities are clearly signposted at the entry to the carpark and the designated parking is no more than one split level away (in either direction) from the entrance level.

Bicycle facilities for building staff

For the purposes of this credit, bicycle 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 the changing facilities.

Staff numbers must be calculated based on one person per 60m^2 of GLA. Areas occupied by major tenants that are contractually obligated to provide cyclist facilities at the rates specified in the Credit Criteria can be excluded from the calculations.

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 retail area, 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:

- 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

- 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.

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 significantly 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 retail centre builds one, then it may be included in the total number of showers provided. If however, showers are required by law for the 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, or public circulation space.

Visitor bicycle parking

Visitor bicycle racks must be located within 50m of a major public entrance in an accessible location that is clearly signposted. While bicycle spaces may be used by couriers and delivery

personnel, they are primarily for the convenience of customers visiting the shopping centre. Racks/rails must be covered and protected from the elements, and 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.

	Nominated Area m^2			Bicycle space/m^2	No. of bicycle spaces min		max
local/community centre	-		< 25,000	500	-		< 50
small regional centre	25,000	-	50,000	750	34	-	66
regional centre	50,000	-	100,000	1,000	50	-	100
super regional centre	>100,000			1,250	80		

Table TRA-3.1: *Provision of visitor bicycle parking*

Access routes

The requirement for safe and convenient cycling routes across the development property, between the building and an adjacent street, is intended to ensure that cyclists have access to the building that is at least as convenient as vehicular access. This does not necessarily require a dedicated right-of-way for cyclists, but it does require deliberate designing of the route (whether on-street or off-street) to ensure safe passage across the property boundary, and through parking areas (if applicable).

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 high-rise office 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:

- 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;

- 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);
- 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 cyclist facilities are close proximity to the assessed building and the access route is clearly marked and sign-posted, convenient, guaranteed and secure;
- 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 practice of cycling to work 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 retail centre 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

REFERENCES & 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

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
http://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
http://www.btre.gov.au

Tra-4 Commuting Mass Transport

POINTS AVAILABLE 6

AIM OF CREDIT

To encourage and recognise developments that facilitate the use of mass transport for work commuting.

CREDIT CRITERIA

Up to six points are awarded for the quality of mass transport options available to building users.

Up to five points are awarded for the quality of mass transport options available to building users. The points are determined using the Green Star Mass Transport Calculator based on:

- The type of mass transport services available within 1000m of the site;
- The number of routes served; and
- The average interval between services during weekday peak hours; and
- The average interval between services during Saturdays and on the evening when the facility is open for late night shopping.

Transit Facility

One point is awarded where a transit facility is located within the retail site development (or on the road directly adjacent to the development) and meets the following criteria:

- One taxi space per 3,500m^2 of nominated area or part thereof and one bus lay-by space for centres under 25,000m^2; OR
- One taxi space per 3,000m^2 of nominated area or part thereof AND where bus routes exist adjacent to the site, two bus lay-by spaces for centres between 25,000m^2 and 50,000m^2; OR
- One taxi space per 2,500m^2 of nominated area or part thereof AND where bus routes exist adjacent to the site, four bus lay-by spaces for centres between 50,000m^2 and 100,000m^2; OR
- One taxi space per 2,000m^2 of nominated area or part thereof AND where bus routes exist adjacent to the site, six bus lay-by spaces for centres over 100,000m^2.

For the purposes of this credit, 'nominated area' is the Retail GFA.

The facility requirements are:

- Security (good visibility and lighting);
- Weather protection (user protection from sun, rain, wind);
- User information (availability of information on routes, schedules, fares, connections etc);

Tra-4 Commuting Mass Transport

POINTS AVAILABLE 6

- Accessibility (distance from transport facility to retail centre, quality of walking conditions, signage, safety from cars); and
- Structured lay-by built alongside the road.

If there is an existing facility adjacent to the site and the point is claimed, the same requirements need to be met for this existing facility.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Design	Green Star SA – Retail As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Completed Green Star SA Mass Transport Calculator • Short report • Site plan extending to surrounding area (1) • Evidence of service frequency	• Completed Green Star SA Mass Transport Calculator • Short report • As built site plan extending to surrounding area (1) • Evidence of service frequency
Where the point for Integrated Public Transport Facility is claimed	Where the point for Integrated Public Transport Facility is claimed
• Site plan extending to surrounding area (2)	• Site plan extending to surrounding area (2)

Completed Green Star SA Mass Transport Calculator

- A copy of the completed Mass Transport Calculator from the excel tool.

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

- Summarising the services using each transport stop showing the route of the bus service for each stop and/or tram or train line servicing the nearest station;
- Justifying all the inputs into the Mass Transport Calculator and referencing all sources of information used;
- Timetables, survey results and CPTR used for the calculations must be included as an appendix

Where the point for the Integrated Public Transport Facility is claimed, describe how the following issues are addressed in the design;

- Security (good visibility and lighting);

- Weather protection (user protection from sun, rain, wind);
- User information (availability of information on routes, schedules, fares, connections etc);
- Accessibility (distance from transport facility to retail centre, quality of walking conditions, signage, safety from cars); and
- Structured lay-by built alongside the road.

Site plan extending to surrounding area (1)

The site plan must clearly justify the 'Distance to Site' inputs in the Calculator. It must be legible and to scale. The major public entrances to the building must be marked. The mass transport stops must be clearly indicated and labelled with the associated services. The site plan must show the following:

- Route course followed by each transport mode;
- Route names and/or numbers;
- Exact walking distances from building entrance to stops/stations;
- Station entrances;
- Public transport interchange entrances; and
- Public transport stops.

As built site plan extending to surrounding area (1)

The site plan must clearly justify the 'Distance to Site' inputs in the Calculator. It must be legible and to scale. The major public entrances to the building must be marked. The mass transport stops must be clearly indicated and labelled with the associated services. The site plan must show the following:

- Route course followed by each transport mode;
- Route names and/or numbers;
- Exact walking distances from building entrance to stops/stations;
- Station entrances;
- Public transport interchange entrances; and
- Public transport stops.

Evidence of service frequency for bus, minibus and/or trains by means of timetables, surveys or CPTR:

- 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; OR
- Survey results of observed bus, minibus or train operations during peak periods; OR

- 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.

Site plan extending to surrounding area (2)

The site plan must clearly indicate the location of the Integrated Public Transport Facility and demonstrate that the facility has integrated the following items:

- Security (good visibility and lighting);
- Weather protection (user protection from sun, rain, wind);
- User information (availability of information on routes, schedules, fares, connections etc);
- Accessibility (distance from transport facility to retail centre, quality of walking conditions, signage, safety from cars); and
- Structured lay-by built alongside the road.

ADDITIONAL GUIDANCE

The number of points achieved is determined by using the Commuting Mass Transport Calculator in the excel tool. The 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). All teams claiming this credit are required to comply with the requirements outlined in this guide.

Integrated Public Transport Facility

The facility at the retail development must be designed in collaboration with local public transport agencies, relevant government agencies, and taxi/bus operators.

- The minimum design requirements for the Integrated Public Transport Facility are:
- Security (good visibility and lighting);
- Weather protection (user protection from sun, rain, wind);
- User information (availability of information on routes, schedules, fares, connections etc);
- Accessibility (distance from transport facility to retail centre, quality of walking conditions, signage, safety from cars); and
- Structured lay-by built alongside the road.

Shopping centre type	Size of centre	Taxi spaces (Retail GFA)	Bus lay-by spaces
Local/community centre	<25,000 m^2	1 per 3,500m^2	1*
Small regional centre	25,000m^2 to 50,000m^2	1 per 3,000m^2	2
Regional centre	50,000m^2 to 100,000m^2	1 per 2,500m^2	4
Super regional centre	>100,000m^2	1 per 2,000m^2	6

* taxi/bus can be combined for local centre

Table Tra-4.5 *Space provision for Integrated Public Transport Facility*

Taxi spaces on site

All designs must comply with the general guidelines and regulations of the relevant road authority.

Bus lay-by

All designs must comply with the general guidelines and regulations of the relevant road authority. Each major council or road authority has a preferred public transport facility layout, which needs to be adjusted for site specific conditions.

Existing public transport facilities

Where existing public transport facilities (e.g. bus lay-by) are located directly at the adjacent road network, these can contribute towards the credit. The existing facilities must meet the same Credit Criteria as the new facilities and be documented in strict accordance with the Documentation Requirements above. Additionally, safe, well-lit, dedicated pedestrian facilities must be provided between the retail centre development and the adjacent existing transport facility conforming to SANS 10246.

BACKGROUND

When a development is poorly located, in relation to the proximity of transport nodes and their frequency of service, then it is unlikely that building occupants will use mass transport to travel to work. Conversely, developments that are within close proximity of good transport nodes with frequent service can encourage building occupants 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 (StatsSA household surveys: http://www.transport.gov.za/library/docs/stats/2001/statistics.html). 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 – 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).

Tra-4 Commuting Mass Transport

POINTS AVAILABLE 6

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 increase , 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).

An Integrated Public Transport Facility increases the convenience, comfort and attractiveness of public transport. Well designed transit stations provide protection from the weather, user information (routes, time schedules, and arrival times), and safe pedestrian access from and to the retail development.

REFERENCES & 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

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

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

Tra-4 Commuting Mass Transport

POINTS AVAILABLE 6

TDM Encyclopedia; Transit Station Improvements
http://www.vtpi.org/tdm/tdm127.htm

Tra-5 Local Connectivity

This credit is not relevant to the Green Star SA - Retail Centre v1 tool.

Tra-6 Trip Reduction – Mixed Use

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise retail centres that are built in mixed use areas in order to reduce the overall number of car trips taken by patrons.

CREDIT CRITERIA

One point is awarded for reducing the average number of vehicular trips generated by the development. The point is determined using the Green Star SA Trip Reduction Calculator where:

- A vehicle trip reduction of more than 15% is demonstrated; and
- Dedicated pathways for pedestrians and cyclists are provided between the retail centre and the adjacent street network.

Compliance with the credit is determined using the 'Trip Reduction Calculator' based on the land uses within 400m walking distance from the retail centre entrance(s); land uses include commercial offices, hotel, residential, retail and warehouse.

Points are only awarded where it is demonstrated that safe, well-lit, dedicated pedestrian facilities are provided between the retail centre development and the adjacent street network, conforming to SANS 10264.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Site plan • Completed Green Star SA Trip Reduction Calculator • Traffic impact assessment	• Short report • Site plan • Completed Green Star SA Trip Reduction Calculator • Traffic impact assessment

Tra-6 Trip Reduction – Mixed Use

POINTS AVAILABLE 1

Short report prepared by a suitable professional that describes how the Credit Criteria has been met by:

- Describing how the development complies with the Credit Criteria, and
- Clearly justifying the inputs into the Trip Reduction Calculator, by referencing sources of information used.

Site plan of surrounding areas

- Describing and mapping the location and land uses within 400m walking distance of the retail centre entrance(s);
- Identifying the relevant density numbers (GFA, number of residential units, number of hotel units) of the different land uses; and
- Indicating the pedestrian routes between the public and staff entrances of the proposed building and the entrances to surrounding developments, including any gates or other crossing barriers along the route(s).
- Design elements required for compliance with SANS 10246 within the development site

Traffic impact assessment showing

- The location and types of land uses, such as commercial office, hotel, residential, retail and warehouse, including the density figures (GFA, number of residential units, number of hotel units) for each type of development.

ADDITIONAL GUIDANCE

Trip Reduction Calculator

Using the Trip Reduction Calculator involves three steps

1. Identify different land uses within a 400m walking distance measured from the entrance(s) of the retail centre.
2. Determine the GFA (Gross Floor Area) of surrounding retail buildings, number of residential units, number of hotel bedrooms and the GFA of commercial office buildings and warehouses.
3. Enter the extent of land uses into calculator which will calculate points achieved.

Land Use: the primary land use/zoning for a portion of land. If the land is developed the actual land use must be used and not the potential land use.

Unit: the measurement standard for different land uses. Predominantly land use is measured in GFA m2. Residential land use is measured in number of residential dwellings, and hotels are measured in number of rooms.

Tra-6 Trip Reduction – Mixed Use

POINTS AVAILABLE 1

Extent: the total GFA (m^2) tally of the number of existing residential dwellings, or number of hotel rooms for each land use type within 400m walking distance from the entrance of the retail centre.

Standard Trip Rate: the number of trips that is generated for a particular land use. For example, the standard trip rate for an office building in the CBD is 1.5 trips per $100m^2$ of GFA. (South African Trip Generation Rates, 1995).

Trips Generated: the number of trips generated is calculated by multiplying the Extent of a Land Use with the Standard Trip Rate.

Trip Reduction Factor: the trip reduction factor is the percentage reduction which has been surveyed at existing developments by independent companies.

Revised Trip Rate: this is the expected trip generation rate after the reduction factor has been taken into account.

Revised Trips Generated: using the revised trip rate the revised number of trips can be calculated by multiplying the extent with the revised trip rate.

Retail Only: the new revised number of trips calculated must be compared to a retail development not located within a mixed land use node. This cell calculates the standard trip generation for a retail development.

Trip Reduction Percentage: by comparing the reduced trip generation with the standard trip generation it is possible to calculated the weighted trip reduction as a percentage.

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 amenities would render on-site amenities meaningless. It would therefore not be appropriate to award points for mixed-use developments if it were not possible to walk between the land uses (separated by physical barriers or highways without crossings).

It must be demonstrated that safe, well-lit, dedicated pedestrian facilities are provided within the assessed property between the retail development and the adjacent street network, conforming to SANS 10264.

Determining the area of study

Identify all public and staff entrances for the Retail Centre. From each entrance draw a circle with a radius of 400m. This denotes the limit of the scope. Using a polyline, identify properties where the property's entrance falls within 400m walking distance of any of the retail centre's entrances. Walking distance may not include routes which would not normally be accessible to pedestrian (e.g. land uses separated by a highway or physical barrier). Where the property entrance falls within the 400m walking distance parameter, the entire area of the property is included in the 'area of study'. See Fig TRA-6.1 for an example of determining the area of study.

Tra-6 Trip Reduction – Mixed Use

POINTS AVAILABLE 1

Identify the GFA of surrounding retail buildings, number of residential units, number of hotel bedrooms and the GFA of commercial office buildings and warehouses that fall within the 'area of study'.

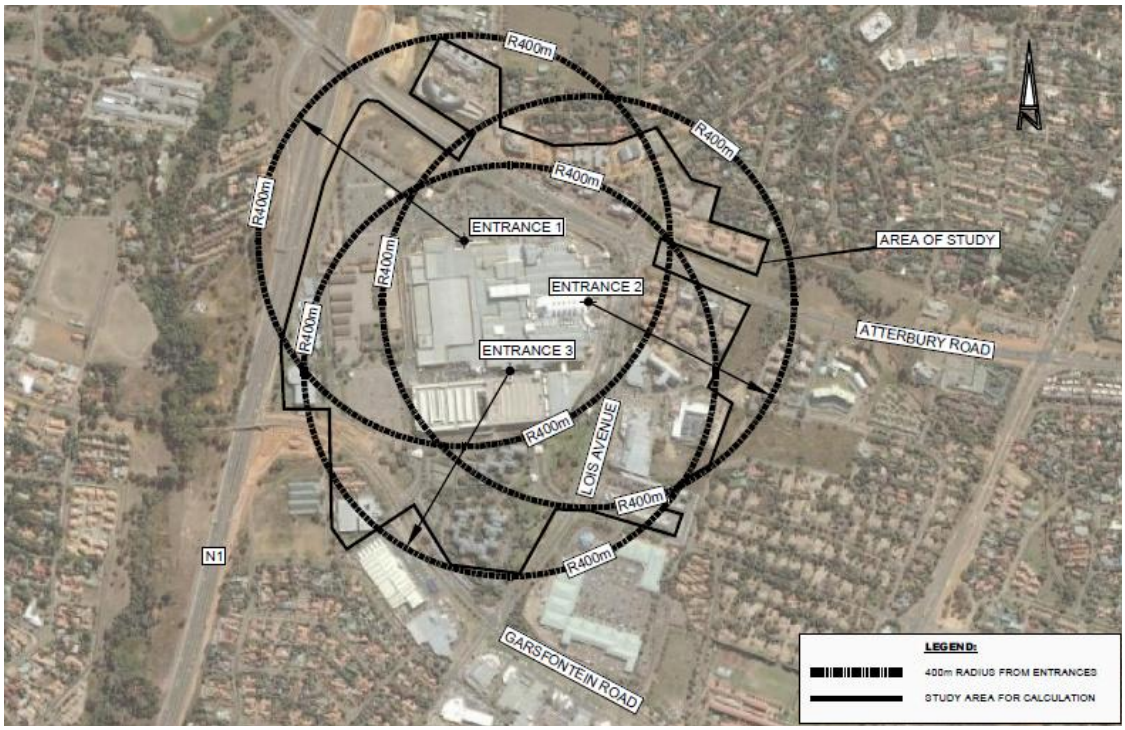

Figure TRA-6.1: *Area of Study for Mixed Use Calculator*

BACKGROUND

Traditionally, land use planning for retail and leisure facilities has put emphasis on private vehicles as the primary mode of access in the design, scale and layout of such facilities. In most instances, these car-orientated developments actively inhibit pedestrians, cyclists and public transport users in their layout, design, scale and location. This credit aims to encourage retail developments that incorporate effective car-based trip reduction measures such as the provisions of quality pedestrian, cycling and public transport access. Mixed use development or retail centres within mixed use areas, and within walking distance, encourage shoppers and retail employees living nearly, to make a modal switch from using cars to walking or cycling. Besides reducing congestion and pollution (bearing in mind that short car journeys generate more noxious emissions per kilometre), walking and cycling can also bring health benefits to the public and should be encouraged.

The Department of Transport published the second edition on South African Trip Generation Rates (1995). The document includes daily and peak hour trip generation rates for a wide variety of land uses. The amount of traffic to be generated by a proposed development is one of the most critical elements of a Traffic Impact Study (TIS).

Tra-6 Trip Reduction – Mixed Use

POINTS AVAILABLE 1

When mixed land use developments are analysed, the appropriate trip rates and trips generated for each land use must be given, hereafter the 'discounting' of trips can be estimated due to the trips shared by two or more land uses (DOT, 1995).

REFERENCES & 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

City Council of Pretoria (1998), Guidelines for Traffic Impact Studies.

Department of Transport and Public Works, Mobility Strategy.

Department of Transport and Public Works, Public Transport Infrastructure Plan.
Department of Transport, (2007), Draft National Scholar Transport Policy.

Department of Transport, (2003), Rural Transport Strategy for South Africa.
Department of Transport (1995), Manual for Traffic Impact Studies.

Department of Transport (1995), South African Trip Generation Rates, 2nd Ed.

Eden District Municipality (2007), NMT Masterplan for Eden District Municipality.

Tran:SIT. Transformation towards sustainable and integrated transport for the urban environment.
http://www.sustainable.org.za/transit/

Tra-7 Vehicle Operating Emissions

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise retail centres that reduce vehicular emissions resulting from traffic congestion by upgrading road infrastructure around the centre.

CREDIT CRITERIA

Two points are awarded where:

It is demonstrated that traffic infrastructure is improved over and above the minimum peak hour traffic flow service levels compared to pre-development baseline traffic flows.

- One point where a 15% reduction in peak hour average CO_2 emissions per vehicle is demonstrated as a result of improved infrastructure.
- Two points where a 30% reduction in peak hour average CO_2 emissions per vehicle is demonstrated as a result of improved infrastructure.

Compliance must be demonstrated via the Traffic Impact Assessment (TIA) and the software that is used to undertake the TIA.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Site plan • Extracts from traffic impact assessment	• Short report • Site plan • Extracts from traffic impact assessment

Short report prepared by a suitable professional that describes how the Credit Criteria has been met, including:

- Description of infrastructure improvements; and
- A summary of the CO_2 calculations showing percentage improvement.

Site plan of surrounding areas, indicating the infrastructure conditions before and after proposed improvements.

Tra-7 Vehicle Operating Emissions

POINTS AVAILABLE 2

Extracts from the traffic impact assessment showing:

- The calculated reduction in peak hour average CO_2 emissions.

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 CO_2 emissions.

Although other gases (CO, NOx, SOx, toluene, benzene etc) are emitted by vehicular exhausts, for the purposes of simplicity CO_2 is used as a proxy for total emissions.

CO_2 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 CO_2 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.

