6. THE SUSTAINABLE BUILDING ASSESSMENT TOOL

6.1. Sub Problem Five and Hypothesis Five

Sub problem: How does the specification for an assessment tool developed in sub problem four compare with the Sustainable Building Assessment Tool (SBAT)?

Hypothesis: A comparison between the specification for an assessment tool and the SBAT will support the validation of the assessment tool specification and identify whether the SBAT is an appropriate tool for integrating sustainable development into the briefing and design of buildings in developing countries.

6.1.1. Introduction

The Sustainable Building Assessment Tool (SBAT) was developed in 1999. The initial idea and approach was developed as part of a school pilot project. The tool however, has evolved through use on a range of projects including leisure, education, residential and commercial buildings. This chapter will include a text version of the SBAT. A later, software version, of the SBAT has been developed. This forms a component of the ‘Sustainable Buildings CD’ and is available from the CSIR in Pretoria, South Africa.

The Sustainable Building Assessment Tool

1. Introduction

Non-renewable resources are being depleted and there is increasing environmental damage as result of human activities. It is therefore increasingly important that this is addressed, and that sustainability becomes a key issue in the way we live and work.

Building and construction can play an important role in supporting sustainability. This is done through careful planning in which design decisions, material specifications and so on are carefully evaluated in terms of their economic, social and environmental impact.

The Sustainable Building Assessment Tool (SBAT) has been designed to help evaluate the sustainability of buildings. This is done by assessing the performance of a building in relation to a number of economic, social and environmental criteria. The tool has been designed for use in developing countries.

The tool can be used in design stages of a new building, or for the refurbishment of an existing building. In the design stage it aims to encourage the development of more sustainable buildings by enabling different options to be evaluated rapidly and compared. It can also be used for existing buildings. This enables the building to be rated in terms of its sustainability and compared with other buildings and to benchmarks.

The SBAT can be used as:

- Part of a brief to the design team: by building owners and developers planning new buildings or refurbishments

- A decision support tool for: building design teams including Architects, Quantity Surveyors, Structural Engineers and Mechanical and Electrical Engineers

- A way of ensuring that policies on sustainability are implemented and integrated into the construction environment: by government and other organisations.

The tool is designed to be easy to use and generates graphical reports, which enable targets and performance to be easily read. The SBAT can be used in a number of ways depending on the level of detail required. It can be used as a design tool by providing a checklist of the main ‘rules of thumb’ and criteria used to design for and assess sustainability in buildings. It can also be used to make a rapid outline assessment of the building and provide the framework for a more detailed analysis of the building if this is required.

Sustainability is a complex issue and not fully understood. The tool therefore is likely to be developed and change over time. It's development and use is based on the precautionary principle, that suggests that it is important to address and implement sustainability in building as a matter of urgency even if this is not fully understood.

2. Using the SBAT

The SBAT can be used for the following purposes:

- Briefing
- Design and Outline assessment
- Detailed Assessment

A. Briefing

To use SBAT as a briefing tool you need to fill in the table in the 'Target Setting' section of this document. This details the criteria that the SBAT assess. Target setting should occurr after a site has been identified, and outline brief for the building has been developed. To ensure that there is proper support from the stakeholders it is suggested that this process happens during a workshop with all of these present. Stakeholders should include, as a minimum, the client, users of building and the design team. Before this workshop each of the stakeholders should have visited the site and read and understood the outline brief for the building.

The Target Setting table should have an option selected for each of the criteria listed. So the group needs to discuss the importance of occupant comfort in terms of users and the site. If they decide that this is a very important issue, they might then tick the 'essential' box. In order to get a clear and shared understanding of the criteria, the description in Section five can be read.

The completed table forms your outline sustainability performance targets. To visualize this target and the different weightings, the radar graph under the Graphical Report can be filled in. To do this read the number at the top of the column in which the 'tick' appears. Then find the appropriate axes on the chart and plot the reading as a dot on this axis. Do this for each of the criteria. When you have completed this, join the dots. This will give you 'target footprint' which enables you to see, and compare the different weightings you have allocated. The further out the points are (ie 4's or 5s) the more rigorous the targets are.

Once these targets have been agreed, this can be provided to the design team, as part of the briefing documents. The design team should then use this as well as other information to

develop their designs. Once they have an outline specification and design they can check to see if this is meeting the targets by assessing the design. This is described next.

B. Design and Outline Assessment

The SBAT can be used to support decision-making during the design process in the following ways. Once the criteria have been read and understood the design team can develop sketch designs and an outline material/component specification. Where there are choices in design or choices of material, the relevant criteria can be referred to in order to come to a decision. As soon as there is a full sketch design and outline material/component specification, an outline assessment can take place.

To do this go through each of the criteria listed in Section five and see if the existing design/specification complies with the criteria. If it does you can ‘tick’ the box adjacent to this. In order to ‘read’ the performance of the building count up the number of ‘ticks’ under each heading ie under Occupant Comfort and record this. These numbers should then be plotted as dots on the relevant axis in the radar diagram in the Graphical Report. Once you have done this join the dots to get a ‘assessment footprint’. If you have already used the diagram to set a ‘target footprint’, make sure you use a different colour in order to distinguish from this!

If you have plotted a ‘target footprint’, comparing this with the ‘assessment footprint’ enables you to see if the targets are being met. If points on the ‘assessment footprint’ are nearer the center of the radar than the ‘target footprint’, the targets have not been met and the design needs to be revisited, in order to see if these targets can be met or exceeded.

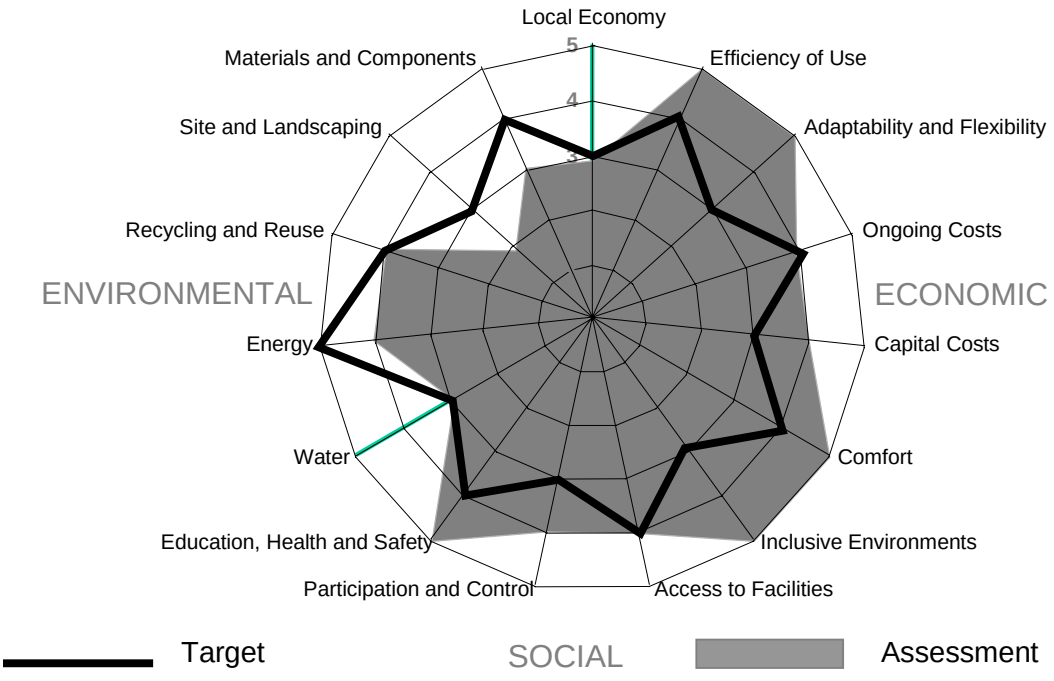
C. Detailed Assessment

Detailed Assessment requires considerable more time than an outline assessment, however it can provide a more accurate and detailed picture of the potential performance of the building. To carry this, detailed benchmark building performance information is required for similar building types for the performance areas described in the tool, such as water, energy, occupant comfort. This information needs to be analysed and developed into challenging performance targets, which replace the existing generic performance targets found in the SBAT. Once these are set, design evaluations are likely to need more detailed calculations or modelling in order to arrive at the performance of the building (for instance of predicted mains potable water consumption). These figures then need to be compared to target performance figures provided in the SBAT in order to evaluate whether the design meets the performance targets set. Target footprints, and assessment footprints are plotted in the same ways as A and B above. The calculations or modelling tools required to assess the performance of the building are available and can be found in building literature or downloaded from the Internet. A number of references are provided at the end of this document.