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 CO_2 emissions per vehicle will be. CO_2 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 100 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;
- 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. Retail centres typically encourage a high level of car-based trips. For example in Sydney, the weekend shopping trips in 2005 were equivalent to some 3.2 million trips each weekend. Between the years of 1991 and 2005, the number of shopping trips had increased by 6.6% during the weekday and by 12.6 during weekends. In 2005, over 65% of the shopping trips were made by car, with 28% made on foot and only 6.7% by public transport (TDC, 2007). Furthermore, retail trade is the top employment sector, with one in six of all jobs in the

Tra-7 Vehicle Operating Emissions

POINTS AVAILABLE 2

Australia being in the retail sector (ABS, 2008). The journey to work for retail sector employees comprises a large share of travel demand and contributes to commuter vehicle use.

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 retail development 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.

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 efficient design of building 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, essential for all living things. Fresh water supplies are increasingly affected by a range of factors including catchment locations, contaminated sources (Draft Water Conservation Strategy Paper – Feb 2000, DWAF) drought and rising demand as government embarks on projects to provide potable water to all communities. In 2006, 'The South African government had provided safe drinking water to 16 million people since 1994.' (Water provision is key to healthy development of children (SA) – DWAF, 16 November 2006)

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 by The Department of Water Affairs & Forestry (DWAF): Directorate of Water Resource Planning, on water availability per Water Management Area clearly shows 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 erratic. **(http://www.dwaf.gov.za/WAR/documents/WMAWaterAvailibility23Feb06.pdf)** 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.

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 and DWAF is assisting, "…reducing water losses, estimated at 29%, to 15%." (National Water Summit Speech by Mrs LB Hendricks, Minister of Water Affairs and Forestry, Gallagher Estate, Midrand, Gauteng, 17 March 2008. **(http://www.dwaf.gov.za/Communications/MinisterSpeeches/2008/NWS17Mar08.doc)**

The use of cooling towers for heat rejection in air conditioning systems is also common and contributes to significant water usage in buildings.

In addition to reducing the demand for water, efficient use of water in buildings can save building owners money in operational costs. 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 recycling from rainwater, greywater and blackwater. Currently, a very small proportion of buildings have grey or rain water recycling plants.

Data obtained from various retailers in South Africa by the GBCSA in 2009 indicated that the water consumption in retail centres varies from 4 to 10 litres / m^2 per day, which gives an average of 7 litres / m^2, equal to 70,000 litres per day for a 10,000m^2 retail centre or 25.5 million litres per annum.

Green Star SA encourages measures to reduce the potable water consumption in buildings. Such reductions will ease the pressure on the South Africa water sources as well as contribute to more cost efficient operation of buildings.

Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

AIM OF CREDIT

To encourage and recognise designs that reduce potable water consumption by building occupants.

CREDIT CRITERIA

Up to five points are awarded where the predicted potable water consumption for sanitary use within the building has been reduced against a 'best practice' benchmark.

The points are determined by the Green Star SA Potable Water Calculator.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Completed Potable Water Calculator If rain, grey or black water systems are installed, the following is also required: • Tender schematic hydraulic drawings • Evidence of the application(s) for approval to the relevant authorities • Evidence of compliance with design standards • Signed letter from the building owner	• Short report • Technical data sheet(s) from the manufacturer • Completed Potable Water Calculator If rain, grey or black water systems are installed, the following is also required: • As built schematic hydraulic drawings • Evidence of approval from the relevant authority • Evidence of compliance with design standards • Signed letter from the building owner • Extract(s) from Commissioning Report

Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

Short report prepared by a suitable professional that describes how the Credit Criteria have been met and including

- Descriptions of all the water-efficient features in the building;
- Justifications of the predicted water savings, wherever not solely achieved by fittings/fixtures; Calculations undertaken for the Potable Water Calculator, including the capacity of all the water reuse, collection and storage systems; and
- Where greywater, blackwater or rainwater systems are to be installed, and the contribution is determined by the design team rather than using the calculator in the Green Star SA – Retail Centre v1 tool, then calculations demonstrating the reduction in potable water consumption must be submitted by a qualified and experienced consultant who has been involved in the design of such systems.

Extract(s) from the specification(s) listing and describing:

- All hydraulic fixtures and fittings in the project including water usage rates;
- All water reuse systems; and
- All water collection systems with a specific mention of the capacity of the system.

Tender schematic hydraulic drawings showing the location of all water reuse, collection and storage systems.

Completed Potable Water Calculator referencing the short report and including supporting evidence.

Technical data sheets from the manufacturer indicating the water usage rates of all fixtures and fittings installed in the building.

As built schematic hydraulics drawings showing the location of all water reuse, collection and storage systems.

Evidence of the application(s) for approval to the relevant authorities indicating the projects clear intent to obtain approval from the relevant local and national/provincial authority to build a water treatment system according to various relevant standards

Evidence of compliance with design standards must be provided to show that the system has been designed to the relevant local and/or national standards.

Evidence of approval from the relevant authority confirming approval of, or no objection to, the documented design. For the purpose of this credit, acceptance of the authority's approval of as installed system is conditional on the project's ability to clearly demonstrate compliance with relevant regulation or standards, which must be cited.

Extract(s) from Commissioning Report demonstrating that the relevant systems have been commissioned and operate as intended by the design; and referencing the Operations and Maintenance (O&M) Manual, clearly indicating that all the intended hydraulic fixtures and fittings and all water reuse, collection and storage systems have been installed.

Signed Letter from the building owner stating that he/she intends to install and use the system, and he/she is aware of the maintenance costs for this system, and that the costs have been budgeted for.

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.

The number of points achieved is determined by using the Potable Water Calculator.

The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculators Guide available from the GBCSA website **(http://www.gbcsa.org.za).** All teams claiming this credit are required to comply with the requirements outlined in this guide.

In most cases, off-setting demand with rainwater or reused water will be necessary to achieve more than two points in the Potable Water Calculator.

If rainwater harvesting or greywater collection is also used for toilet flushing then to avoid double-counting, the volume of water provided for the irrigation credit must be entered into the Potable Water Calculator. The Potable Water Calculator does not undertake detailed calculations of water storage efficiency. However, the storage tank must have a minimum of 20 days storage capacity for the toilet flushing demand entered.

Non-potable water is defined as water that is collected on site or recycled/recovered from a previous use such as blackwater or greywater. Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of non-potable water used. In addition to the surface water table dropping, there is a global deficit of groundwater, and extracting water from any neighbourhood fresh-water sources merely localises what otherwise would take place on the municipal or provincial level.

The GBCSA strongly supports the use of shared/centralised water treatment facilities. When the amenity is within the project, but other uses (for base building projects) or tenants (for fitout projects) are present in the building, this credit requires evidence that the use of such facilities by the project being assessed is not compromised (e.g. that a proportion of facilities is dedicated for exclusive use of the project).

BACKGROUND

Rainwater, greywater & blackwater

Collecting rainwater from roofs and other impervious surfaces can add to the amount of non-potable water available for use in buildings. Retail centres with large roof areas are particularly well suited for rainwater collection.

Wat-1 Occupant Amenity Water

POINTS AVAILABLE 5

Greywater 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 and Forestry, 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.

REFERENCES & 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 & Forestry
http://www.dwaf.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

Wat-2 Water Meters

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise the design of systems that both monitor and facilitate management of water consumption.

CREDIT CRITERIA

Up to three points are awarded as follows:

Two points are awarded where it is demonstrated that:

- Water meters are installed for all major water uses in the development.

An additional point is awarded where:

- The above is achieved; AND
- There is an effective automated mechanism for monitoring water consumption data which is able to perform as a leak detection system; AND
- A metering and verification strategy is developed for the project.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender schematic hydraulic drawings Where an automated monitoring system is present, the following additional documentation is required: • Extract(s) from the specification(s) • BMS/monitoring system point schedule • Copy of the metering and verification strategy	• Short report • As built schematic hydraulics drawings Where an automated monitoring system is present, the following additional documentation is required: • As installed BMS/monitoring system point schedule • Extract(s) from the Commissioning Report • Copy of the metering and verification strategy

Wat-2 Water Meters

POINTS AVAILABLE 3

Short report on water management prepared by the relevant qualified project team member to describe how the Credit Criteria have been met:

- Identifying the major water uses in the building; and
- Describing how the water consumption data will be effectively monitored during the building's operation, including the function of the alert and leak detection systems.

Tender schematic hydraulics drawings showing the location of all water meters in the project, and the associated water uses.

Extract(s) from the specification(s) listing the major water uses within the project and stipulating their sub-metering requirements; indicating water meters are to be connected to the automated monitoring system (e.g. BMS).

BMS/monitoring system point schedule showing the connection of water meters to the automated monitoring system (e.g. BMS).

As built schematic hydraulics drawings clearly showing the locations of all water meters in the project, and the associated water uses.

As installed BMS/monitoring system point schedule showing the connection of water meters to the automated monitoring system (e.g. BMS), and confirming that all of them have been correctly installed/connected.

Extract(s) from the Commissioning Report showing that all the meters and the monitoring system have been commissioned and are operating as intended by the design. Furthermore, a copy of the output report of the system must be included in the submission.

Metering and verification strategy describing in not more than one A4 page a summary of the overall metering and verification strategy for the project. Proof of the building owner / landlord's approval of the strategy must be provided with this submission.

ADDITIONAL GUIDANCE

Major water uses are considered to include the following as a minimum (where installed):

- Tenants above 500m^2 to be individually metered;
- Tenants below 500m^2 to be metered in groups of at most 4;
- Common area / base building bathrooms;
- Evaporative heat rejection systems;
- Fire system water;
- Irrigation systems;
- Car wash facilities;
- Food preparation facilities;

- Wash-down systems;
- Recycled water supply;
- Rainwater supply; and
- Humidifiers.

It may be necessary to provide separate sub-metering on other water uses within the building if they are deemed equally substantial – the assessors reserve the right to request this after the round 1 submission.

Award of the third point requires an effective system for collecting, recording and monitoring data from the sub-meters, and for alerting the facility management of any change in water consumption trends (which may indicate problems such as leaks) during the building's operation. In most cases, effectiveness will necessitate the design of automated monitoring systems, as part of a Building Management System (BMS). Wherever such a system is present to monitor water data, water sub-meters must be linked to them. The BMS or equivalent system must provide a leak detection system and include an alarm that is triggered in the event of a new trend in water consumption.

It must be clear that the sub-metering is provided by the base building owner/developer.

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.

Separate metering of rainwater supply is not required if rainwater is used solely for manual irrigation.

Metering and verification strategy

The metering and verification strategy must highlight the frequency and methodology of meter reading, data collection and storage, verification and reporting. The frequency of readings must be a minimum of once a month. This document must be based on what the actual methodology will be that the retail centre will adopt for their metering and verification whilst the building is in operation, and must be developed in conjunction with the building owner / landlord, signed off by the landlord.

Wat-2 Water Meters

POINTS AVAILABLE 3

BACKGROUND

To help reduce water consumption, accurate information on usage is required at the building management level. The inclusion of water meters or sub-meters to major water users in the building is a simple and effective way of carrying this out. When water users know how much water they use, and the cost associated with that particular use, behaviour and usage pattern changes accordingly. A water management device that replaces the traditional water meter installed in some areas of Cape Town is saving 5,000 litres of water per household per month. (Source: The Good News)

Leaks and wastage on the site of the development and in the building itself can result in significant water losses and costs, as well as having the potential to cause major damage.

REFERENCES & FURTHER INFORMATION

South Africa, The Good News
http://www.sagoodnews.co.za/environment/water_saving_device_cuts_losses_for_cape_s_poor_.html

Water Efficiency South Africa
http://www.waterefficiencysa.co.za

Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

AIM OF CREDIT

To encourage and recognise the design of systems that aim to reduce the consumption of potable water for landscape irrigation.

CREDIT CRITERIA

Up to three points are awarded as follows:

One point is awarded where:

- Potable water consumption for landscape irrigation has been reduced by 50%;

Two points are awarded where:

- Potable water consumption for landscape irrigation has been reduced by 90%

  OR

- Plants chosen require no additional watering once established (i.e. xeriscaping).

If there is no landscaping, or the total landscaping represents less than 1% of the site area, these two points are 'Not Applicable' and are excluded from the Points Available, used to calculate the Water Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

One additional point is awarded where:

- 30% or more of the site is landscaped and the above criteria for 90% reduction of potable water consumption for landscape irrigation has been met.

If there is no landscaping, or the total landscaped area represents less than 30% of the site area, this third point is 'Not Applicable' and is excluded from the Points Available, used to calculate the Water Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where irrigation systems are installed: • Short report • Extract(s) from the specification(s) • Tender schematic hydraulic drawing(s) • Tender site plan(s)	Where irrigation systems are installed: • Short report • Extract(s) from the Commissioning Report • As built hydraulics drawing(s) • As built site plan(s)
Where a xeriscape garden is installed: • Tender site plan(s) • Landscape report • Confirmation of xeriscape garden installation	Where a xeriscape garden is installed: • As built site plan(s) • Landscape report • Evidence that there is no provision of irrigation system(s)
Where the credit is claimed as 'Not Applicable': • Tender site plan(s) • Confirmation from the architect	Where the credit is claimed as 'Not Applicable': • As built site plan(s) • Confirmation from the architect

Short report by a suitably qualified engineer detailing:

- The proposed landscape irrigation system, its water sources and operation;
- Calculations (with justification of values used) for the reference case; and
- Demonstration of how the proposed system meets the Credit Criteria against the reference case; and referencing:
  - Hydraulics drawings; and
  - The design or commissioning report extracts and compliance with Department of Environment, Agriculture & Tourism requirements when necessary.

Extract(s) from the specification(s) identifying the proposed landscape irrigation system, its water sources and operation requirements.

Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

Extract(s) from the Commissioning Report demonstrating that the system has been commissioned and operates as intended by the design, and expressed in the hydraulics report.

Tender or as built schematic hydraulic drawing(s) indicating the design, location and water supply of the irrigation system; and specifically showing that the tank size is consistent with calculations.

As built site plan(s) for the entire site showing the use for all areas (including roofs) and demonstrating that landscaping is or is not provided.

Tender site plan(s) of the entire site showing the use of each area (including roofs) and clearly indicating the location, or lack of landscaped area.

Landscape Report justifying why the design can be classified as 'xeriscaping'.

Confirmation of xeriscape garden installation from the owner indicating that the provision of irrigation systems for the xeriscape garden will be removed within twelve months of landscaping installation and that the landscape will not receive watering after this time.

Evidence that there is no provision of irrigation system(s) e.g. a letter by the building owner that the irrigation system has been removed or will be within 12 months of practical completion.

Confirmation from the architect that landscaping (including roof, vertical and planter gardens) is either not present or jointly accounts for less than 1% of the project site area (calculations are required in the latter case).

Confirmation from the architect that landscaping (including roof, vertical and planter gardens) jointly accounts for 30% or more of the project site area (calculations are required).

ADDITIONAL GUIDANCE

The credit requires that the solution(s) described in this credit correlate with the other relevant credits claimed, e.g. Wat-1 'Occupant Amenity Water' and Eco-4 'Change in Ecological Value'.

If a xeriscape garden is proposed, it must be evident that it will not require irrigation during the building's operation.

If reduction in the demand of potable water is proposed, the reduction must be demonstrated clearly against a robust reference case (see Additional Guidance).

The first two points of this credit will only be considered to be 'Not Applicable' if it is clearly demonstrated that landscaping (including roof, vertical and planter gardens) is either not present or jointly accounts for less than 1% of the project site area.

The additional one point of this credit will only be considered to be 'Not Applicable' if it is clearly demonstrated that there is no landscaping (including roof, vertical and planter gardens), or the total landscaped area represents less than 30% of the site area.

Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

Reduction in potable water demand

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 non-potable water for landscape irrigation.

If rainwater harvesting or greywater collection is also used for toilet flushing then to avoid double-counting, the volume of water provided for the irrigation credit must be entered into the Potable Water Calculator. The Potable Water Calculator does not undertake detailed calculations of water storage efficiency. However, the storage tank must have a minimum of 20 days storage capacity for the toilet flushing demand entered.

Non-potable water is defined as water that is collected on site or recycled/recovered from a previous use such as blackwater or greywater. Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of non-potable water used. In addition to the surface water table dropping, there is a global deficit of groundwater, and extracting water from any neighbourhood fresh-water sources merely localises what otherwise would take place on the municipal or provincial level.

Establishing the reference case

The reduction in potable water consumption is to be estimated against the amount of potable water that would be used in the most common solution permitted by regulation. At the time of the publication of this Technical Manual, most projects would assume above-ground sprinkler systems. However, should these become prohibited, it would not be acceptable to assume such a system for the reference case.

Xeriscape garden

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.

Relevant authority approval

Where greywater and/or blackwater treatment and reuse systems are present, reference must be made to the Wat-1 and/or Emi-6 credit compliance claimed in terms of approvals to authorities.

BACKGROUND

Irrigation demand is not included in the Potable Water Calculator (Wat-1 'Occupant Amenity Water') due to difficulties in setting a benchmark for use in retail buildings (including area and type of plants).

In South Africa the quantity of water used for landscape irrigation in some instances accounts for as much as 50% of the total water consumed on office premises.

Wat-3 Landscape Irrigation

POINTS AVAILABLE 3

REFERENCES & FURTHER INFORMATION

Landscape Irrigation Association of South Africa
http://www.liasa.co.za
Water Conservation & use in Agriculture
http://www.wca-infonet.org

Water Efficiency South Africa
http://www.waterefficiencysa.co.za

Wat-4 Heat Rejection Water

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise design that reduces potable water consumption from heat rejection systems.

CREDIT CRITERIA

Up to four points are awarded as follows:

Two points are awarded where:

- Potable water consumption of water consuming heat rejection systems is reduced by 50%.

Four points are awarded where:

- Potable water consumption of water consuming heat rejection systems is reduced by 90%; OR
- No water consuming heat rejection systems are provided.

Wat-4 Heat Rejection Water

POINTS AVAILABLE 4

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For mechanically air conditioned spaces, where water consuming heat rejection systems are used: • Short report (1) • Extract(s) from the specification(s) (1) • Tender schematic hydraulic drawing(s) (1)	For mechanically air conditioned spaces where water consuming heat rejection systems are used: • Short report (1) • Extract(s) from the Commissioning Report (1) • As built hydraulics drawing(s) (1)
For mechanically air conditioned spaces where non water based heat rejection systems are used: • Short report (2) • Extract(s) from the specification(s) (2) • Tender schematic hydraulic drawing(s) (2)	For mechanically air conditioned spaces where non water based heat rejection systems are used: • Short report (2) • As built hydraulic drawing(s) (2) • Extract(s) from commissioning report
For naturally ventilated and mechanically assisted naturally ventilated spaces: • Opening area schedule OR • Compliance note	For naturally ventilated and mechanically assisted naturally ventilated spaces: • Opening area schedule OR • Compliance note

Short report (1) on the water-based heat rejection system(s) in the project, prepared by a suitably qualified project team member, referencing drawings and detailing:

- The heat rejection requirements of the building;
- Any proposed water-based heat rejection system;
- Calculations (and justification of values used) for the reference case; and
- How the proposed system meets the Credit Criteria against the reference case.

Short report (2) which describes the non water based heat rejection system(s) installed in the project, prepared by a suitably qualified project team member, referencing drawings.

Wat-4 Heat Rejection Water

POINTS AVAILABLE 4

Short report (3) for naturally ventilated spaces and mechanically assisted naturally ventilated spaces, demonstrating that the building operates as a naturally ventilated retail space in accordance with SANS 10400-O and requires no mechanical air conditioning for occupancy.

Extract(s) from the specification(s) (1) identifying and detailing the proposed heat rejection system, its water sources and operation requirements.

Extract(s) from the specification(s) (2) identifying and detailing the non water based heat rejection system(s).

Extract(s) from the commissioning report demonstrating that the installed system has been fully commissioned and operates as intended by the design.

Tender or as built schematic hydraulic drawing(s) (1) highlighting:

- The location and water supply of the water-based heat rejection systems; and
- Any supplementary equipment that may be required to achieve the specified reduction in potable water consumption.

Tender or as built schematic hydraulic drawing(s) (2) highlighting the non water based heat rejection system(s).

Compliance note indicating that full points have been achieved for the IEQ-1 'Ventilation Rates' credit.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Tender architectural drawing(s) for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

As built architectural drawing(s) for each typical naturally ventilated space, with ventilation openings, inlets and outlets clearly indicated and dimensioned.