3. Project Information

A	Project	
B	Physical Address	
C	Contact person Telephone Fax Email	
D	Description of function	
E	Description of users	
F	Description of location	
G	Assessment based on (information sources):	
H	SBAT use	❑ Brief ❑ Outline Assessment ❑ Detailed Assessment
I	Assessment carried out by:	Name: Telephone: Fax: Email:

Graphical Report



4. Target Setting

Criteria	No Requirement 1	Low Requirement 2	Medium Requirement 3	High Requirement 4	Essential 5
Social					
Occupant Comfort					
Inclusive Environments					
Access to Facilities					
Participation and Control					
Education Health and Safety					
Economic					
Local Economy					
Efficiency of Use					
Adaptability and Flexibility					
Ongoing Costs					
Capital Costs					
Environmental					
Water					
Energy					
Waste					
Site					
Materials and Components					

5. Building Performance: Social (SO)

SO1 Occupant Comfort

The quality of environments in and around buildings has been shown to have a direct impact on health, happiness and productivity of people. Healthier, happier, more effective people contribute to sustainability by being more efficient and therefore reducing resource consumption and waste. However, the quality of this internal environment must be achieved with minimal cost to the environment. Occupant comfort is reliant on a number of factors including amount of fresh air, day lighting, air temperature, views, and the level of control that individuals have over their indoor environment.

SO1.1 Lighting

The main working spaces are well day lit. Effective solar control. Glare minimised.

Criteria: 5% day light factor

SO1.2 Ventilation

Adequate clean air supply to each inhabitant. Supply taken from unpolluted source

Criteria: All working spaces have equivalent of opening window area equivalent to 10% of floor area

SO1.3 Noise

Noise levels limited in working spaces to acceptable levels.

Criteria: Noise levels not over 45dB (A) for long continuous periods

SO1.4 Views
Design to all working areas to have access to a view out.

Criteria: All working spaces to be maximum of 6m from a window

SO1.5 Thermal comfort
Thermal comfort throughout year

Criteria: Indoor environment maintained within temperature range (range dependent on activities etc)

SO2 Inclusive Environments
Buildings should be designed to accommodate, and be accessible to everyone, or specially designed buildings need to be provided. Ensuring that buildings are inclusive supports sustainability as replications is avoided and change of use supported. It also ensures that as legislation in this area tightens, expensive retrofits are not required in order to ensure compliance.

SO2.1 Public Transport
The building can be accessed by disabled people using public transport.

Criteria: Entrance located 100, or fewer metres to disabled accessible public transport

SO2.2 Routes, Changes in level
All routes between and within buildings can be easily navigated by physically disabled people and other people.

Criteria: Adequate width, turning circles, no changes in level between or within buildings or, all changes in level catered for with appropriate ramps of 1:12 fall, or lifts, routes surfaces have smooth and even surface

SO2.3 Signage & Edges
Visually impaired and other people can move around and use the building easily and safely

Criteria: all edges i.e. between walls and floors and stair nosings clearly distinguished through the use of contrasting colour. Accessible signage provided.

SO2.4 Furniture and Fittings
Furniture and fittings can be easily used by disabled and other people

Criteria: Location, configuration and design of furniture and fittings specified

SO2.5 Toilets, Bathrooms and kitchens
Toilets and bathrooms are or can be easily adapted for use by disabled

Criteria: Spatial configuration of and equipment in spaces

SO3 Access to Facilities
Conventional living and working patterns require regular access to a range of services. Ensuring that these services can be accessed easily and in environmentally friendly ways supports sustainability by increasing efficiency and reducing environmental impact.

SO3.1 Childcare
Occupants of building can pick up / drop children easily, without having to make additional long distance car journeys.

Criteria: Distance between home and or work and schools and or crèches not more than 3km.

SO3.2 Banking
Occupants have easy access to banking facilities.

Criteria: Banking services (i.e. ATM) provided close by (within 3km) or Internet service or mobile service provided.

SO3.3 Retail
Occupants have easy access to retail facilities for everyday items (ie groceries).

Criteria: Relevant retail outlets provided within 3km or alternative Internet or delivery service provided.

SO3.4 Communication
Occupants have easy access to communications facilities during their working day or on their route home.

Criteria: Postal, telephone or email facilities close by (within 3km).

SO3.5 Work
Occupants do not have to undertake long vehicular journeys to get to and from work.

Criteria: Maximum distance between work and residence 10km.

SO4 Participation & Control
Ensuring that users are allowed to participate in decisions about their work environment helps ensure that they care for and manage this properly. Control over

aspects of their local environment enables personal satisfaction and comfort. Both of these support sustainability by promoting proper management of buildings and increasing productivity.

SO4.1 Environmental control
Occupants of building have reasonable control over their environmental conditions

Criteria: Level of control over environmental conditions by individuals; access to openable windows, blinds, control of light and temperature

SO4.2 User manual and training
Occupants and managers of the building understand the building and it's systems and how these should be operated.

Criteria: Building user manual, facilities management training, induction for new occupants

SO4.3 Social spaces
Occupants have access to spaces which enable formal / informal social interaction to take place easily.

Criteria: Design and location of spaces provided for informal and formal social interaction

SO4.4 Amenity
Amenities provided and easily accessible to building users and visitors

Criteria: Design and location of amenities

SO4.5 Community involvement
Space and equipment shared with local communities

Criteria: Accessibility of facilities by local communities

SO5 Education Health and Safety
Buildings need to cater for the well-being, development, health and safety of the people that use them. Learning and access to information is increasingly seen as a requirement of a competitive work force. All of these factors contribute to sustainability by helping ensure that people remain healthy and economically active, thus reducing the 'costs' (to society, the environment and the economy) of unemployment and ill health.

SO5.1 Education
Support for learning provided.

Criteria: Access to and provision of space, equipment and material to support learning

SO5.2 Security
Occupants are safe and feel safe in the building and on regularly used routes to and from the building.

Criteria: Spatial configuration, visual links, lighting, technological and physical security systems

SO5.3 Smoking
Smokers do not affect health of building users

Criteria: Avoidance of cross contamination

SO5.4 Health

Internal environmental conditions do not affect health of occupants

Criteria: Materials, components and finishes screened for health hazards

SO5.5 Exercise and recreation
Occupants have easy access to sport and recreational facilities

Criteria: Facilities within 3km.

6. Building Performance: Economic (EC)

EC1 Local Economy
The construction and management of buildings can have a major impact on the economy of an area. The economy of an area can be stimulated and sustained by buildings that make use and develop local skills and resources.

EC1.1 Local contractors
Building makes use of local contractors

Criteria: Type and location of contractors used, percentage of total contractor cost spent on local contractors

EC1.2 Local building material supply
Building uses local materials

Criteria: Percentage of total construction materials such as cement, sand, bricks etc that are sourced locally

EC1.3 Local component, fittings and furniture manufacture
Building uses component, fittings and furniture sourced locally

Criteria: Percentage of building components i.e. windows and doors that are produced locally

EC1.4 Outsource opportunities
Building creates opportunities for small emerging businesses. This includes outsourcing of catering, cleaning services and security as well as making space and equipment available for businesses to use for retail, education etc.

Criteria: Design, location of spaces, management plan

EC1.5 Repairs and maintenance
Building maintenance and repairs can be carried out by users or by local contractors.

Criteria: Percentage of building and furniture and fittings that can be serviced locally

EC2 Efficiency of Use
Buildings cost money and make use of resources whether they are used or not. Effective and efficient use of buildings supports sustainability by reducing waste and the need for additional buildings.

EC2.1 Space Use
Buildings should make good use of space

Criteria: m^2 per person

EC2.2 Space Management
Space should be managed efficiently

Criteria: Effective space management systems

EC2.3 Shared Use
Facility shared between a number of users

Criteria: Spatial, technological and managerial arrangements for shared use

EC2.4 Use of technology
Access to technology (ie email, internet, video conferencing) to reduce requirement for travel and space.