ADDITIONAL GUIDANCE

Points under this credit will not be awarded unless the solution(s) described in this credit correlate with the other relevant credits claimed, e.g. Ene-1 'Greenhouse Gas Emissions'.

If reduction in the demand for potable water is proposed, the credit requires that the reduction has been demonstrated and justified clearly and against a robust reference case.

For the purposes of this credit, non-potable water is defined as water that is collected on-site or recycled/recovered from a previous use such as blackwater or greywater.

Wat-4 Heat Rejection Water

For the purposes of this credit any form of evaporative cooling systems are deemed to be water based systems.

Previously unused water from high-value fresh water sources (e.g. lake, river or groundwater) cannot contribute to the amount of non-potable water used. In addition to the surface water table dropping, there is a global deficit of groundwater each year, and extracting water from any neighbourhood fresh-water sources merely localises what otherwise would take place on the municipal or provincial level.

For naturally ventilated projects only:

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation Rates' 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 Rates', points will not be awarded for this credit through this deemed-to-satisfy route.

Establishing the reference case

Potable water demand of water-based heat rejection systems can be reduced through mixed-mode air conditioning, efficient use of conventional systems (e.g. cooling towers) or through the use of alternative technologies.

The reduction in potable water consumption is to be estimated against the amount of potable water that would be used in the reference case specific to this project.

The reference case is to be established as follows:

- To reflect water consumption for evaporation, bleed and draining required by Eurovent 9/5, 2nd Edition, 2002, for full cleaning;
- The cooling demand must be based on the thermal model used for Ene-1 ‘Greenhouse Gas Emissions’;
- An hour-by-hour calculation must be completed for an average day in January, April, July and October; and
- Six cycles of concentration are to be assumed.

Mixed-mode

Mixed-mode buildings must demonstrate that the predicted reduction in the operation hours of the mechanically air conditioned system does in fact equate to the stipulated reduction in potable water consumption. Note that 50% reduction in operation hours does not usually equate to a 50% reduction in water consumption by water-based heat rejection systems.

Mixed-mode projects can assume that water consumption savings due to the mixed-mode system are proportional to the cooling energy savings. For example, if the cooling energy consumption is reduced by 30% per annum due to the natural ventilation mode of operation, compared to full HVAC mode of operation, then for the purpose of this credit, the cooling tower water consumption can be considered to be reduced by 30%.

Wat-4 Heat Rejection Water

POINTS AVAILABLE 4

BACKGROUND

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 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.

REFERENCES & FURTHER INFORMATION

CIBSE, AM 10:1997, Natural Ventilation in Non-domestic Buildings

Eurovent, 9/5, 2nd Edition: 2002, Recommended Code of Practice to Keep Your Cooling System Efficient & Safe

Wat-5 Fire System Water Consumption

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise building design that reduces consumption of potable water used for the building's fire protection and essential water storage systems.

CREDIT CRITERIA

One point is awarded where:

- There is sufficient temporary storage for a minimum of 80% of the routine fire protection system test water and maintenance drain-downs, for reuse on-site; and
- Each floor fitted with a sprinkler system has isolation valves or shut-off points for floor-by-floor / area by area (minimum of one per 10,000 m^2) drain downs;

OR

- The fire protection system does not expel water for testing or maintenance.

If the building does not have a fire protection and sprinkler system, this credit is 'Not Applicable' and is excluded from the Points Available used to calculate the Water Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Short report • Tender schematic fire suppression drawing(s) Where the credit is claimed as 'Not Applicable': • Copy of the Development Approval OR • Extracts from the Fire Engineering report	Submit all the evidence and ensure it readily confirms compliance. • Short report • As built schematic fire suppression drawing(s) • Extract(s) from commissioning report Where the credit is claimed as 'Not Applicable': • Copy of the Development Approval OR • Extracts from the Fire Engineering report

Wat-5 Fire System Water Consumption

POINTS AVAILABLE 1

Short report from a suitable professional that describes how the Credit Criteria has been met, including:

- The proposed fire protection system, its operation and testing requirements, justifying how the system design meets the Credit Criteria and how the collected water will be reused on site.
- Where the project has no fire sprinkler system, the report must state how the project meets the required fire safety standards outlined in the SANS 10400:1990.

Tender schematic fire suppression drawing(s) for each typical floor and drawings of the water storage and reuse system(s).

Extract(s) from commissioning report demonstrating that the fire protection system has been commissioned and operates as intended by the design.

Copy of the Development Approval where it is indicated that the building does not have a sprinkler system.

Extracts from the Fire Engineering report where it states that the building's fire suppression system has no sprinklers.

As built schematic fire suppression drawing(s) for each typical floor and drawings of the water storage and reuse system(s).

ADDITIONAL GUIDANCE

It must be clearly demonstrated that no less than 80% of the water from testing and maintenance drain-downs will be reused on site. If the proposed fire protection system expels water for testing, this will require an effective collection and reuse system, as well as sufficient storage capacity.

The fire protection system is deemed to include:

- Hydrants;
- Fire hose reels;
- Storage and sprinkler-test tanks; and
- Sprinkler-test and drain-down points.

As sprinkler water may not be suitable for reuse, sprinkler pipe drain-down water can be excluded from this credit, where the credit applies to water for re-use.

Collected test water can be reused within the fire protection system or other water recycling systems, but it must be reused on site.

Temporary water storage facilities for fire systems must have the capacity to store test water at any time of the year and cannot share any component of the rainwater tank capacity that is used in any calculations for other water credits. If the storage tank designated for collection and storage of fire system water is simultaneously used for rainwater or recycled water

storage, it must be designed (e.g. sized sufficiently) to avoid overflow of collected water into the sewerage system or the watercourse.

BACKGROUND

To comply with statutory requirements, fire protection systems are regularly tested and maintained to ensure that, in the event of a fire, the system will operate and deliver water flow rates to meet required design standards. In most instances sprinkler and hydrant testing requires that the system pressure is reduced to simulate a fire condition and start the booster pumps, usually by opening a valve and draining this water to a drainage system. Due to the frequency of maintenance this volume of water can be considerable.

Additionally, fire services tanks often serve a dual function as storage for potable water. To maintain cleanliness and structural integrity these tanks are often drained to allow maintenance activities to be carried out (maybe once every two years). The volume of such tanks can be up to 50,000-100,000 litres and it is not unusual for leaks to occur after maintenance, requiring further draining and repair.

Fitting the sprinkler system on each floor with isolation valves or shut-off points ensures that the sprinkler system on any particular floor can be carried out independently of the sprinkler systems on other floors. However, all isolation valves fitted must be in accordance to the requirements of the fire fighting regulations.

REFERENCES & FURTHER INFORMATION

Automatic Sprinkler Inspection Bureau (Pty) Limited, Eleventh Edition Rules for Automatic Sprinkler Installations, 2009
http://www.asib.co.za

South African National Standards
http://www.sabs.co.za

SANS 1475-2:2008, Fire Hose Reels, Hydrants and Booster Connections, Edition 4.

SANS 10287:2000, Code of Practice for Automatic Sprinkler Installation for Fire Fighting Purposes

SANS 10400:1990, Part T and W, Code of Practice for the Application of the National Building Regulations

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 building materials used in projects and choosing the least harmful when using virgin building materials. The Green Star SA rating tool rewards initiatives and strategies to do so.

Materials and resource concepts 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 Storage

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise the inclusion of storage space that facilitates the recycling of resources used within buildings to reduce waste going to disposal.

CREDIT CRITERIA

Two points are awarded where a dedicated storage area for the separation and collection of recyclables from tenancies and common areas is provided and it:

- is adequately sized to handle the collection and sorting of all waste streams specified in the Requirements Basic List, and a minimum of two items selected from the Compliance Requirements Extended List.
  - Basic List – paper, cardboard, plastic, glass, metal
  - Additional List – cooking oils, compostable organic materials, fluorescent & CFLs, batteries, motor oil.
- Meets the access and space requirements under Additional Guidance in the Green Star SA Retail v1 Technical Manual.
  - Includes a holding area for items of re-use.
  - Is separate from, but adjacent to, general waste facilities.
  - Is located in the same level as the loading dock with a clearly marked, sign-posted, convenient and guaranteed access route which allows level access from tenancies (or goods lifts are provided) and avoids the need for manual handling of waste.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender drawings Where a compactor is provided • Extract of the specification(s)	• Short report • As built drawings Where a compactor is provided • Extract of the specification(s)

Mat-1 Recycling Waste Storage

POINTS AVAILABLE 2

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

- Identifying how the design provides adequately sized waste storage area to handle recyclable waste
- Identify how the design complies with the access criteria as indicated in Additional Guidance.
- Providing calculations that demonstrate that the area provided is adequately sized to handle recyclable waste streams specified under Additional Guidance, based on:
    - A profile of projected waste generated; and
    - Collection frequency of each waste profile.

Tender drawing(s) marked up to show:

- The location of the recycling storage area(s) with dimensions indicated;
- The dock layout for all docks, showing equipment location labelled with recyclable type, and
- The route connecting the tenancies to the waste storage facilities, indicating level changes and where goods lifts are being provided.

As built drawing(s) marked up to show:

- The location of the recycling storage area(s), with dimensions indicated;
- The dock layout for all docks, showing equipment location labelled with recyclable type, and
- The route connecting the tenancies to the waste storage facilities, indicating level changes and where goods lifts are being provided.

Where a compactor is provided as part of the strategy for minimising waste volumes:

Extracts from specification(s) delineating the compactors capacity.

ADDITIONAL GUIDANCE

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 all items listed under the Basic - waste stream list. Space provision must be made for a minimum of two additional waste items as suggested in the Extended – waste stream list.

Mat-1 Recycling Waste Storage

POINTS AVAILABLE 2

BASIC WASTE STREAM	EXTENDED WASTE STREAM
• cardboard	• compostables
• paper	• cooking oil
• plastic (PET, HDPE, LDPE, other)	• CFLs
• metal	• batteries
• glass	• motor oil

Where multi docks are provided, these facilities must individually meet the requirements of the credit.

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. If a vehicle turntable is used it must have a 30 tonne capacity.
- 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).
- A retail development requires a minimum vertical clearance of 3.8 meters.

External recycling waste storage

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 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);

- 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

Waste generation in the developed world grew by 20% between 1980-2000, and is expected to increase by a further 30% by 2020. Offices are known to produce enormous waste streams, including those of plastics, cardboards, glass bottles, aluminium cans, and of course large amounts of paper waste. Studies have found that most often, the paper waste generated in offices is recyclable paper, and usually printed only on one side. Even in offices with paper recycling systems, large amounts of recyclable paper was found to still end up in the general rubbish.

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.

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 approx 47%, with countries like Switzerland, The Netherlands and Germany at the top of the list with levels between 70% and 80%.

SustainableChoice, an Australian based organization, states that producing paper from recovered fibres consumes 60% less energy and 55% less water than manufacturing paper 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.

Mat-1 Recycling Waste Storage

POINTS AVAILABLE 2

REFERENCES & 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

SustainableChoice
http://www.sustainablechoice.com.au/

CalRecycle – California Government fact sheet.
http://www.calrecycle.ca.gov/ReduceWaste/Business/factSheets/Retail.htm

Wrap Material change for a better environment.
http://www.wrap.org.uk/retail/index.html

Institute of Waste Management of Southern Africa
http://www.iwmsa.co.za/

Mat-2 Building Reuse

POINTS AVAILABLE 5

AIM OF CREDIT

To encourage and recognise developments that reuse existing buildings to minimise materials consumption.

CREDIT CRITERIA

Five points are available as follows:

Two points are awarded where it is demonstrated that at least 50% of the total façade of the building by area, comprises re-used building façade.

Up to three points are awarded where a proportion of the existing major structure, by gross building volume, is reused:

- One point for 30% reuse; OR
- Two points for 60% reuse; OR
- Three points for 90%.

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

Mat-2 Building Reuse

POINTS AVAILABLE 5

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where façade or structure is being used: • Short report • Site documentation • As built drawing(s) of original building(s) • Tender drawing(s) of new building	Where façade or structure is being used: • Short report • Site documentation • As built drawing(s) of original building(s) • As built drawing(s) of new building
Where the credit is being claimed as 'Not Applicable': • Short report • Site documentation	Where the credit is being claimed as 'Not Applicable': • Short report • Site documentation

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

- Providing calculations and a complete area schedule that demonstrate that the GFA of the original building(s) is less than 20% of the GFA of the building replacing them, referencing documentation from original buildings;

  OR

- Describing what elements of the façade/structure are being retained, and providing calculations and a complete area/volume schedule for both the original and new buildings that demonstrate that the total area (for façade calculations) or volume (for structure calculations) retained from the original building(s) is sufficient to meet the Credit Criteria. All of the original façade/structure must be accounted for;

  OR

- Stating that the site contained no building(s) at the time of purchase.

Site documentation:

Scaled site plans (with built area and GFA quantified) or aerial photographs generated at, or prior to, site purchase, showing the built area on the site.

As built drawing(s) of the original building(s):

- Elevation drawings marked up to show the location and area of the reused façade; and
- Floor plan drawings marked up to show the location and associated building volume of the reused structure and indicating the building(s)' GFA.

Tender drawing(s) of the new building:

- Elevation drawings marked up to show the location and area of the reused façade; and
- Floor plan drawings marked up to show the location and associated building volume of the reused structure and indicating the building(s)' GFA.

As built drawing(s) of the new building:

- Elevation drawings marked up to show the location and area of the reused façade; and
- Floor plan drawings marked up to show the location and associated building volume of the reused structure and indicating the building(s)' GFA.

ADDITIONAL GUIDANCE

The documentation must clearly demonstrate that the stipulated proportion of the façade/structure has been retained, regardless of how much additional material has been added.

This credit will only be deemed 'Not Applicable' if the calculations account for all of the building(s) that existed on the site.

In addition to conservation of materials, land and water, as well as reduced embodied energy, factors such as energy performance determine whether conservation of an existing building is the best environmental outcome. The design team should consider this in determining to what extent the existing building should be retained and refurbished.

This credit addresses the retaining of existing materials, not the final design; therefore, it is irrelevant whether the retained elements are clad in, or otherwise refurbished with, additional material.

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, their total area must be used in the calculations for these credits. If the development comprises both a refurbishment and a new addition, the Credit Criteria are to be read as pertaining to the refurbishment only.

Refurbishment projects are likely to achieve this credit without difficulty unless the building is entirely re-clad. Externally affixed elements such as fixed shading devices are excluded from the calculation of façade.

Mat-2 Building Reuse

POINTS AVAILABLE 5

Structure

A major structure is defined as floors, columns, beams and load bearing walls and where these are required for structural use by the new building foundations. The allocation of the points for reuse of structure is based on gross building volume and not material volume, as the latter would be difficult to calculate. The credit requires that the existing major structure is reused without significant strengthening or alteration works (where mass of new material is equal to or greater than 50% of the total mass for the reused structure).

It is not necessary for the reused structure to correspond to a similar proportion of the new building for this credit to be awarded.

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. Indirect economic benefits include reduced demolition and transportation costs.

REFERENCES & 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

eThekwini Municipality website
http://www.durban.gov.za/durban/services/services/cleansing/recycling/construction
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-2 Building Reuse

POINTS AVAILABLE 5

Concrete Thinker: Concrete Thinking for a Sustainable World
http://www.concretethinker.com
http://www.concretethinker.com/Papers.aspx?DocId=36

Mat-3 Recycled Content & Reused Materials

POINTS 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 three points are awarded as follows:

One point where at least 1% of the project's total contract value is represented by re-used products/ materials.

Up to two points are awarded for use of material with recycled content as follows:

- One point where the total value of recycled material content represents 1% of the contract value.
- Two points where the total value of recycled material content represents 2% of the contract value.

The value of recycled material content is calculated by multiplying the material cost of products containing recycled content by the percentage of recycled content (both post-consumer and pre-consumer) and summing all the results.

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

Only materials or products permanently installed on the project site are eligible. Mechanical, electrical, plumbing components and specialty items such as elevators and equipment must be excluded from the compliant materials total.

Mat-3 Recycled Content & Reused Materials

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For reused materials: • Short report • Extract(s) from specification(s) (1) • Extract(s) from the contract For recycled materials: • Short report • Extract(s) from specification(s) (2) • Extract(s) from the contract	For reused materials: • Short report • Extract(s) from the contract • Confirmation from contractor • Evidence of reuse For recycled materials: • Short report • Extract(s) from the contract • Confirmation from contractor • Evidence of recycled content

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

- Documenting all separate uses of compliant products and materials in the project; and
- Providing calculations that demonstrate that the total value of compliant materials accounts for at least the percentage specified in the Credit Criteria

  OR

  For Design projects, if the actual value of compliant materials is not yet known, the percentage can be estimated by a qualified Quantity Surveyor.

Extract(s) from specification(s) (1) where the reused products and materials in the project as well as the associated quantities of these materials are stipulated.

Extract(s) from specification(s) (2) where the recycled products and materials in the project as well as the associated quantities, and percentage of recycled content of these materials are stipulated.

Confirmation from the contractor that all reused/recycled items have been installed.

Evidence of reuse of products/materials, such as purchase receipts of items purchased from a second-hand retailer or removal list/inventory to confirm previous location of the item.

Extract(s) from the contract that includes the project's total contract value.

Evidence of recycled content of products/materials, such as a material data sheet indicating the percentage of recycled content of the product.

ADDITIONAL GUIDANCE

Reused material content

It must be demonstrated that:

- The actual or estimated total monetary value of reused products/materials is reasonably justified (It is acceptable to substitute the actual amount paid with the fair market value of a reused material, as long as it is justified in the submission):
- The claimed monetary value of the project reflects the entire project scope; and

Examples of reused materials include, but are not limited to, bricks, windows, cladding, pre-cast concrete panels (as their reuse is not rewarded in the 'Recycled Content of Concrete' credit), flooring and doors as well as sanitary and lighting fixtures and fittings.
For a product/material to be classified as 'reused' at least 80%) of the item must be in its original form. The percentage must be calculated by area, length, volume or mass, whichever is more appropriate - the metric chosen must be justified. The remaining percentage of the item can be refurbished or new (as in the case of new upholstery). Painting or coating is inconsequential to determining whether the product is reused.

Recycled material content

Any recycled material that is derived from a post-consumer, post-agricultural, and post-industrial process (excluding re-utilisation of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the process that generated it) may be claimed for this credit.

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. The value of recycled content must constitute either 1% or 2% of the material costs.

Items with a high recycled content that may be considered for this credit include insulation, aluminium, glazing, gypsum, bricks, 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.

Material recycled content value	=	material cost	X	(% post-consumer recycled content	+	% post-industrial recycled content)

Mat-3 Recycled Content & Reused Materials

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).

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,
require significantly less energy to manufacture, reducing the embodied energy of the product (ICE, 2008).

REFERENCES & 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

eThekwini 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/casestudies/casestudy_index.html

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.

Mat-4 Shell and Core or Integrated Fitout

This credit is not relevant to the Green Star SA - Retail Centre 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

Three points are available as follows:

Up to two points are available where the project has reduced the absolute quantity of Portland cement, as an average across all concrete mixes, by substituting it with industrial waste product(s) or oversized aggregate as follows:

- For 1 point, 30% for in-situ concrete, 20% for precast concrete and 15% for stressed concrete;

  OR

- For 2 points, 60% for in-situ concrete, 40% for precast concrete and 30% for stressed concrete.

An additional point is awarded where:

- At least one of the above points is achieved;

  AND

- 10% of all aggregate used for structural purposes is recycled (Class 1 RCA in accordance with Australian standard HB155-2002) or slag aggregate;

  AND

- No natural aggregates are used in non-structural uses (e.g. building base course, sub-grade to any car parks and footpaths, backfilling to service trenches, kerb and gutter).

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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Mat-5 Concrete

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
To demonstrate replacement of Portland cement: • Concrete Technologist report • Quantity Surveyor report • Extract(s) from specification(s) Where the additional point is claimed, the following evidence is also required: • Concrete Technologist report Where the credit is claimed as 'Not Applicable': • Quantity Surveyor report	To demonstrate replacement of Portland cement: • Concrete Technologist report • Quantity Surveyor report • Confirmation(s) from supplier(s) • Confirmation from contractor Where the additional point is claimed, the following evidence is also required: • Concrete Technologist report Where the credit is claimed as 'Not Applicable': • Quantity Surveyor report

Concrete Technologist report that describes how the Credit Criteria have been met by:

- Providing a breakdown of all concrete uses in the project, with the description, volume, composition and proportions of components clearly identified for each mix and use;
- Clearly indicating the volume of Portland cement replaced by the industrial waste product or oversize aggregate;
- Correlating with the specification;
- If oversized aggregate is used, calculations that demonstrate that this approach is equivalent to reducing the amount of cement used in a project by replacing it with industrial waste products; and
- Where the additional point is claimed, identifying all aggregate uses in the project, describing where recycled or natural aggregate is used, and demonstrating that the Credit Criteria has been met.

Quantity Surveyor report estimating the total material value of the new concrete as a proportion of the contract value.

Mat-5 Concrete

POINTS AVAILABLE 3

Extract(s) from the specification(s):

- Nominating how the Credit Criteria will be met, accounting for all concrete in the project;
- Stating that no industrial waste product came from industrial facilities co-fired with hazardous waste;
- Where industrial waste product is being used for cement replacement, identifying the proportion of industrial waste product to be used in place of cement;
- Where oversized aggregate is being used for cement replacement, identifying the use of oversize aggregate in order to reduce the amount of cement required in a project; and
- Where the additional point is claimed, nominating the proportion of recycled aggregate to be used and stipulating that the recycled aggregate be classified as Class 1 RCA, in accordance with the Australian code HB 155-2002. (Currently, no equivalent South African code exists.)

Confirmation(s) from supplier(s):

- Of the quantities of Portland cement, industrial waste product and aggregate (both recycled and non-recycled) supplied to site;
- That no industrial waste product came from industrial facilities co-fired with hazardous waste; and
- Where the additional point is claimed, nominating the proportion of recycled aggregate to be used and stipulating that the recycled aggregate be classified as Class 1 RCA, in accordance with the Australian code HB 155-2002. (Currently, no equivalent South African code exists.)

Confirmation from the contractor that all of the concrete used on site complies with the Credit Criteria by identifying all concrete uses in the project and describing the mix and product used.

ADDITIONAL GUIDANCE

This credit addresses all concrete, including non-structural uses such as paving, footpaths, kerbs, channels and gutters; it must be clear that all of the concrete in the project has been accounted for.

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.

Alternative assessment for oversized aggregate

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.

Note that any pre-existing concrete that is retained in a refurbished project cannot be included in the calculation of this credit; it is addressed in Mat-2 'Building Reuse' and Mat-3 'Reused Materials'.

Aggregates

It is a prerequisite to claim at least one point for cement replacement in order to claim the additional point for aggregate. 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 concrete 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.

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 commercial 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.

Cement replacement (post-industrial)

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.

Recycled concrete aggregate (RCA)

Concrete waste can be processed to produce roadbase/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 roadbase 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 & 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.
SANS1491-2:2005 Portland cement extender Part 2: Flyash.
SANS1491-3:2006 Portland cement extender Part 3: Silica fume.

Mat-6 Steel

POINTS 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:

- In a predominantly structural steel building, the average post-consumer recycled content of the structural steel, by mass, is at least 24% (i.e. 60% of the structural steel has a recycled content of 40%) or at least 60% of the structural steel, by mass, is reused.

OR

- In a predominantly reinforced concrete building, the average post-consumer recycled content of the steel reinforcing, by mass, is at least 54% (i.e. 60% of the steel reinforcing by mass has a recycled content of 90%), or at least 60% of the steel reinforcing, by mass, is reused.

Two additional points are awarded where

- the average post-consumer recycled content of all steel (total of structural steel, steel reinforcing and steel products), by mass, is at least 54% (i.e. 90% of the total steel has a recycled content of 60%),

OR

- at least 90% of all the steel by mass on the project is reused.

If the material cost of 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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Mat-6 Steel

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the project is claiming the use of reused or recycled steel: • Short report • Quantity Surveyor report • Extract(s) from specification(s) Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report	Where the project is claiming the use of reused or recycled steel: • Short report • Quantity Surveyor report • Confirmation(s) from supplier(s) • Confirmation(s) from contractor(s) Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report

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

- Identifying the total amount (by mass) of steel used within the building structure;
- Identifying all of the applications of steel installed within the building structure;
- Identifying the product used for each type of application;
- Identifying the total amount (by mass) of steel used for each application within the building structure;
- Referencing the quantity surveyor estimation of the total mass of steel in the building's structure, as well as supplier and contractor evidence of the post-consumer content of the steel used; and
- Demonstrating via a summary table (and calculations wherever relevant) that the steel with confirmed post-consumer content jointly accounts for the stipulated proportion of steel in the project.

If steel was supplied for uses outside the building structure, these uses must be clearly identified and excluded from the calculations.

Quantity Surveyor report that estimates the total mass and material cost of the steel within the building structure as a proportion of the project's contract value.

Mat-6 Steel

POINTS AVAILABLE 3

Extract(s) from the specification(s) where the steel requirements are identified, clearly referencing post-consumer content or reuse for the stipulated percentage of all relevant steel in the project.

Confirmation(s) from the supplier(s) of:

- The total quantity of steel supplied to the project; and
- The post-consumer recycled content of each steel product supplied to the project (via product-specific evidence such as Materials' Data Sheets).

Confirmation(s) from the contractor(s) of:

- All of the applications of steel installed within the building structure;
- The product used for each type of application; and
- The total amount (by mass) of steel used for each application within the building structure.

ADDITIONAL GUIDANCE

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.

All steel used within the building structure is addressed by this credit, including all concrete reinforcement steel (stressed, in situ or pre-cast) and structural steel. This includes, but may not be limited to, hot rolled beams, columns, angles, mullions and reinforcement as well as cold-formed products such as purlins, girts, cladding and profiled steel decking.

It must be clear that all of the relevant steel uses in the project have been accounted for. 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.

$$\text{Average post-consumer recycled content} = \frac{\text{Total mass of post-consumer recycled content}}{\text{Total mass of steel (recycled + non-recycled)}}$$

Any pre-existing steel that is retained in a refurbished project cannot be included in the calculation of this credit; it is addressed in Mat-2 'Building Reuse' and Mat-3 'Reused Materials'.

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.

Mat-6 Steel

POINTS AVAILABLE 3

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 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 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%.

Mat-6 Steel

POINTS AVAILABLE 3

REFERENCES & FURTHER INFORMATION

South African Institute of Steel Construction
http://www.saisc.co.za

One Steel, Information on One Steel – Part 4 (2000)
http://www.onsteel.com

Steel Recycling Institute (US).
http://www.recycle-steel.org

UK Steel
http://www.uksteel.org.uk
http://www.uksteel.org.uk/fact5.htm

Mat-7 PVC Minimisation

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise the reduction in use of Poly Vinyl Chloride (PVC) products in South African buildings.

CREDIT CRITERIA

One point is awarded where:

30% of the total cost of PVC content is reduced through replacement with alternative materials.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Quantity Surveyor report • Extract(s) from the specification(s)	• Short report • Quantity Surveyor report • Extract(s) from schedule(s) • Confirmation from supplier(s) or contractor

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

- Referencing attached evidence;
- Identifying all major standard PVC uses within the project;
- Identifying the reference case for anticipated cost of PVC in the project;
- Identifying the expected cost of PVC within all of the major standard PVC uses in the project; and
- Nominating, through calculations and a summary table, how the cost of PVC has been reduced against the reference case.

Quantity Surveyor report that establishes the reference case by identifying the total anticipated cost of PVC if PVC is specified for all major standard PVC uses in the project.

Extract(s) from the specification(s) that relate to all major standard PVC uses within the project that identify the material to be used.

Extract(s) from schedule(s) of all major standard PVC uses within the project, identifying the material(s) being used.

Confirmation from supplier(s) of the total amount, cost, type and composition of the PVC products supplied to the project whenever they fall within the PVC uses reflected in the reference case.

Confirmation from the contractor of all the material installed (PVC and non-PVC) for the major standard PVC uses within the project.

ADDITIONAL GUIDANCE

The credit addresses all major standard PVC uses in retail centre base buildings, deemed to include pipes, pipe insulation, conduits, wire and cable sheathing, flooring, blinds, window framing and cladding. Reduction in PVC is demonstrated by cost against the reference case in which PVC is specified for all of these uses.

The cost of materials used to replace the standard PVC uses is not relevant. What is relevant is the amount of money that was not spent on PVC for those uses.

The calculations for PVC reduction are to be based on the cost of the PVC only, not on the cost of the entire product if it consists of more than just PVC.

It must be demonstrated that:

- The non-PVC products reduce the amount of PVC used in the project;
- All of the major standard PVC uses within the project have been accounted for;
- The reference case has been established accurately;
- The substitution of PVC is clearly documented and part of the design; and
- The cost reduction has been appropriately, reasonably and transparently calculated against the reference case.

Recycled PVC counts towards the total amount of PVC used in the building, not towards the reduction of PVC.

Establishing the reference case

The major standard PVC uses in retail centre base buildings include pipes, pipe insulation, conduits, wire and cable sheathing, flooring, blinds, window framing and cladding. Reduction in PVC is demonstrated by cost against the reference case, established by the Quantity Surveyor, in which PVC is specified for all of these uses.

Mat-7 PVC Minimisation

POINTS AVAILABLE 1

The calculations for PVC reduction are to be based on the cost of the PVC only, as estimated by the Quantity Surveyor or provided by the material supplier, not on the cost of the entire product if it consists of more than just PVC. The table below can be used to estimate the cost of PVC within the products. Whenever the defaults in table Mat-7.1 are not used, projects must provide justification for the values used instead.

PVC use	Expected cost of PVC within the product
Insulation	Actual cost
Pipes	95%-100%
Conduits	95%-100%
Sheathing for copper wires and cables	10%
Backing of commercial-grade carpet tile	10%

Table Mat-7.1: *Major Standard PVC uses and expected contribution of PVC towards cost.*

Actual PVC uses and costs

For each material type, where PVC is substituted completely or in part by an alternative, that alternative percentage must be nominated and must be consistent with the specification.

For refurbished buildings, existing PVC materials that are not being replaced must be excluded from the cost calculations.

Example of PVC calculations

Standard Material plus other PVC uses	Total final budgeted cost for those items (Standard PVC cost)	Actual material used in the project	Cost for PVC items used in the project (Actual PVC cost)	Reduction in use by cost
Stormwater pipes	R10,000	Cast Iron above ground Clay pipes below ground	R0	100%
Sewerage pipes	R10,000	PVC above ground Clay pipes below ground	R6,000	40%
Electrical cabling	R15,000	PVC	R15,000	0%
Electrical conduit	R6,000	Steel used for 30% of conduits. PVC remainder	R3,300	45%
Total	**R41,000**		**R24,300**	**41%**

Table Mat-7.2: *Example of PVC reduction calculation*

The PVC reduction by cost in the example in table Mat-7.2 is 41% which achieves 1 point.

Mat-7 PVC Minimisation

Alternatives to PVC

To inform project teams, the following information on alternative materials has been provided. The GBCSA does not recommend or endorse any products; each project team should evaluate alternatives on their merit.

Pipes – One of the largest uses of un-plasticised PVC (known as u-PVC) is in rigid pipes for above and below ground drainage and gas pipes. There is a range of traditional and new material alternatives to PVC in above and below ground and indoor and outdoor piping. Vitrified clay pipes are suitable for underground sewerage pipes, and are very durable. High Density Polyethylene (HDPE) pipes are more flexible and shock resistant than PVC pipe.

For above ground drainage uses such as soil and vent pipes and rainwater drainage, materials such as zinc, cast iron, copper, galvanised steel or aluminium can be used as an alternative.

Electrical Cables – The main alternative power and data cables use polyethylene as an insulation and sheathing material. Rubber-sheathed cables are also available. PVC-free cables typically cost more at present but have started to drop in price as individual consumers and municipalities demand alternative materials to PVC.

Alternative cable types can have better properties than PVC in the event of a fire. They may generate less smoke, do not release hydrochloric acid or dioxins, and have fire-resistant qualities which may match or outstrip PVC.

The benchmarked quantity of PVC assumes separate telephone, data and electrical cables. Another acceptable means of reducing the use of PVC in cabling is to combine data and telephone in the same cable; an example might be Voice-Over-Internet Protocol (VOIP) or to use wireless data and telephone systems instead of cabled systems.

Electrical Conduits – Polyethylene and steel are alternatives to PVC conduits for electricity cables.

Floor Coverings – PVC is still used for wet-area floor coverings, as well as for carpet backing. Alternative wet-area floor coverings include linoleum, rubber and composite floor coverings which do not include PVC.

Blinds – Blinds can be manufactured from a wide variety of weaves and materials, some of which are made from PVC or have PVC coating. There are a large number of alternatives to PVC blinds, including fabric and glass fibre weaves.

Window Framing – Alternatives to PVC for window frames include timber, aluminium, steel and fibreglass.

Cladding – The external cladding of large volume spaces can often be made from vinyl (PVC) boards. PVC is also sometimes used as a protective coating for metal cladding systems.

Alternatives to PVC cladding include:

- Metal cladding systems;
- Timber cladding;
- Concrete or masonry systems;

- Plywood or composite wood board products; and
- Fibre-Cement sheeting.

PVC is sometimes used for internal cladding as well, and again many of the above alternatives might apply.

Finishes and fittings – Other finishes and fittings which may include PVC include various types of wallpaper, electrical and light fittings, covers, doors, etc. In almost all instances, PVC alternatives are available at a comparable cost.

BACKGROUND

In the developed world it is reported that over 50% of PVC is manufactured specifically for the construction industry. PVC is used in almost all electrical and data cable and ducting and for clean, grey and foul water supply drainage.

GBCSA acknowledges and seeks to reduce the global human health implications of carcinogens, mutagens and teratogens, all of which are identified attributes of some of the primary chemical components necessary for the manufacture of PVC products. As a leading environmental organisation advocating best practice green building principles, the GBCSA seeks to discourage the use of all materials and their constituents whose manufacturing, use or disposal are responsible for perpetuating the 'upstream' production, in-use release, or 'downstream' disposal of compounds or chemicals which are known to be toxins.

While from the technical point of view human health impacts can be distinguished from environmental impacts, both are inextricably linked to the definition of a 'green building' as represented by Green Star SA. If a building or fitout aspire to be green, they should not be able to overlook the potentially grave human health risks posed by the choice of materials in the built environment. Reduction of PVC in buildings was a major environmental initiative of the Sydney 2000 Olympics (the 'Green Games'). In addition to the human health impacts, the issue of disposal of end-of-life PVC can be problematic.

REFERENCES & FURTHER INFORMATION

AEA Technology (United Kingdom) (2000) Economic Evaluation of PVC Waste Management, A report produced for European Commission Environment Directorate
http://ec.europa.eu/environment/waste/studies/pvc/economic_eval.htm

Environment Australia (2003), End-of-life Environmental Issues with PVC in Australia, Prepared by Dr. John Scheirs, ExcelPlas Polymer Technology (EPT) for Department of the Environment and Water Resources, June 2003
http://www.environment.gov.au/settlements/publications/waste/pvc/suggestions.html

US Green Building Council's Technical and Scientific Advisory Committee (2007) Assessment of the Technical Basis for a PVC-Related Materials credit for LEED

Mat-7 PVC Minimisation

POINTS AVAILABLE 1

Australian Safety and Compensation Council, Hazardous Substances and Dangerous Goods.
http://www.ascc.gov.au/nr/exeres/4ac369d3-e9c7-40e6-b930-d4716794a970.htm

Environmental Defence (U.S.), Chemical Scorecard
http://www.scorecard.org/chemical-profiles/

Greenpeace, PVC Alternative Database
http://archive.greenpeace.org/~toxics/pvcdatabase/

Inform (U.S.), Purchasing for Pollution Prevention
http://www.informinc.org/p3_00.php

International Occupational Safety and Health Information Centre, International Chemical Safety Cards
http://www.ilo.org/public/english/protection/safework/cis/products/icsc/

Mat-8 Sustainable Timber

POINTS 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

Two points are available as follows:

- One point is awarded where 50% (by cost) of all timber products used in the building and construction works have been sourced from any combination of the following:
  - Reused timber;
  - Post-consumer recycled timber; or
  - Forest Stewardship Council (FSC) Certified Timber.
- An additional point is awarded where 95% (by cost) of all timber products used in the building and construction works satisfy the abovementioned sourcing criteria.

If the material cost of timber represents less than 0.1% of the project's contract value then this credit is 'Not Applicable' and is excluded from the Points Available, used calculate the Materials Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Mat-8 Sustainable Timber

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the project is claiming use of sustainable timber: • Short report (1) • Quantity Surveyor report (1) • Timber schedule • Extract(s) from the specification(s) Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report (1)	Where the project is claiming use of sustainable timber: • Short report (2) • Quantity Surveyor report (2) • Confirmation from supplier(s), including Chain of Custody Certificates • Confirmation from contractor, including Chain of Custody Certificates Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report (2)

Short report (1) prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Providing cost calculations and a summary table to confirm that reused, recycled and FSC timber jointly account for at least 50% or 95% of timber costs in the project.

Short report (2) prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Listing all uses of timber on the project and the timber used,
- Identifying (with supporting receipts) the supplier cost of all timber uses in the project; and
- Providing cost calculations and a summary table to confirm that reused, recycled and FSC timber jointly account for at least 50% or 95% of timber costs in the project.

Quantity Surveyor report (1):

- Estimating the total material cost of timber including estimated value of the existing timber if part of refurbishment, as a proportion of the project's contract value.

Quantity Surveyor report (2) showing:

- The total actual material cost of timber (existing timber if part of refurbishment) as a proportion of the project's contract value; and
- For refurbishment projects claiming this credit, the volume and market value of timber material retained within the existing building.

Timber schedule of all timber uses in the project and the proposed material for those uses.

Extract(s) from the specification(s) demonstrating Credit Criteria requirements stipulating the timber source for each requirement and that the evidence confirming compliance with the Credit Criteria (e.g. FSC Certificates) and receipts be kept and logged.

Confirmation from supplier(s):

- Indicating the quantity, cost and type of all timber supplied to the project;
- Identifying properties of the timber as they relate to the Credit Criteria, i.e. whether the timber was reused, recycled or FSC Certified; and
- Wherever FSC Certified timber is used, including Chain of Custody Certificates for the last company in the chain of custody of each product or material prior to it being procured for this project.

Confirmation from contractor identifying all timber uses within the project and indicating the quantity and type of timber used.

ADDITIONAL GUIDANCE

This credit addresses all timber within the project, including formwork, temporary works and composite wood products. No distinction is made between applications, temperate or tropical timbers, or between hardwoods and softwoods.

It must be clearly demonstrated that all timber in the project has been accounted for, and that reused, recycled and FSC certified timber jointly accounts for at least 50% or 95% of cost.

For each source that is claimed to satisfy the requirements of this credit, the supplier will be required to certify the credentials of the timber against the Credit Criteria.

Retained timber in refurbishment

Note that any pre-existing timber that is retained in a refurbished project can be included in the calculation of this credit, if its quantification is well justified.

Expected timber uses 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.

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.

$$\text{Recycled content value (R)} = \text{\% post-consumer recycled content by weight} \times \text{material cost}$$

$$\text{Total percentage recycled content} = \frac{\text{total recycled content value (R)}}{\text{total timber cost}} \times 100$$

FSC

FSC Certificates must be presented for all FSC Certified timber. FSC Chain of Custody Certificates must also be provided for the final party in custody of the material or product until it has been procured for the project.

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.

$$\text{Certified wood material percentage} = \frac{\text{FSC–certified wood material value (R)}}{\text{Total new wood material value (R)}} \times 100$$

Chain of Custody

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.

It must be clear that the evidence accounts for all uses of the relevant material in the project, i.e. via using 'all' in the specification or, where appropriate, providing a summary table listing all uses and the attributes of the material(s) used.

For a product to receive points within this credit for FSC certification, a full chain of custody must exist. That is, 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 provides product to the workstation manufacturer who doesn't have FSC certification, who then sells it to the project, then chain of custody is lost, and points will not be

awarded for that workstation. Contractors and subcontractors 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. (Note: These requirements are for Green Star SA and may vary from FSC rules.) The following is an extract from the Forest Stewardship Council website (**http://www.fsc.org**):

"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."

Industry Type required?	Process Stage	Chain-of-custody
Building & Construction	Sawmills, Lumberyards	YES
	Manufacturers of forest products	YES
	Timber broker	YES
	Building contractors	NO*
	Retailers (i.e. DIY stores)	NO
Printing & Paper	Pulp, paper producer	YES
	Paper merchant	YES
	Broker	YES
	Printers	YES
	Publisher	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*

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

industry for FSC certified timber; however a large demand exists internationally. Approximately 25% of the FSC certified timber in SA is exported.

REFERENCES & FURTHER INFORMATION

Forest Stewardship Council
http://www.fsc.org/ and http://www.fsc.org/resource_center.html

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 Disassembly

POINTS 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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Short report • Quantity Surveyor report • Tender drawings • Extract(s) from specification(s) • Comprehensive Disassembly Plan Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report	Submit all the evidence and ensure it readily confirms compliance. • Short report • As built drawings • Comprehensive Disassembly Plan Where the credit is being claimed as 'Not Applicable': • Quantity Surveyor report

Mat-9 Design for Disassembly

POINTS AVAILABLE 1

Short report prepared by a suitable 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.

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 drawings/As built drawings:

- 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.

Extract(s) from the specification(s) that:

- Identify products and materials that demonstrate compliance with the Credit Criteria and describe their requirements; and
- Stipulate that whenever materials/products that enable compliance with the Credit Criteria are fabricated on site, the contractors are required to mark them with their inherent properties and date of fabrication.

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 must be recovered, indicating the order of disassembly to enable them to be extracted without material damage or interference from other building materials/elements.

Mat-9 Design for Disassembly

POINTS AVAILABLE 1

ADDITIONAL GUIDANCE

To be designed for disassembly, the relevant building elements must exhibit the following properties:

- Connections allow for disassembly;
- Elements to be recovered are clearly marked, 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 must 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.

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 fitout'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 & 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 Dematerialisation

POINTS 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 available where a substantial reduction in materials consumption occurs as follows:

- Where it is demonstrated that the building's structural requirements and integrity have been achieved using 20% less structural steel (by mass) OR 20% less concrete and reinforcing/stressing steel (by mass), OR 20% less timber (by volume) than in a structure with conventional steel, concrete or timber framing, without changing the load path to other structural components.

OR

- Where any two of the initiatives below are demonstrated:

Structure

Where it is demonstrated that 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, without changing the load path to other structural components.

Ductwork

– The building is fully naturally ventilated;
OR

– The requirement for ductwork has been reduced by 95%.

Building Efficiency

For new buildings, where it is demonstrated that Building Efficiency, defined as the ratio of the total UA over the total GFA, is at least 85%.

Finishes

– 95% of all base building floor material is exposed structure with no covering (e.g. exposed sealed concrete floor);
OR

– 95% of all base building ceiling is exposed structure (and services, where relevant) with no cladding (e.g. exposed concrete ceiling).

Mat-10 Dematerialisation

POINTS AVAILABLE 1

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 – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where structure dematerialisation initiatives are undertaken: • Short report from a structural engineer • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required Where ductwork is minimised: • Short report • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required Where Building Efficiency is achieved: • Short report • Tender drawings	Where structure dematerialisation initiatives are undertaken: • Short report from a structural engineer • Confirmation from contractor • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required Where ductwork is minimised: • Short report • Confirmation from contractor • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required

Mat-10 Dematerialisation

POINTS AVAILABLE 1

Where finishes are minimised: • Short report • Schedules of finishes Where dual-function cladding is installed: • Short report • Tender drawings Where piping is minimised: • Short report • Relevant tender schematic hydraulic drawings • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required	Where Building Efficiency is achieved: • Short report • As built drawings Where finishes are minimised: • Short report • As built drawings • As installed schedules of finishes • Confirmation from contractor Where dual-function cladding is installed: • Short report • As built drawings • Extract from the Commissioning Report Where piping is minimised: • Short report • Relevant as built hydraulic system drawings • Confirmation from contractor • Where reduction is demonstrated against a reference case, a Quantity Surveyor report will also be required

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

- Referencing supporting documentation and describing, with calculations and summary tables wherever appropriate, how the Credit Criteria have been achieved; and
- Where the use of structural steel is minimised, a separate short report must be prepared by a qualified structural engineer that:
  - Describes how the amount of steel has been reduced;
  - Includes the calculations of the reduction in the total amount (by mass) of steel necessary for the designed structure against the reference case; and
  - Confirms that the reduction has been achieved without changing the load path to other structural components.

Quantity Surveyor report establishing the reference case against which the reduction in steel, ductwork or piping will be measured. The report must identify the expected, standard practice scenario for the amount of the relevant material.

Tender/As built drawings:

- Floor plans marked up to demonstrate building efficiency; and
- Floor plans or reflected ceiling plans marked up to show, and quantify associated areas, where finishes are installed.

Schedule(s) of finishes that lists all uses of the relevant product/material type in the project.

Tender schematic hydraulic drawings marked up to indicate the underground piping or piping associated with toilets or urinals, whichever initiative is claimed.

Confirmation from contractor indicating the amount and type of product/material installed in accordance with the specifications, e.g. that no piping was installed to serve toilets or urinals.

As installed schedule of finishes that lists all uses of the relevant product/material type in the project.

Extract from the Commissioning Report confirming that the dual-function cladding has been commissioned and performs as intended by the design.

As built hydraulic system drawings marked up to indicate the underground piping or piping associated with toilets or urinals, whichever initiative is claimed.

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.

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.

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 & 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 in this credit.

One point is awarded where:

- 20% of the project's contract value is represented by materials or products (used in the construction of the project) that have been sourced from within 400km of the site.

One point is awarded where:

- 10% of the project's contract value is represented by materials or products (used in the construction of the project) that have been sourced from within 50km of the site.

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

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment must be excluded from the local materials total.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from specification(s) • Extract from contract	• Short report • Extract from contract • Logbook/spreadsheet • Manufacturer information

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

- Documenting all compliant materials' points of origin, extraction and manufacture with distances to site; and
- Providing calculations that demonstrate that the total value of the products/materials from within the specified radii account for the percentages required of the project's contract value.

  OR

  For Design projects, if the actual value of compliant materials is not yet known, the percentage can be estimated by a qualified Quantity Surveyor.

Extract(s) from specification(s) where the locally sourced products and materials in the project as well as the associated quantities of these materials are stipulated, or simply requiring that the required percentage of materials from the credit criteria are sourced locally.

Extract(s) from the contract that includes the project's total contract value.

Logbook/spreadsheet recording all materials, product costs, manufacturers, distance from manufacturer to project site and distance from extraction site to project site.

Manufacturer Information indicating the location of extraction, harvest or recovery as well as processing and manufacturing for each compliant material nominated.

ADDITIONAL GUIDANCE

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 may include transport/shipping costs to the site, but may 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

Mat-11 Local Sourcing

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 emissions, one can achieve vast improvement 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 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 tonnes of CO_2 emissions. This is equivalent to the CO_2 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 & FURTHER INFORMATION

Beddington Zero Energy Development: Construction Materials Report Part 1, Nicole Lazarus, Bioregional Development Group.
http://www.bioregional.com/Materials%20report%20web%20cut%20final%20draft.pdf

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 occur **(http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm).**

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 species **(http://www.botany.uwc.ac.za/envFacts/facts/biosa.htm).** South Africa is one of 17 countries that have been termed as Megadiverse; these 17 countries collectively house two thirds of the world's biodiversity **(http://www.megadiverse.org).**

Threats to South Africa's Biodiversity

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 (Australian Green Star Office Design v3 Rating Tool).

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.

Eco – Conditional Requirement

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
- All points are achieved in Emi-5 'Watercourse Pollution' and 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.

Eco – 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.

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• 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) • 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).

Eco – Conditional Requirement

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;
- 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.

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.

Eco – Conditional Requirement

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 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.

Eco – Conditional Requirement

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*.

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

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;

Eco – Conditional Requirement

- 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.

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.

Eco – Conditional Requirement

'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.

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.

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http://www.agis.agric.za/agismap_atlas/

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Eco – Conditional Requirement

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SACNASP Act (Act 27 of 2003)
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 Topsoil

POINTS 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:

- All topsoil impacted by the construction works is separated and protected from degradation, erosion or mixing with fill or waste;

  AND

- Where at project completion:
  - Protected topsoil is spread over impacted areas to a minimum depth of 200 mm and a maximum depth of 600 mm, 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.

  AND

- Where protected topsoil remaining on site is productive.

Where 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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Short report (1) • Where the credit is claimed as 'Not Applicable': • Short report (2)	• Short report (1) • Where the credit is claimed as 'Not Applicable': • Short report (2)

Eco-1 Topsoil

POINTS AVAILABLE 1

Short report (1) prepared by a suitable professional that describes how the Credit Criteria have been met by:

- Quantifying the amount of topsoil on the site at time of purchase; all assumptions must be justified;
- Defining the area that will be / has been impacted by construction activities;
- Where topsoil is present and affected, describing how the integrity of the site's topsoil specifically within the impacted area will be / has been protected throughout construction works in the form of a topsoil management plan or in the case of the as built scenario, describing how the integrity of the site's topsoil has been protected throughout construction works;
- Describing, with calculations and references to drawings, the 'before' and 'after' conditions that account for all topsoil on the site, and clearly confirming that none of the site's topsoil by volume will be covered by hard surfaces as a consequence of the design, and that all of the site's topsoil will remain productive on site or be transported to a nearby land holding and deposited under the supervision of an ecologist.
- Describe the measures to ensure soil integrity should it be required to be transported;
- Defining the area selected for soil relocation/deposition should it be required; and
- Showing extract(s) from the contract stipulating the requirements of topsoil management that the contractor and sub-contractors must adhere to.

Short report (2) prepared by a suitable professional(s) that describes how no topsoil was impacted by the construction works.

ADDITIONAL GUIDANCE

Pre-existing contaminated topsoil is excluded from this credit and is dealt with in the following two ways.

1. For contamination of a portion of the existing topsoil, the contaminated soil is not included in the topsoil calculations.
2. For contamination of all existing topsoil, the credit is 'Not Applicable' and must be marked 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

If existing topsoil is contaminated during the construction process, the credit can not be earned and must be marked as zero points achieved.

The 'site' is defined by the scope of Green Star SA assessment. If a development consists of several buildings, the site must be defined for each registered building. Stockpiling of soil on sites of the other buildings within the development is not acceptable.

Eco-1 Topsoil

POINTS AVAILABLE 1

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.

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.

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.

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 forfeit this credit.

Correct topsoil management

- Conduct 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.
- All suitable topsoil occurring within the impacted area of construction 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

Permanent hard surfaces

Permanent hard surfaces are defined as:

- Any permanent structure (e.g. building or car park); and
- Any impervious or semi-impervious surfaces (e.g. paved or unpaved car parks).

Where there is insufficient topsoil to spread a 200 mm layer over the required area, the project must ensure that at least 75% of the volume of pre-development productive topsoil occurring within the impacted area must remain on site.

The correct implementation of the topsoil management plan will demonstrate that the integrity of the site's topsoil was not compromised during construction works.

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 (Jones 2002).

Conservation is necessary because soil formation is a slow process. One centimetre of soil takes between 100 and 400 years to develop (Kassam et al; 1992).

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

Refer also to the Management Category Man-7 'Waste Management'

Eco-2 Reuse of Land

POINTS 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 or a building extension;

  OR

- At the time of the site purchase, 75% of the site had been previously built on.

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

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Short report	• Short report

Short report including the following items:

- Description of the built area on the site at the time of purchase and providing calculations (with justification of all inputs used) of the proportion of the built area on the site; and
- A locality plan that demonstrates that the location and extent of the site falls within the municipal approved urban edge.

ADDITIONAL GUIDANCE

For a new building, the documentation current at the time of site purchase must clearly demonstrate that at least 75% of the site area was built on at the time of site purchase.

Furthermore the second point will not be awarded if the documentation current at the time of site purchase indicates that the site was outside of the approved urban edge.

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).

A car park demonstrated to have existed at the time of site purchase is considered to be 'previously developed land'. Please note that to ensure that the Aim of the Credit is met, the Assessors will look for evidence that the site had indeed been developed and that the car park is and was legitimate.

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 find out more about these parameters within the provincial context, the relevant provincial and local government planning departments should be contacted.

To determine the alignment and status of an urban edge within a municipality, the project team must contact the planning department of the district or metropolitan municipality or alternatively the relevant provincial department with the planning mandate.

Eco-2 Reuse of Land

POINTS AVAILABLE 2

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.

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 Land

POINTS 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.

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. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure that it readily confirms compliance. • Short report Where the credit is claimed as 'Not Applicable': • No evidence is required from projects that are refurbishments or building extensions.	Submit all the evidence and ensure that it readily confirms compliance. • Short report Where the credit is claimed as 'Not Applicable': • No evidence is required from projects that are refurbishments or building extensions.

Eco-3 Reclaimed Contaminated Land

POINTS AVAILABLE 2

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

- Identifying the type and extent of contamination;
- Outlining all available decontamination options, and proposing the remediation strategy where required; and
- In order for encapsulation to be deemed appropriate for meeting the Credit Criteria, the report must clearly identify that no other remediation options exist for this project.

ADDITIONAL GUIDANCE

The submission must show that:

- 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.

Encapsulation is only an acceptable form of remediation if there are technically no other remediation options.

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.

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.

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,

Eco-3 Reclaimed Contaminated Land

POINTS AVAILABLE 2

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'.

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.

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

Hazardous Substances Act 15 of 1973

SABS Codes of Practice 0228 & 0229

Asbestos Regulations 2001

Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

AIM OF CREDIT

To encourage and recognise developments that maintains or enhances the ecological value of their sites.

CREDIT CRITERIA

Up to four points are awarded where:

- For greenfield sites, the site has no threatened or vulnerable species or sensitive ecological units and for reused sites (e.g. refurbishments), such species and ecological units are adequately protected if present; AND
- There is no net reduction of native vegetation; 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 are determined by the Green Star SA Change of Ecological Value Calculator.

Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure that it readily confirms compliance.	Submit all the evidence and ensure that it readily confirms compliance.
• Completed Change of Ecological Value Calculator • Short report • Tender architectural site plan • Landscaping schedule	• Completed Change of Ecological Value Calculator • Short report • As built architectural site plan • Landscaping schedule
Where the project claims to create land types with ecological value of 25 or greater, the following is also required: • Evidence of ecosystem viability	Where the project claims to create land types with ecological value of 25 or greater, the following is also required: • Evidence of ecosystem viability
For reused sites where threatened or vulnerable species are present, the following is also required: • Endangered species protection plan • Confirmation from a suitably qualified registered ecologist	For reused sites where threatened or vulnerable species are present, the following is also required: • Endangered species protection plan • Confirmation from a suitably qualified registered ecologist

Completed Change of Ecological Value Calculator, using inputs consistent with supporting documentation.

Short report by a suitably qualified registered ecologist (as per the ECO-0 definition) 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.

- Where the site is identified as a brownfield site by selecting the urban area 'vegetation type', justification must be provided;
- Where the site's bioregion and vegetation type is identified and the presence of threatened or vulnerable species on the site is either confirmed or refuted;
- Where the project claims to create land types with ecological value of 25 or greater, the report must identify the conditions and time period necessary for the these areas to assume and perform their ecological function;
- In complex and sensitive designs, instalment and maintenance plans will be required to be developed and implemented by the building management, e.g. as part of the Operations and Maintenance (O&M) Manual; and

- The short report may rely on additional evidence of ecosystem viability to demonstrate that the installed landscape will function as intended by the design.

Tender or As built architectural site plan of the design clearly identifying all land types present on the site in accordance with the Change of Ecological Value Calculator and indicating the area they occupy.

Landscaping schedule where planting and any requirements necessary to ensure that the landscaping functions as intended by the design are nominated.

Evidence of ecosystem viability including any evidence that may be necessary to demonstrate that the installed landscape will function as intended by the design.

Endangered species protection plan for protecting the existing threatened or vulnerable species and that:

- 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.

Confirmation from a suitably qualified registered ecologist that the proposed plan for protecting the existing threatened or vulnerable species on the site is adequate.

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.

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.

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.

Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

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.

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 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 site 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.

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.

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.

Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

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.

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.

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 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.

Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

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;
- 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.

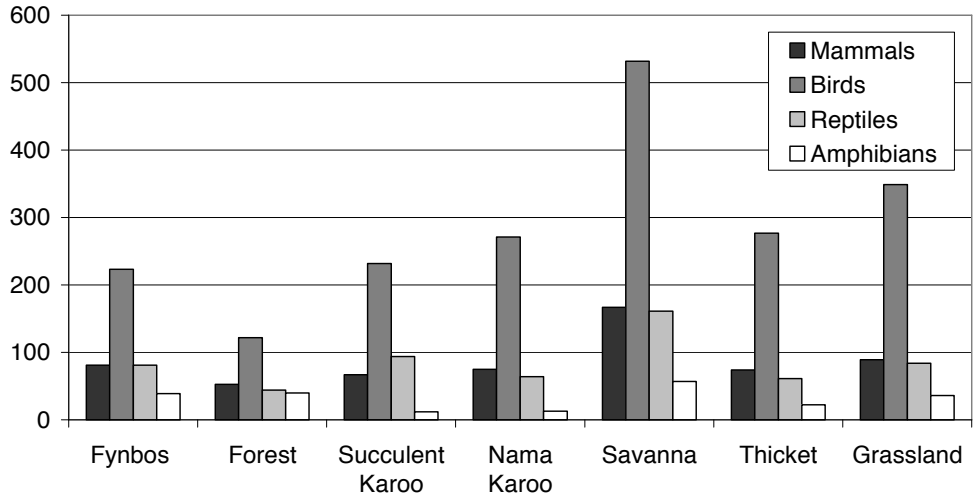


Figure Eco-4.1: *Fauna species richness per taxonomic group of the biomes of South Africa*

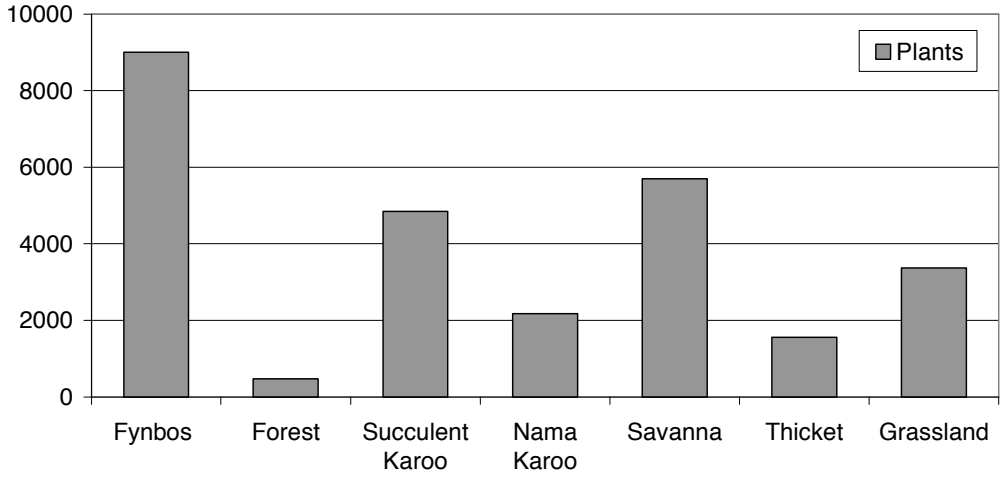


Figure Eco-4.2*: Flora species richness per taxonomic group of the biomes of South Africa*

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.

Eco-4 Change of Ecological Value

POINTS AVAILABLE 4

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

Eco-5 Urban Heat Island

POINTS AVAILABLE 2

AIM OF CREDIT

To recognise and reward initiatives taken to reduce the heat island effect of buildings which impact on microclimates, human and wildlife habitats.

CREDIT CRITERIA

Two points are available as follows:

One point is awarded where:

- The project uses any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots, but excluding roofs):
  - Provide shade by using vegetation,
  - Provide shade using structures with a solar reflectance index (SRI) of at least 29 or covered by solar energy systems.
  - Use hardscape materials with an SRI of at least 29.
  - Use an open-grid pavement system (at least 50% pervious).

One point is awarded where:

- The project uses roofing materials with a solar reflectance index (SRI) equal to or greater than 78 for low-sloped roofs (<10 degree pitch) or 29 for steep-sloped roofs (>10 degree pitch) for a minimum of 75% of the roof surface.

OR

- The project installs a vegetated roof that covers at least 50% of the roof area.

OR

- The project installs roofing meeting the SRI requirements and vegetated roof surfaces that, in combination, meet the following criteria:

$$\frac{\text{Roof area meeting minimum SRI}}{0.75} + \frac{\text{Area of vegetated roof}}{0.5} > \text{Total roof area}$$

Eco-5 Urban Heat Island

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where the heat island effect is reduced for hardscaping: • A short report • Tender site plan drawings • Extracts from the specifications Where the heat island effect is reduced for roofing: • A short report • Tender roof plan drawings • Extracts from the specifications	Where the heat island effect is reduced for hardscaping: • A short report • As built site plan drawings • Manufacturer Data Sheets Where the heat island effect is reduced for roofing: • A short report • As built roof plan drawings • Manufacturer Data Sheets

A short report prepared by an appropriate professional describing how the point has been achieved, and demonstrating that the sum of the qualifying area values meets the Credit Criteria requirements.

Tender / As built site plan drawings

- Illustrating the project boundary line and identifying all hardscaping (including roads, pathways, courtyards and parking lots), landscaping, and building footprint areas; and
- Labelling each portion of hardscape that complies with the Credit Criteria with information about its surface; i.e. area of tree shading, area of shading from structure or area shaded by solar panels, SRI values of reflective paving materials and area covered, pervious material areas, etc.

Tender /As built roof plan drawings

- Illustrating all roof areas; and
- Labelling each portion of roof area that complies with the Credit Criteria with information about its surface, i.e. SRI values of reflective roofing materials, vegetated roof, etc.
- Extracts from the specifications stipulating where relevant:
- Landscaping requirements to achieve shading criteria;
- Solar reflectance index requirements for architectural devices, structures, hardscape materials and roofing materials; and

- Pervious percentage requirement for open-grid pavement system(s).

Manufacturer Data Sheets where relevant, stipulating:

- Solar reflectance index values for architectural devices, structures, hardscape materials and roofing materials used to meet the Credit Criteria; and
- Pervious percentage for open-grid pavement systems used to meet the Credit Criteria.

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 (a 10 square metre area of paving with complaint 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.

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 in the southern hemisphere), with the arithmetic mean of these three values used as the affective 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 source: LEED Reference Guide for Green Building Design and Construction, 2009

Table Eco-5.1 *Solar Reflectance Index for standard paving materials*

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.

Microsurfaces and coatings over tar paving can be used to meet the required SRI value for this credit. Coatings and integral colourants 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.

Eco-5 Urban Heat Island

SRI Values for Solar Infrared temperature	Solar reflectance	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
White coating , 2coats 20mils	0.85	0.91	5°C	107

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 source: LEED Reference Guide for Green Building Design and Construction, 2009

Table Eco-5.2 *Solar Reflectance Index (SRI) for typical roofing materials*

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, which can be found at **http://coolcolors.lbl.gov/assets/docs/SRI%20Calculator/SRI-calc10.xls**, 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 (source: LEED Reference Guide for Green Building Design and Construction, 2009)

Vegetated Roofs

A vegetated 'green' or 'eco' 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 usually 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 evapo-transpiration. Vegetated roofs also have some insulating benefits, retain stormwater, are aesthetically appealing, add biodiversity, act as a CO_2 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 appurtenances, 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.

$$\left(\frac{\text{Area of low-slope SRI material}}{78 \times \frac{0.75}{\text{SRI value}}} + \frac{\text{Area of Steep-slope SRI Material}}{29 \times \frac{0.75}{\text{SRI value}}} + \frac{\text{Vegetated roof area}}{0.5} \right) > \left(\text{Total roof area} - \text{deducted area} \right)$$

Equation 2 *(source: LEED Reference Guide for Green Building Design and Construction, 2009)*

BACKGROUND

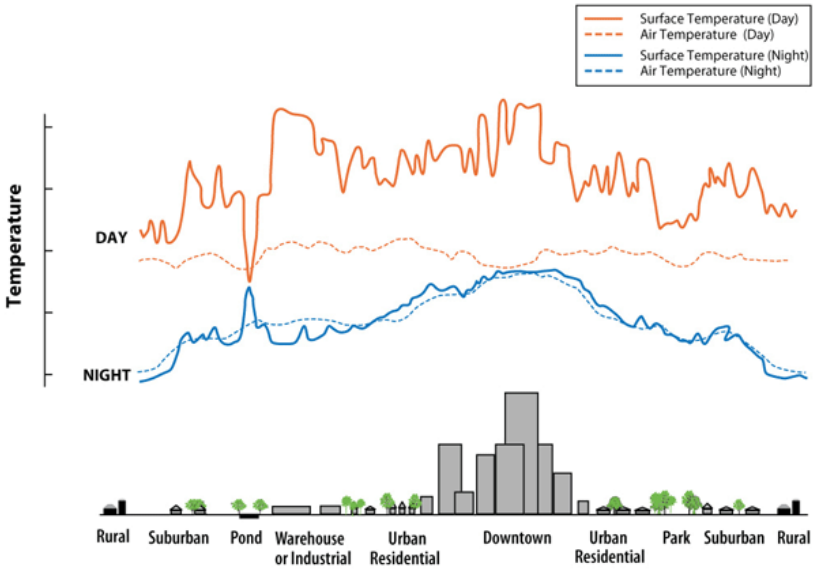
The use of dark, non-reflective surfaces for parking, roofs, walkways and other hardscapes contributes to the heat island effect by absorbing the sun's warmth, which then radiates into the surroundings. As a result, ambient temperatures in urban areas are artificially elevated, increasing cooling loads, 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.

Eco-5 Urban Heat Island

POINTS AVAILABLE 2

Causes of Urban Heat Island Effect.

The urban heat island effect (UHIE) 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.



Source: U.S. Environmental Protection Agency, Heat Island Effect, 2009

- 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, called the 'urban canyon effect';
- Buildings block wind thereby inhibiting cooling by convection;
- 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 (Source: U.S. EPA, Heat Island Effect, 2009)

Eco-5 Urban Heat Island

POINTS AVAILABLE 2

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 hardscaping 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 hardscaping 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, 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/
http://eetd.lbl.gov/CoolRoof/ref_01.htm

RealClimate, The Surface Temperature Record and the Urban Heat Island
http://www.realclimate.org/index.php/archives/2004/12/the-surface-temperature-record-and-the-urban-heat-island/

U.S. Environmental Protection Agency, Heat Island Effect
http://www.epa.gov/hiri/about/index.htm

U.S. Environmental Protection Agency. Reducing Urban Heat Island: Compendium of Strategies
http://www.epa.gov/hiri/resources/pdf/BasicsCompendium.pdf

Cool Roofs
http://www.coolroofs.org

ENERGY STAR® Roofing Products
http://www.energystar.gov

Emissions

The credits in the Emissions Category target the environmental impacts of a building's emissions. The Green Star SA rating tools target emissions including and relating to watercourse pollution, light pollution, ozone depletion, global warming, Legionella and sewerage.

Traditionally in South Africa, stormwater has been transported separately from the sewerage system. 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. The necessity to deal with both the quantity and quality of runoff is now recognised, as well as benefit from capturing and recycling the stormwater.

Light travelling up into the night sky or spilling on to neighbouring properties 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 Hydrochloroflourocarbons (HCFCs), used as refrigerants and in insulation materials, deplete the ozone layer as well as contribute to global warming when emitted. (ChloroFluorocarbons, Ozone Hole Watch, **http://www.nas.nasa.gov/About/Education/Ozone/cfc.html**) Long-term damage to the Earth's stratospheric ozone layer will expose living organisms to harmful radiation from the sun.

Greenhouse gas emissions related to energy production are addressed in the Energy category of this tool, and not in the Emissions category.

Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise the selection of refrigerants and other gases that do not contribute to long-term damage to the Earth's stratospheric ozone layer.

CREDIT CRITERIA

One point is awarded where

- All HVAC refrigerants and gaseous fire suppression systems used have an Ozone Depletion Potential (ODP) of zero;

  OR

- No refrigerants or gaseous fire suppression systems are used.

Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms.
For buildings with refrigerants/gasses: • Short report • Tender schematic drawing(s) • Extract(s) from the specification(s)/schedule(s)/contract(s) For buildings with no refrigerants/gasses: • Signed letter from building owner OR • Short report detailing non-refrigerant cooling systems In the case of Naturally Ventilated Buildings: • Compliance note OR • Opening Area Schedule	For buildings with refrigerants/gasses: • Short report • As built schematic drawing(s) • Confirmation from the Contractor/Supplier For buildings with no refrigerants/gasses: • Signed letter from building owner OR • Short report detailing non-refrigerant cooling systems • Extract(s) from commissioning records • Confirmation from Contractor (2) In the case of Naturally Ventilated Buildings: • Compliance note OR • Opening Area Schedule

Short report prepared by a mechanical engineer that describes how the Credit Criteria have been met by:

- Referencing specifications and tender drawings;
- Describing the HVAC system and identifying all systems that contain refrigerant;
- Describing any gaseous fire suppression systems;
- Indicating all of the type and volume of refrigerant(s) used in the system(s); and
- Where the project is a refurbishment, describing how the existing system(s) are converted, confirming this can be performed and maintained viably and without any refrigerant loss to the atmosphere.

Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

Tender schematic drawing(s) of the HVAC and gaseous fire suppression system(s), indicating location and type of all components containing refrigerant.

Extract(s) from the specification(s), schedules/contract(s):

- Where the requirements for the HVAC system are stipulated;
- Where it is stipulated that any refrigerant must have an ODP of zero;
- Where it is stipulated that any gaseous fire suppression system must have an ODP of zero; and
- Where the project is a refurbishment, stipulating the requirements for the conversion of the existing system.

As built drawing(s) of the HVAC and gaseous fire suppression system(s), indicating location and type of all components containing refrigerant.

Confirmation from the contractor/supplier detailing:

- HVAC system – location, type and volume of all refrigerant; and
- Fire Suppression system – location, type and volume of all gases.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned and found to operate as intended by the design.

Signed letter from the building owner confirming that the base-building services do not include any artificial cooling or gaseous fire suppression systems.

Short report detailing non-refrigerant cooling systems to include all non-refrigerant cooling systems used to provide cooling to the building (such as absorption chillers, evaporative cooling etc).

Confirmation from Contractor (2) Certification confirming that no refrigerants or gaseous fire suppression systems are used.

Compliance note indicating that at least one point has been achieved for the IEQ-1 Ventilation Rates credit.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

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.

It must be clearly demonstrated that only zero-ODP refrigerants are utilised in all HVAC systems and fire suppression systems throughout the project.

Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

For naturally ventilated projects only:

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation Rates' 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 Rates', the point will not be awarded for this credit through this deemed-to-satisfy route.

General

Refurbishment projects must demonstrate that the existing system(s) are converted to systems that utilize zero-ODP refrigerants viably and without loss of refrigerant to the atmosphere. Specifying that the original refrigerants be replaced with zero-ODP refrigerants will not suffice.

Where no refrigerants are used, the applicant must provide evidence demonstrating that the building is naturally ventilated or mechanically ventilated without refrigerant-based cooling.

The following table gives Ozone Depletion Potential for some commonly used gases. For other gases, manufacturer's data or other evidence must be submitted to verify the ODP. Greyed out cells mean that the gas does not comply with the Green Star SA requirements.

Refrigerant/Gas	Ozone Depletion Potential (ODP)
R11	1.0
R12	0.83
R22	0.05
R134a	0
R407c	0
R410a	0
R290 (propane)	0
R600 (butane)	0
R1270 (propene)	0
Ammonia	0
Halon 1211	3
HFC227ea (FM200)	0
Inergen	0
CO_2	0
Air	0
Water	0

Table Emi-1.1: *Ozone Depletion Potential of some common gases*

Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

Currently there are no Chlorofluorocarbon (CFC) and Hydrochlorofluorocarbon (HCFC) refrigerants available which meet the requirements of this credit. The credit can, however, be achieved through the use of Hydrofluorocarbons (HFCs) or hydrocarbon-based refrigerants.

BACKGROUND

Building services have an impact on the amount of damage done to the ozone layer from Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (HCFCs). These substances are used as refrigerants and in some insulation materials. These substances have been known to cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also have significant global-warming potentials and contribute to global warming (refer to credit Emi-2 'Refrigerant GWP').

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.

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://www.defra.gov.uk/environment/climatechange/uk/fgas/pdf/fluorgasreg-guidance.pdf

Emi-1 Refrigerant / Gaseous ODP

POINTS AVAILABLE 1

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), Refrigerant Selection Guide 2003. Melbourne.
http://www.airah.org.au/downloads/airah_rsg2003.pdf

United Nations Environmental Program, Ozone Secretariat.
www.unep.org/ozone

US Environmental Protection Agency
http://www.epa.gov/ozone/

Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise the selection of refrigerants that reduce the potential for increased global warming from the emission of refrigerants to the atmosphere.

CREDIT CRITERIA

Up to two points are awarded as follows:

- One point where 50% of the fluorocarbon refrigerant charge has been replaced with refrigerant(s) that have a Global Warming Potential (GWP) of 10 or less;
- Two points where:
  - All refrigerants have a GWP of 10 or less;
    OR
  - Where no refrigerants are used at all.

Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For buildings with refrigerants/gasses: • Short report (1) • Tender schematic drawing(s) • Extract(s) from the specification(s)/schedule(s) For buildings with no refrigerants/gasses: • Signed letter from building owner OR • Short report (2) In the case of Naturally Ventilated Buildings: • Compliance note OR • Opening Area Schedule	For buildings with refrigerants/gasses: • Short report (1) • As built schematic drawing(s) • Extract(s) from O&M manuals • Confirmation from the Contractor/Supplier For buildings with no refrigerants/gasses: • Signed letter from building owner; OR • Short report (2) • Extract(s) from commissioning records • Confirmation from Contractor (2) In the case of Naturally Ventilated Buildings: • Compliance note OR • Opening Area Schedule

Short report (1) prepared by a mechanical engineer that describes how the Credit Criteria have been met:

- Referencing specifications and tender drawings;
- Describing the HVAC system and identifying all systems that contain refrigerant;
- Indicating all of the type and volume of refrigerant(s) used in the system(s); and
- Where the project is a refurbishment, describing how the existing system(s) are converted, confirming this can be performed and maintained viably and without any refrigerant loss to the atmosphere.

Tender schematic drawing(s) of the HVAC system(s), indicating location and type of all elements containing refrigerant.

Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

Extract(s) from the specification(s), schedule(s) or tender contract:

- Where the requirements for the HVAC system are stipulated;
- Where it is stipulated that any refrigerant must have a GWP of less than 10; and
- Where the project is a refurbishment, stipulating the requirements for the conversion of the existing system.

As built schematic drawing(s) of the HVAC system(s), indicating location and type of all elements containing refrigerant.

Extract(s) from the O&M manuals that stipulate that only refrigerants with GWP of 10 or less can be used for any replacements of the relevant system(s).

Confirmation(s) from the contractor/supplier(s) of the type and quantity of all the refrigerants supplied to the project, to include evidence that the refrigerants have a GWP of 10 or less.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned and found to operate as intended by the design.

Signed letter from the building owner confirming that the base-building services do not include any artificial cooling.

Short report (2) detailing non-refrigerant cooling systems used to provide cooling to the building (such as absorption chillers, evaporative cooling etc).

Confirmation from Contractor (2) confirming that no refrigerants are used.

Compliance note indicating that at least one point has been achieved for the IEQ-1 Ventilation Rates credit.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

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.

For naturally ventilated projects only:

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation Rates' 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 Rates', points will not be awarded for this credit through this deemed-to-satisfy route.

Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

General

The natural refrigerant must be used in an application that would normally involve a synthetic fluorocarbon refrigerant.

It must be clearly demonstrated that the GWP of all HVAC refrigerants is less than 10, and that the O&M manual specifies the future replacement of those refrigerants with similar refrigerants.

Refurbishment projects must demonstrate that the existing system(s) are converted to systems that utilize refrigerants with GWP of 10 or less viably and without loss of refrigerant to the atmosphere.

The following table gives Global Warming Potential for some commonly used gases. For other gases, manufacturer's data or other evidence must be submitted to verify the GWP. Greyed out cells mean that the gas does not comply with the Green Star SA requirements.

Refrigerant/Gas	Global Warming Potential (GWP) 100 year time horizon
R11	4000
R12	8500
R22	1700
R134a	1300
R407c	1600
R410a	1900
R290 (propane)	3
R600 (butane)	3
R1270 (propene)	3
Ammonia	<1
Halon 1211	1300
HFC227ea (FM200)	2900
Inergen	0
CO_2	1
Air	0
Water	<1

***Table Emi-2.1**: Global Warming Potential of some common gases*

The 100-year Global Warming Potential is considered for the purpose of the Green Star SA – Retail Centre 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

Emi-2 Refrigerant GWP

POINTS AVAILABLE 2

Potential over 100 years; and is used by the UN Intergovernmental Panel on Climate Change (IPCC), for further details see reference section below.

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.

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.

Small packaged systems containing refrigerant can be exempted from these requirements if (a) Credit Emi-1 has been awarded (i.e. the refrigerants have an ODP of zero) and (b) the total refrigerant on the project from all such systems combined is less than 2.5kg. Manufacturers' datasheets for the equipment indicating total refrigerant charge must be submitted to allow exemption.

BACKGROUND

The use of Chlorofluorocarbons (CFCs) and Hydrochloroflourocarbons (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.

REFERENCES & FURTHER INFORMATION

Refer to Emi-1.

Ammonia as a Refrigerant Position Document ASHRAE 2002
ASHRAE Standard 15, Safety Standard for Refrigeration Systems

Department of Trade and Industry (U.K.), Refrigeration and Air Conditioning CFC and HCFC Phase-Out: Advice on Alternatives and Guidelines for Users.
http://www.berr.gov.uk/files/file29101.pdf

Intergovernmental Panel on Climate Change, Climate Change 2001, Working Group 1: The Scientific basis Chapter 6 Radiative forcing of Climate Change
http://www.grida.no/climate/ipcc_tar/wg1/247.htm

Emi-3 Refrigerant Leaks

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise building systems design that minimises environmental damage from refrigerant leaks.

CREDIT CRITERIA

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 a refrigerant leak detection system is installed to cover high-risk parts of the plant;

  OR

- 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

- The project has installed a refrigerant recovery system 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 points in Emi-1 ‘Refrigerant ODP’ and Emi-2 ‘Refrigerant GWP’ are achieved OR if the building is naturally ventilated, this credit is ‘Not Applicable’ and is excluded from the Points Available, used to calculate the Emissions Category Score. Type 'na' in the appropriate ‘No. of Points Achieved’ column of the rating tool.

Emi-3 Refrigerant Leaks

POINTS AVAILABLE 2

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
To claim one or two points: • Short report • Extract(s) from the specification(s) • Tender schematic mechanical drawing(s)	To claim one or two points: • Short report • Extract(s) from O&M manual • As built mechanical drawing(s)
To claim credit as 'not applicable', for projects where refrigerants comply with Emi-1 & 2: • Emi-1 and 2 must have been awarded	To claim credit as 'not applicable', for projects where refrigerants comply with Emi-1 & 2: • Emi-1 and 2 must have been awarded
To claim credit as 'not applicable', for projects with no refrigerants: • Confirmation from the mechanical engineer	To claim credit as 'not applicable', for projects with no refrigerants: • Confirmation from the mechanical engineer
In the case of Naturally Ventilated Buildings: • Opening area schedule OR • Compliance note	In the case of Naturally Ventilated Buildings: • Opening area schedule OR • Compliance note

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

Referencing specifications and tender drawing(s);

- Describing the HVAC system and identifying all systems that contain refrigerant;
- Indicating all of the type and volume of refrigerant(s) used in the system(s);
- 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 the additional point is claimed, including full details of the refrigerant recovery system.

Emi-3 Refrigerant Leaks

POINTS AVAILABLE 2

Extract(s) from the specification(s) demonstrating the refrigerant leak detection system(s) are detailed as per Credit Criteria;

Where the additional point is claimed, demonstrating the chiller and refrigerant recovery characteristics are as mentioned in the Credit Criteria.

Tender schematic mechanical 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.

As built mechanical drawing(s) of the HVAC system(s), indicating location and type of all elements containing refrigerants 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 the O&M Manual explaining the correct operation of the leak detection and recovery system.

Extract(s) from the Commissioning Records demonstrating that the HVAC systems have been commissioned and found to operate as intended by the design.

Confirmation from the mechanical engineer that there are no refrigerants used or that there are only non-refrigerant based systems.

Compliance note indicating that full points have been achieved for the IEQ-1 Ventilation Rates credit.

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

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. However the Credit Criteria does not need to be met for those systems that comply with both Emi-1 ‘Refrigerant ODP’ and Emi-2 ‘Refrigerant GWP’ (documented in accordance with the Technical Manual). Please refer to Emi-1 and Emi-2 for Compliance Requirements relevant for those refrigerants.

The refrigerant leak detection and recovery systems must be viable, i.e. designed or commissioned to operate properly to meet the Aim of Credit.

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.

Emi-3 Refrigerant Leaks

POINTS AVAILABLE 2

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.

For naturally ventilated projects only:

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation Rates' by meeting the requirements for 'Naturally Ventilated Spaces' this credit is 'Not Applicable' and no additional documentation is required. Where the project does not achieve full points for IEQ-1 'Ventilation Rates', the 'Not Applicable' route will not be accepted on this credit through this deemed-to-satisfy route.

Method based on air-sensing of refrigerant leak

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.

Emi-3 Refrigerant Leaks

POINTS AVAILABLE 2

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 Credit Criteria for Emi-1 and Emi-2.

BACKGROUND

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

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

ASHRAE Fundamentals Handbook 1997.

ASHRAE Standard 15, Safety Standard for Refrigeration Systems.

Australian Institute of Refrigeration Air Conditioning and Heating (AIRAH) (2003), Refrigerant Selection Guide 2003, Melbourne.
http://www.airah.org.au

Emi-3 Refrigerant Leaks

Automated Buildings Journal, Far-reaching International Standards and Regulations Requiring Refrigerant Leak Detection Still Not Generally Known.
http://www.automatedbuildings.com/news/jun02/art/murco/mrc.htm

Department of Trade and Industry (U.K.), Refrigeration and Air Conditioning CFC and HCFC Phase-Out: Advice on Alternatives and Guidelines for Users.
http://www.berr.gov.uk/files/file29101.pdf

Journal of Non Destructive Testing (2003), A New Type of Refrigerant Leak Detector for Leak Tests in the Refrigerating and Air Conditioning Industry. Volume 8.

Naval Facilities Engineering Service Centre – Environmental Services (U.S.), Leak Detection and

Prevention Guidelines for HVAC&R Systems
https://portal.navfac.navy.mil/portal/page?_pageid=181,1&_dad=portal&_schema=PORTAL

United Nations Environmental Program, Ozone Secretariat.
http://www.unep.org/ozone/treaties.shtml

Emi-4 Insulant ODP

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise the selection of insulants that do not contribute to long-term damage to the Earth's stratospheric ozone layer.

CREDIT CRITERIA

One point is awarded where no ozone-depleting substances are associated with either the manufacture or the composition of all thermal and acoustic insulants in the project.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Summary Sheet • Extract(s) from the specification(s) Where there are no thermal insulants used on a project: Signed letter from suitably qualified person	Submit all the evidence and ensure it readily confirms compliance. • Summary Sheet • Manufacturer's Data Sheets • Confirmation from the Contractor Where there are no thermal insulants used on a project: • Signed letter from suitably qualified person

Extract(s) from the specification(s) where the requirements for thermal and acoustic insulants are stipulated clearly demonstrating compliance with the Credit Criteria.

Summary Sheet listing all thermal and acoustic insulation products used on the project and their application confirming that no ozone depleting substances are used in manufacture or composition.

Manufacturer's Data Sheets (MDS) for each product listed on the summary sheet. The MDS must clearly confirm that the insulants are free of ozone-depleting substances in both manufacture and composition.

Confirmation from the contractor that all materials installed were as per the summary sheet.

Emi-4 Insulant ODP

POINTS AVAILABLE 1

Signed letter from suitable qualified person (e.g. mechanical engineer) where it is confirmed that no thermal or acoustic insulants are used on the project.

ADDITIONAL GUIDANCE

The specification must clearly stipulate all thermal and acoustic insulation to be free of ozone-depleting substances in both manufacture and composition.

For refurbishment projects only: any insulation which is already in place and which is not being altered or refurbished, may be excluded from the calculations.

Substances that have an Ozone Depleting Potential (ODP) greater than zero are to be avoided in the manufacture or composition of all insulants whilst satisfying all other criteria for their purpose. Alternatives to insulation manufactured and blown with ozone-depleting substances are available for almost all insulation applications.

The manufacturing process of insulants changes regularly; manufacturer data will need to be consulted by design and specification team in order to achieve compliance.

This credit is relevant to the insulation of building services and building fabric. As such, in order to claim this credit, projects must submit the relevant sections of the Architectural or Façade Specifications and all the applicable services specifications where insulation is commonly specified (i.e. mechanical, electrical, fire, hydraulics).

Insulants are likely to be used in the following application (the list is not exhaustive):

- Building services insulation; such as:
  - Chilled water pipework;
  - Refrigerant pipework;
  - Ductwork;
  - Hot & cold water pipes; and
  - Water tanks and water cylinders.
- Building fabric insulation in walls, roof, floor, window frames, doors, cavity closures, and lintels.

Acoustic insulation.

Where a project contains no thermal or acoustic insulants the point will be awarded.

BACKGROUND

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.

Emi-4 Insulant ODP

POINTS AVAILABLE 1

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.

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.

REFERENCES & FURTHER INFORMATION

The Green Guide to Specification
http://www.thegreenguide.org.uk

United Nations Environmental Program, Ozone Secretariat.
www.unep.org/ozone/treaties.shtml

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, the natural watercourses.

CREDIT CRITERIA

Up to three points are awarded as follows:

- One point is awarded where the development does not increase peak stormwater flows for rainfall events of up to a 1-in-2 year storm
- One point is awarded where all stormwater leaving the site, at any time up to a 1-in-20 year storm event, is treated or filtered in accordance with either:
  - CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines
    OR
  - Australian and New Zealand Environment Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.
- An additional point is awarded where:
  - Both of the above points are achieved;
    AND
  - A riparian buffer zone that has three separate zones of pollution buffering is installed within 9 meters of a waterway or natural watercourse and the development.

Where the project site does not contain or is not immediately adjacent to a waterway, the additional point is 'Not Applicable' and is excluded from the Points Available, used to calculate the Emissions Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Emi-5 Watercourse Pollution

POINTS AVAILABLE 3

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Tender site plan If the stormwater systems include equipment such as petrol interceptors etc.: • Extract(s) from the specification(s)	• Short report • As built drawings If the stormwater systems include equipment such as petrol interceptors etc.: • Extracts from the O&M Manual

Short report prepared by the relevant project team member that describes which points are claimed and how Credit Criteria have been met by:

- Referencing the specification and site plan;
- Where applicable, the short report must reference the documentation submitted in the General section of this submission. Projects must ensure that the information contained within the short report and the information submitted in the general section is clear, consistent, and properly referenced. All other documentation must be provided as per the Technical Manual at the time of submission.
- Where the peak stormwater flow point is claimed, providing calculations of original peak stormwater flow in m³/sec (based on site conditions at the time of purchase) against projected peak stormwater flow in m³/sec; and
- Where the stormwater treatment point is claimed,
  - Referencing the guidelines used;
  - Describing the treatment system(s); and
  - Confirming the 1-in-20 year storm event flow rate used for the design.
- Where the additional point is claimed, detailing the planting, soil types, slope or gradient of the area, additional mulching (if appropriate) and extent of the Riparian Buffer Zone to be installed.

Tender site plan

- Showing the stormwater systems included in the project design;
- Where the additional point is claimed, showing the position, size and location of the Riparian Buffer Zone, complete with data on soil type and slope of the area.

Extract(s) from the specification(s) where requirements for control and treatment of stormwater runoff treatment are stipulated.

Emi-5 Watercourse Pollution

POINTS AVAILABLE 3

As built drawing(s)

- Showing the stormwater system included in the project design; and
- Where the additional point is claimed, showing the position, size and location of the Riparian Buffer Zone, complete with data on soil type and slope of the area.

Extract(s) from the O&M manual demonstrating that sufficient information has been provided for ongoing operation and maintenance of the stormwater system(s).

ADDITIONAL GUIDANCE

If an attenuation/retention pond or other strategy is shared between sites or projects it must be demonstrated that this is the case and how this provides sufficient attenuation for the project and the other sites/projects linked to the same pond. Refer to the GBCSA's GSSA Eligibility document on the GBCSA website (www.gbcsa.org.za) for more detail on shared services.

Watercourses will be deemed immediately adjacent if there is no publicly-usable land or land in third-party ownership between the watercourse and the development.

Compliance with this credit can be achieved through a variety of technologies and strategies:

- **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 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.

- **Rainwater harvesting** for toilet flushing or irrigation 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; and
- **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.

BACKGROUND

Stormwater in South Africa has traditionally been channelled away from sites as rapidly as possible to the nearest watercourses 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.

The contaminants in stormwater can be grouped according to their water quality impacts:

- **Oils 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.
- **Suspended solids:** Suspended solids have two main constituents: organic, primarily from sewerage, 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, phosphorous 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:
  - Sewerage 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 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 serious health risks from cholera, typhoid, infectious hepatitis and a range of gastrointestinal diseases.
- **Toxic organics:** These include garden pesticides, industrial chemicals and landfill leaching. 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 have shown that stormwater can be exploited in a cost effective and environmentally sensitive manner for new urban developments. In this context:

- Water reclamation can reduce potable water demand considerably;
- Properly managed stormwater flows 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.

REFERENCES & FURTHER INFORMATION

CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines
available for download free of charge at **http://www.publish.csiro.au/nid/18/pid/2190.htm**

SANS 1200:LE 1982 Stormwater Drainage – Standardized Specification for Civil Engineering Works
http://www.sabs.co.za

Department of DWAF and Water Affairs (Water Quality)
http://www.dwaf.gov.za/Dir_WQM/default.asp

National Environmental Management Act No. 107 OF 1998
http://www.deat.gov.za (Department of Environment, Agriculture and Tourism (DEAT)

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

Department of Environment and Water Resources
http://www.environment.gov.au/about/councils/anzecc/index.html

ANZECC (2002) Guidelines for Urban Stormwater Management:
dataserver.planning.sa.gov.au/publications/840p.pdf

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 building outflows to the sewerage system due to building occupants' usage have been reduced against an average-practice benchmark as follows:

- One point for a 30% reduction;
- Two points for a 50% reduction;
- Three points for a 70% reduction; or
- Four points for a 90% reduction.

The points are determined by the Green Star SA Sewerage Calculator.

An additional point is awarded where:

- At least one point above is achieved; AND
- There is a Blackwater Treatment Maintenance Plan; AND
- There is a maintenance contract for a minimum of five year to ensure that the blackwater treatment system operates as intended by the design.

Where no blackwater treatment system is installed, the additional point is 'Not Applicable' and is excluded from the Points Available, used to calculate the Emissions Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

Emi-6 Discharge to Sewer

POINTS AVAILABLE 5

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Design	Green Star SA – Retail As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
Where no water reuse systems are installed: • Sewerage Calculator • Potable Water Calculator Where water reuse systems are installed the following is also required: • Short report • Extract(s) from the specification(s) • Tender hydraulic drawings • Evidence of the application(s) for approval to the relevant authorities • Evidence of the required design standards Where the additional point is claimed the following is also required: • Signed Letter from the Building Owner	Where no water reuse systems are installed: • Sewerage Calculator • Potable Water Calculator Where water reuse systems are installed the following is also required: • Short report • As built hydraulic drawings • Extract(s) from the commissioning records • Evidence of approval from the local authority • Evidence of the required design standards Where the additional point is claimed the following is also required: • Blackwater treatment maintenance plan • Copy of the maintenance contract

Sewerage Calculator, completed in accordance with the Potable Water & Sewerage Calculators Guide.

Potable Water Calculator, completed in accordance with the Potable Water & Sewerage Calculators Guide.

Short Report prepared by a suitably qualified professional describing how the Credit Criteria have been met by:

- Describing the system, how it works and its treatment capacity compared with typical demand annually; including how the annual percentage of water diverted from the sewer was calculated and calculations demonstrating capacity (under various rainfall conditions).

Extract(s) from the specification(s) where the system(s) are described. The specification is to detail the capacity of the system as described in the short report.

Emi-6 Discharge to Sewer

POINTS AVAILABLE 5

Tender hydraulic drawing(s) and As built hydraulic drawings showing the location and details of the treatment systems relative to the building including the location of water storage systems.

Extract from the Commissioning Records demonstrating that the water treatment systems have been commissioned and operate as intended by the design.

Evidence of the application(s) for approval to the relevant authorities indicating the projects clear intent to obtain approval from the relevant local and national/provincial authority to build a water treatment system according to various relevant standards

Evidence of the required design standards must be provided to show that the system has been designed to the relevant local and/or national standards.

Evidence of approval from the relevant authority confirming approval or no objection of the documented design; the authority's approval of as installed system may be conditional on the project's ability to clearly demonstrate compliance with relevant regulation or standards, which may be cited.

Signed Letter from the building owner stating that he/she intends to install and use the system, and he/she is aware of the maintenance costs for this system, and that the costs have been budgeted for.

Blackwater Treatment Maintenance Plan including:

- 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.

Copy of the maintenance contract for the blackwater treatment system, for a minimum of five years after commissioning and stipulating adherence to 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 grey-water 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. Up to two points can be achieved for discharge reduction from fittings/fixtures alone; the other two points can only be obtained through grey and blackwater reuse systems. The Potable Water Calculator must be used in accordance with the Potable Water and Sewage Calculators Guide available from the GBCSA website **(http://www.gbcsa.org.za).** 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 related credits such as Wat-1 'Occupant Amenity Water') and be clearly justified by the documented design (for Green Star SA – Retail Design v1 assessment) or by the as built evidence (for Green Star SA – Retail As Built v1 assessment).

All water treatment systems must be clearly incorporated into the design documentation.

Relevant authority approval

Where greywater and/or blackwater treatment and reuse systems are present, evidence of approval from the relevant authorities, such as government agencies, local council, the water utility, or the department of public health, must be provided in an As Built submission.

The evidence would be assessed on a project by project basis, and the GBCSA will make the final decision based on the merits of the evidence submitted.

There are a number of water treatment and reuse technology options, most of which are generally divided into greywater treatment and blackwater treatment.

Greywater is water which would normally go to sewer from sources which are low risk relative to pathogens, chemicals and viruses - such as the water from showers and hand basins. This water may only require low level treatment before it can be reused for applications such as irrigation. Higher level treatment technologies can allow greywater to be reused for toilet flushing.

Blackwater is generally defined as water that has been mixed with faecal waste or water with a dangerous chemical content such as waste from cooling towers. Blackwater requires more intensive biological, chemical or physical treatment and disinfection before reuse.

Some applications where greywater and blackwater have recently been treated and reused in commercial building designs include:

- Irrigation;
- Toilet flushing;
- Cooling Towers; and
- Washdown.

Emi-6 Discharge to Sewer

POINTS AVAILABLE 5

Storage is important as it maximises the usefulness of greywater, although excessive periods of storage may lead to bacteria growth, smells etc. For these reasons greywater should be treated and disinfected before storage. Storage requirements will depend on:

- Climate (irrigation demands);
- Demand for reuse water;
- Presence/size of disposal area; and
- Maximum daily greywater output.

In cases where the Potable Water & Sewerage Calculator does not adequately account for a specific situation, project teams may submit separate calculations demonstrating reductions in discharge to sewer.

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

SANS: 10252-1: 2004 Water Supply and Drainage for Building, Part 1 – Water Supply Installations for Buildings

SANS: 10252-2: 2004 Water Supply and Drainage for Building, Part 1 – Drainage installations for buildings

National Environmental Management Act No. 107 OF 1998

NEMA Regulations Government Notice R385 of 2006

Listing Notice 1 Government Notice R386 of 2006

Listing Notice 2 Government Notice R387 of 2006

(Department of Environment, Agriculture and Tourism (DEAT)
http://www.deat.gov.za

South Africa Department of Water Affairs & Forestry
http://www.dwaf.gov.za

Emi-7 Light Pollution

POINTS 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 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 – Retail Centre v1 Technical Manual.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) • Luminaire Schedule • Tender drawing(s)	• Short report • As built Luminaire Schedule • Manufacturers' Data Sheets • As built drawing(s)

Short report from the lighting engineer describing how the Credit Criteria have been met by:

- Detailing the external and atrium lighting on the site, the areas illuminated, calculations and illumination diagrams (including horizontal and vertical light distribution) to demonstrate that no light spill is impacting the night sky or neighbouring properties.
- For any façade lighting, a calculating to show that the building Luminance meets the requirements above; and

- Confirming design and achieved light levels and that 95% of areas do not exceed the minimum requirements given in CIBSE LG6.

Extract(s) from the specification(s) where relevant lighting and its requirements is identified, e.g. atrium and external lighting.

Luminaire schedule for all external lighting and relevant internal lighting (where a glazed atrium is present), nominating the type, lighting distribution and quantity of each luminaire.

Tender drawing(s)

- Site plan indicating the location and type of all external luminaires, and marked up to show the area(s) that does not exceed the minimum requirements of CIBSE LG6 for illuminance levels; and
- Where a glazed atrium is present, atrium drawings indicating the location and type of internal luminaires.

As built drawing(s)

- Site plan indicating the location and type of all external luminaires, and marked up to show the area(s) that does not exceed the minimum requirements of CIBSE LG6 for illuminance levels; and
- Where a glazed atrium is present, atrium drawings indicating the location and type of internal luminaires.

As built luminaire schedule for all external lighting and relevant internal lighting (where a glazed atrium is present), nominating the type, lighting distribution and quantity of each luminaire.

Manufacturers' Data Sheets for all relevant luminaires indicating light output levels and light distribution diagram.

ADDITIONAL GUIDANCE

Where the credit is achieved, there is to be no point in the sky hemisphere which looks directly at a 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.

Emi-7 Light Pollution

POINTS AVAILABLE 1

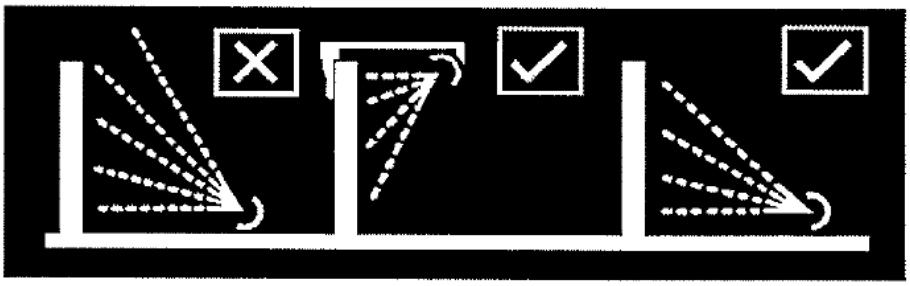
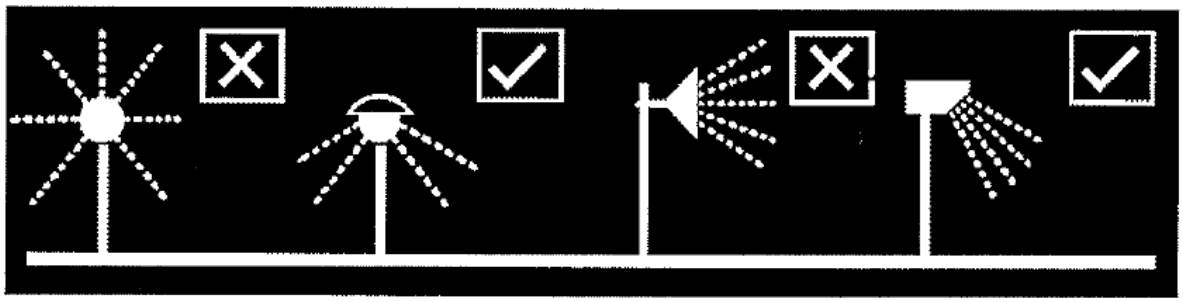


Figure Emi-7.1 *Illustration of acceptable and unacceptable external lighting to achieve this credit (General Notes for the Reduction of Obtrusive Light, Institute of Lighting Engineers, 2005, p.2)*



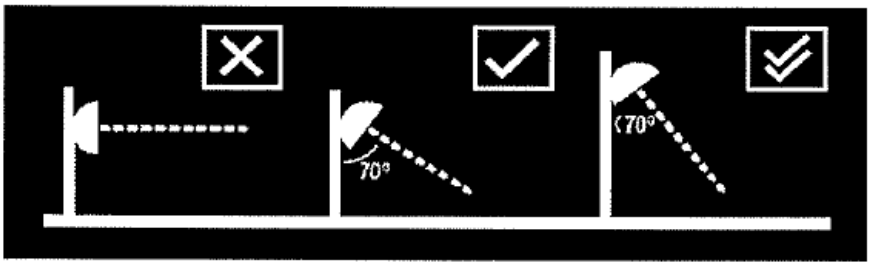


Figure Emi-7.2 *Illustrations of acceptable and unacceptable column lighting to achieve this credit (General Notes for the Reduction of Obtrusive Light, Institute of Lighting Engineers, 2005, p.2)*

Emi-7 Light Pollution

POINTS AVAILABLE 1

Light fittings that have an opaque canopy or polished asymmetrical reflectors will meet the requirements for the awarding of this credit.

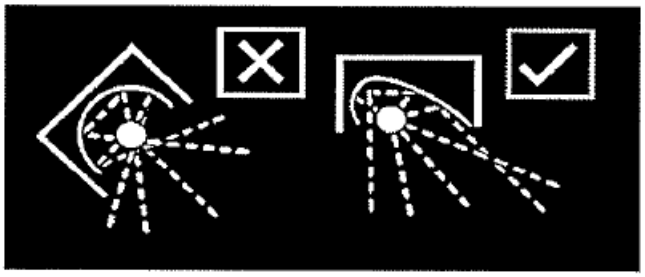


Figure Emi-7.3 *Symmetrical and asymmetrical reflectors (General Notes for the Reduction of Obtrusive Light, Institute of Lighting Engineers, 2005, p.2)*

Reflectors for light fittings shining downwards should also be in accordance with the following second diagram, where no direct light beam is allowed upwards above the horizontal plane of the light fitting:

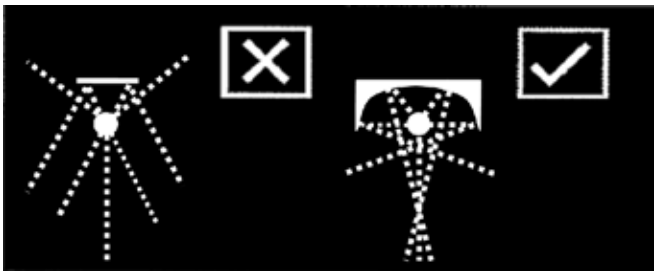


Figure Emi-7.4 *Downward facing reflectors (diagram prepared by the GBCSA)*

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.

Emi-7 Light Pollution

POINTS AVAILABLE 1

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 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/

The Urban Wildlands Group
http://www.urbanwildlands.org

Emi-8 Legionella

POINTS AVAILABLE 1

AIM OF CREDIT

To encourage and recognise building systems designed to eliminate the risk of Legionnaires' disease (Legionellosis), as far as reasonably practicable.

CREDIT CRITERIA

One point is awarded where:

- There are no water based heat rejection system(s) serving the building's nominated area;

OR

- Water-based heat rejection system(s) serving the building's nominated area meet all of the following:
  - Do not contain water that is kept at a temperature between 20ºC and 50ºC;
  - Do not release an aerosol spray during operation;
  - Are designed and built to maintain constant movement of the water in the system, when in operation, to prevent stagnation;
  - 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's nominated area must be designed in accordance with SANS 10252-1:2004

For the purposes of this credit, 'nominated area' is defined as the GLA and common areas (excluding parking and tenancies that provide their own air).

Emi-8 Legionella

POINTS AVAILABLE 1

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
For naturally ventilated buildings: • Opening area schedule OR • Compliance note Where the building is mechanically air-conditioned: • Short report • Tender drawing(s) • Extract(s) from specifications • Statement confirming no evaporative systems Additionally where the air-conditioning system uses water to reject heat: • Copy of the Legionella Risk Management Plan Where water storage systems are installed: • Statement confirming compliance to required standards	For naturally ventilated buildings: • Opening area schedule OR • Compliance note Where the building is mechanically air-conditioned: • Short report • As built drawing(s) • Extract(s) from Commissioning Report • Statement confirming no evaporative systems Additionally where the air-conditioning system uses water to reject heat: • Copy of the Legionella Risk Management Plan • Manufacturer's data sheet(s) Where water storage systems are installed: • Statement confirming compliance to required standards

Opening Area Schedule prepared by the architect listing each habitable room, its floor area and the area of external openings (openable windows/external doors) in that room. The schedule must include the openings area expressed as a percentage of the room floor area, to clearly demonstrate compliance with the 5% minimum requirement in SANS 10400-O. The position and arrangement of opening areas must be in accordance with SANS 10400-O clause 004.

Compliance note indicating that full points have been achieved for the IEQ-1 'Ventilation Rates' credit.

Emi-8 Legionella

POINTS AVAILABLE 1

Short report prepared by the mechanical engineer describing how all the Credit Criteria have been met by describing the HVAC system and the components relevant to these Credit Criteria. For water-based heat rejection systems the report must highlight the water operating temperature range or how the system(s) avoid creating an aerosol spray, and how the system avoids stagnation and must include a description of the maintenance process.

Tender drawing(s) of the HVAC system, with relevant components clearly highlighted.

Extract(s) from specifications of the HVAC system highlighting where the systems relevant to this credit have been specified.

Statement confirming no evaporative systems prepared by a mechanical engineer confirming that there are no cooling towers (direct or indirect), evaporative cooling systems with circulating water, or any other evaporative systems which might pose a risk of Legionella infection.

As built drawing(s) of the HVAC system, with relevant components clearly highlighted.

Extract(s) from the Commissioning Records demonstrating that the system(s) where present have been commissioned and found to operate as intended by the design.

Copy of the 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.

Statement confirming compliance to required standards prepared by the mechanical engineer 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.

Manufacturer's data sheet(s) where the water-based heat rejection system is described and shown to either meet the required operating temperature range or how the system avoids creating an aerosol spray; how the system prevents water stagnation; and a description of the maintenance process for the system.

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 and are viable (e.g. of sufficient capacity).

Water that is kept at a temperature between 20ºC and 50ºC has a direct impact on the growth of Legionella. The certified assessor will look for evidence that the design of the system and the ongoing 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.

Emi-8 Legionella

POINTS AVAILABLE 1

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.

For naturally ventilated projects only:

For purposes of this credit, where the building is claiming IEQ-1 'Ventilation Rates' 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 Rates', the point will not be awarded for this credit through this deemed-to-satisfy route.

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.

Emi-8 Legionella

POINTS AVAILABLE 1

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 know 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.

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.pd

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
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

For HVAC Management plans, see

Department of Human Services, Public Health Division, Victoria (2001), Managing the Risk of Legionnaires Disease
http://www.health.vic.gov.au/environment/downloads/suppnoteshospitals.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

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

For Temperature ranges see

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

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 boilers have NO_X emissions of < 100 mg/kWh (at 0% excess O2);

  AND

- All generators comply with the Tier 3 emissions standards as defined by the United States Environmental Protection Agency (EPA) or the equivalent European Stage IIIA 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. Type ‘na’ in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	**Green Star SA – Retail Centre As Built**
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report • Extract(s) from the specification(s) To claim credit as ‘not applicable’: • Signed letter from building owner	• Short report • Manufacturer Information To claim credit as ‘not applicable’: • Signed letter from building owner

Short Report which describes how the Credit Criteria have been met by:

- Referencing each boiler and giving its capacity in kW and NO_X emission rate in mg/kWh; and
- Referencing each generator and confirming that it meets the EPA Tier 3 or European Stage IIIA standard.

Emi-9 Boiler and Generator Emissions

POINTS AVAILABLE 1

Extract(s) from the specification(s) where the requirements for the boilers and generators are specified, clearly demonstrating compliance with the Credit Criteria.

Manufacturer Information for each boiler and generator clearly indicating compliance with the NO_X emission rates of any boilers (in mg/kWh) or the EPA Tier 3 or European Stage IIIA standards for generators.

Signed letter from building owner confirming no boilers or generators present in the project.

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.

It must be clearly demonstrated that all boilers and generators throughout the project comply with the requirements.

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 building 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.

Any combined heat and power (CHP) or cogeneration systems must comply with the Tier 3 requirements to obtain the credit.

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/m^3 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;

a. 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).

b. 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).

c. 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 ÷ (20.9 – x)

where x = % excess O2 (NOT excess air) and 20.9 is the percentage of O2 in the air.

Generators

Refer to the latest tables for emissions requirements from the United States EPA Tier 3 Non-Road Engine Emission Requirements on their website:
http://www.epa.gov/OMS/standards/nonroad/nonroadci.htm

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.

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 Gasfired 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 1

AIM OF CREDIT

To encourage and reward designs that avoid kitchen exhaust fumes being expelled directly into adjacent spaces that people occupy.

CREDIT CRITERIA

One point is awarded when it is demonstrated that the building mechanical system meets the following requirement:

- Exhaust points are located not closer than 10m to a neighbouring usable space or walkway, or a fresh air intake (of that development or another development)

If the developer is not in control of the design of any kitchen exhaust ducting or exhaust risers, then this credit is 'Not Applicable' and is excluded from the Points Available, used to calculate the Emissions Category Score. Type 'na' in the appropriate 'No. of Points Achieved' column of the rating tool.

DOCUMENTATION REQUIREMENTS

Green Star SA – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance. • Short Report • Extract(s) from specification(s) • Tender schematic drawings Where the credit is being claimed as 'Not Applicable': • Signed letter from the building owner	Submit all the evidence and ensure it readily confirms compliance. • Short Report • As built schematic drawings Where the credit is being claimed as 'Not Applicable': • Signed letter from the building owner

Short report prepared by a mechanical engineer that describes how the Credit Criteria have been met by:

- Providing a schedule of all kitchen exhaust points within the building, indicating the distance to the nearest neighbouring usable space or walkway, or a fresh air intake (of that development or another development).

Emi-10 Kitchen Exhaust Emissions

POINTS AVAILABLE 1

Tender schematic drawings of the HVAC system highlighting the location of all exhaust points and the dimensioned distance between each exhaust point and the nearest neighbouring usable space or walkway, or a fresh air intake (of that development or another development).

As built schematic drawings of the HVAC system highlighting the location of all exhaust points and the dimensioned distance between each exhaust point and the nearest neighbouring usable space or walkway, or a fresh air intake (of that development or another development).

Signed letter from the building owner stating that he/she is not in control of the design of any kitchen exhaust ducting or exhaust risers.

ADDITIONAL GUIDANCE

No additional guidance.

BACKGROUND

Retail centres typically have a number of restaurants with kitchens, which are sometimes found not to be adequately exhausted from the building, often negatively affecting the air-quality of neighbouring spaces or properties. In mixed use developments this can be even more of a problem, where for example one might find an office or apartment space directly adjacent to a retail centre restaurant. It is The affects of contaminants, odours, smoke and grease from kitchen exhaust systems in useable spaces, walkways or fresh air intakes can be reduced or even eliminated by limiting the minimum distance between kitchen exhaust points and these spaces.

This credit does not address the type of exhaust systems provided or the type of filtration used to clean the air. However these are important considerations in the design of kitchen exhaust systems. Refer to SANS 1850:2003 for the design and manufacture of commercial kitchen extraction systems.

REFERENCES & FURTHER INFORMATION

South African National Standards, SANS 10400: 1990, Part O Ventilation, Code of Practice for the Application of the National Building Regulations
http://www.sabs.co.za/Business_Units/Standards_SA/WebStore/search/detail.aspx?id=2657&lang=EN

SANS 1850:2003 The design and manufacture of commercial kitchen extraction systems
http://www.sabs.co.za/Business_Units/Standards_SA/WebStore/search/detail.aspx?id=9352&lang=EN

Emi-10 Kitchen Exhaust Emissions

POINTS AVAILABLE 1

ASHRAE Handbook 2007 – HVAC Applications, Chapter 31 Kitchen Ventilation
http**://www.ashrae.org**

Innovation

The Innovation Category is included within the Green Star SA – Retail Centre 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. Retail Centre) 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 initiation can be awarded in both Design and As Built certifications for the same project.

Inn-1 Innovative Strategies and Technologies

POINTS AVAILABLE 2

AIM OF CREDIT

To encourage and recognise pioneering initiatives in sustainable design, process or advocacy.

CREDIT CRITERIA

Up to two points can be 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 for this credit are allocated as:

- One point is awarded when either of the above is true for the South African market; and
- 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 – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report	• Short report

Inn-1 Innovative Strategies and Technologies

POINTS AVAILABLE 2

Short Report 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 – Retail Centre 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.

Inn-1 Innovative Strategies and Technologies

POINTS AVAILABLE 2

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 Benchmarks

POINTS 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 can be awarded for an innovation initiative 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 – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report	• Short report

Short Report 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;
- 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.

Inn-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 2

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 – Retail Centre 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 – Retail Centre 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

Inn-2 Exceeding Green Star SA Benchmarks

POINTS AVAILABLE 2

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 can be 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 – Retail Centre Design	Green Star SA – Retail Centre As Built
Submit all the evidence and ensure it readily confirms compliance.	Submit all the evidence and ensure it readily confirms compliance.
• Short report	• Short report

Inn-3 Environmental Design Initiatives

POINTS AVAILABLE 1

Short Report 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);
- 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 – Retail Centre 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;

Inn-3 Environmental Design Initiatives

POINTS AVAILABLE 1

- Be related to attributes, not operations; and
- Be robust.

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 – Retail Centre 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 the United Kingdom's 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 retail context.

The following table summarises the weightings for the South African Office and South African Retail tools.

	South African Green Star SA – Office v1	**South African Green Star SA – Retail v1**
Management	9	10
Indoor Environment Quality	15	10
Energy	25	25
Transport	9	12
Water	14	15
Materials	13	13
Ecology	7	7
Emissions	8	8
	100	**100**

Table App-A.1: *Comparison of Weightings with different Environmental Rating tools*

APPENDIX B – Public Transport Calculator Example

PUBLIC TRANSPORT CALCULATOR EXAMPLE

Transport services to the project site during peak periods include:

On week days:

- One bus service with a stop 50m from the project site, with a service frequency of 15 minutes, to a major railway station (the travel time to the major railway station is 12 minutes);
- The station has two train services with a frequency of 12 minutes;
- The station also has four bus routes, one with a frequency of 15 minutes and the remainder with a frequency of 25 minutes (not including the one from the site); and
- One minibus taxi route has a stop 50m from the project site, with an observed frequency of 10 minutes in both directions of travel.

On Saturdays:

- One bus service with a stop 50m from the project site, with a service frequency of 30 minutes, to a major railway station (the travel time to the major railway station is 24 minutes);
- The station has two train services with a frequency of 30 minutes;
- The station also has four bus routes, one with a frequency of 25 minutes and the remainder with a frequency of 30 minutes (not including the one from the site); and
- One minibus taxi route has a stop 50m from the project site, with an observed frequency of 30 minutes in both directions of travel.

Data to enter into the Public Transport Calculator

For 'Weekday Services':

1. Bus service terminating 50m from the site
   - Type = Bus
   - Frequency = 15 min
   - Services = 0.5 (service between station and site = ½ = 0.5)
   - Distance = 0-250m

2. Train services

The train interchange is within 15 minutes travel time and the connecting service's (the bus above) frequency is less than 30 minutes, therefore, services at the railway interchange can be included in the calculator provided they are modified as follows:

- Trains with 12 minute frequency
  - Type = Train

APPENDIX B – Public Transport Calculator Example

  - Frequency = 12 min
  - Services = 1 (No. of services halved = 2/2 = 1)
  - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

3. Bus services from train interchange

- Bus with 15 minutes frequency
  - Type = Bus
  - Frequency = 15 min
  - Services = 0.5 (No. of services halved = ½ = 0.5)
  - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)
- Buses with 25 minute frequency
  - Type = Bus
  - Frequency = 30 min
  - Services = 1.5 (No. of services halved = 3/2 =1.5)
  - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

4. Minibus taxi services

  - Type = Taxi
  - Frequency = 10 min
  - Services = 2 (each direction counts as one service)
  - Distance = 0-250m

No. of bus, midibus or minibus services

Walking dist from building to public transport	Contracted		Uncontracted	
	Frequency of service during peak periods		Frequency of service during peak periods	
	15 min	30 min	15 min	30 min
0 – 250m	0.5		2	
250 – 500m	0.5	1.5		
500 – 750m				
750 – 1,000m				

APPENDIX B – Public Transport Calculator Example

No. of train services

Walking dist from building to public transport	Frequency of service during peak periods	
	15 min	30 min
0 – 250m		
250 – 500m	1	
500 – 750m		
750 – 1,000m		

For 'Saturday Services':

1. Bus service terminating 50m from the site
   - Type = Bus
   - Frequency = 30 min
   - Services = 0.5 (service between station and site = ½ = 0.5)
   - Distance = 0-250m

2. Train services

The train interchange is within 30 minutes travel time and the connecting service's (the bus above) frequency is less than 30 minutes, therefore, services at the railway interchange can be included in the calculator provided they are modified as follows:

- Trains with 30 minute frequency
  - Type = Train
  - Frequency = 30 min
  - Services = 1 (No. of services halved = 2/2 = 1)
  - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

3. Bus services from train interchange

- Bus with 30 minutes frequency
  - Type = Bus
  - Frequency = 30 min
  - Services = 0.5 (No. of services halved = ½ = 0.5)
  - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

APPENDIX B – Public Transport Calculator Example

- Buses with 25 minute frequency
  - Type = Bus
  - Frequency = 30 min
  - Services = 1.5 (No. of services halved = 3/2 =1.5)
  - Distance = 250-500m (Distance from site to bus service = 50m plus 250m for connecting interchange rule)

The total for buses from the interchange is therefore 2 at 30 min frequency at 300m distance.

4. Minibus taxi services
   - Type = Taxi
   - Frequency = 30 min
   - Services = 2 (each direction counts as one service)
   - Distance = 0-250m

No. of bus, midibus or minibus services

Walking dist from building to public transport	Contracted		Uncontracted	
	Frequency of service during peak periods		Frequency of service during peak periods	
	15 min	30 min	15 min	30 min
0 – 250m		0.5		2
250 – 500m		2		
500 – 750m				
750 – 1,000m				

No. of train services

Walking dist from building to public transport	Frequency of service during peak periods	
	15 min	30 min
0 – 250m		
250 – 500m		1
500 – 750m		
750 – 1,000m		

No. of points from Calculator = 2

Table App-B.1: *Example values entered into Public Transport Calculator*

APPENDIX C – Ecology Calculator Example

CHANGE OF ECOLOGICAL VALUE CALCULATOR EXAMPLE

An existing building development is to be redeveloped. The existing site land uses, and associated areas, are as follows:

- Existing Building: 500m²
- Impermeable car park area: 250m²
- Concreted walkway: 50m²
- Bare ground: 500m²
- Weeds: 500m²
- Exotic Garden: 200m²
- Indigenous habitat which has not been disturbed for at least 10 years: 1,000m²

The site does not include any rare, threatened or vulnerable flora or fauna

After the redevelopment, the site will consist of:

- Proposed building: 1,500m² less area of green roof (500m²) = 1,000m²
- Indigenous roof garden: 500m²
- Created wetland area: 500m²
- Indigenous habitat is not disturbed and remains at 1,000m²

APPENDIX C – Ecology Calculator Example

The output from the Ecology Calculator is as follows:

In which bio-region is the site located? Highveld Grassland

In which vegetation type is the site located? Egoli Granite Grassland

Land Type	BEFORE Land Types Before Construction (m^2)	AFTER Land Types After Construction (m^2)
Building	500	1,000
Impermeable/concreted Area	300	
Bare Ground	500	
Weed Infestations	500	
Exotic Garden	200	
Indigenous Garden		
Indigenous Roof Garden		500
Exotic Grazing		
Existing Natural Grazing*		
Crop Farming		
Existing Natural Waterway/Riparian Zone*		
Existing Natural Wetland*		
Rehabilitation/Creation of Wetland/Riparian		500
Exotic Plantation Forest		
Indigenous Plantation Forest		
Regenerated Indigenous Habitat (< 10 years old)*		
Indigenous Habitat (> 10 years old)*		
Indigenous Habitat (> 20 years old)*	1,000	1,000
TOTAL	**3,000**	**3,000**
ECOLOGICAL DIVERSITY INDEX:	34.67	43.33
CHANGE IN ECOLOGICAL DIVERSITY INDEX	8.67	
Points Achieved	**2**	

* = affected by Bioregion Reservation Importance Factor

Table App-C.1: *Example of results using Ecology Calculator*