Criteria: Access to technology, reduction in travel and space requirements

EC2.5 Occupancy schedule
Systems to ensure efficient use of space and services

Criteria: Hours of the week that the building is occupied

EC3 Adaptability and Flexibility
Most buildings can have a life span of at least 50 years. It is likely that within this time the use of the building will change, or that the feasibility of this will be investigated. Buildings, which can accommodate change easily, support sustainability by reducing the requirement for physical adaptation and associated disruption, energy consumption and cost as well as the need for new buildings.

EC3.1 Spaces
Spaces should be readily adapted for different uses. For instance spaces may be required for work during the day, social activities in the evening and quite study during weekends and at night.

Criteria: Spatial configuration

EC3.2 Furniture
Internal spaces can be easily reconfigured to suite different organisation requirements / users

Criteria: Configuration and shape of spaces, construction of partitions.

EC3.3 Services
Services can configured to allow different internal arrangements and can be accessed easily to be extended / altered

Criteria: Location and access to services

EC3.4 Structure
Structure / load bearing elements configured to enable variety of different internal arrangements

Criteria: Location and size of structural elements

EC3.5 Vertical Circulation and Service Cores
Vertical circulation and service cores configured to enable range of different spatial arrangements

Criteria: Location and size of vertical circulation and service cores.

EC4 Ongoing Costs

EC4.1 Maintenance
Level of requirement for ongoing maintenance of the building considered and understood. Costs for this limited through design, and planned for.

Criteria: Lifecycle costs considered in specification of materials, components, and equipment. Design items such as light bulbs can be easily reached and replaced without use of expensive equipment).

EC4.2 Cleaning
Building can be kept clean easily and safely

Criteria: Window location and access, floor materials and access

EC4.3 Security / care taking
Building is reasonably secure without requiring large ongoing costs.

Criteria: Spatial layout and visual supervision by neighbouring occupied buildings

EC4.4 Insurance / water / energy / sewerage
Ongoing costs of water, energy and insurance minimised.

Criteria: Meters can be easily accessed. Building manual provides detail on when these should be read, to enable ongoing monitoring and improvement.

EC4.5 User awareness
Building occupants aware of levels of consumption and waste production

Criteria: Highly visual information (sign boards or intranet) displaying current, previous and targeted consumption and waste performance

EC5 Capital Costs
Buildings are generally one of the most valuable assets that people, and often organisations and governments own. Money spent on buildings is not available for other uses such as health, education and business development. Often in addition, the high cost of buildings results in the services (i.e. health and education) and the accommodation (for work and living) being provided at costs beyond the reach of people, and enterprises with the limited resources.

EC5.1 Consultant fees
Consultant fees not just calculated on total project cost basis. Incentives provided to consultants to reduce capital and ongoing costs.

Criteria: Professional fee structure

EC5.2 Build-ability
Building design cost efficient to build and minimise waste

Criteria: Building form. Replication of elements and components. Design / planning grid that relates to materials / component module sizes

EC5.3 Initial costs
Initial cost of building limited.

Criteria: Building design which enables building to be built at minimal initial cost, allowing building to be developed and grow, over time, as additional funding becomes available – buildings designed as a set of independent, interrelated components, building built as shell first with finishes etc to be added later.

EC5.4 Shared costs
Capital costs to building users and developers minimised

Criteria: Partnerships – cost savings through agreement with other users/partners

EC5.5 Sharing arrangements
Capital costs of the building minimised:

Criteria: Quantity of new space reduced through arrangements to use existing spaces and buildings.

Building Performance: Environmental (EN)

EN1 Water
Water is required for many activities. However the large-scale provision of conventional water supply has many environmental implications. Water needs to be stored (sometimes taking up large areas of valuable land and disturbing natural drainage patterns with associated problems from erosion etc); it also needs to be pumped (using energy) through a large network of pipes (that need to be maintained and repaired). Having delivered the water, parallel efforts are then required to dispose of this after it is used in reticulation and sewerage systems. Reducing water consumption supports sustainability by reducing the environmental impact required to deliver water, and dispose of this after use. Maintaining natural ground water systems also supports sustainability through maintaining existing ecosystems and avoiding the environmental impact associated with for disposal of storm water and runoff.

EN1.1 Rainwater
Water consumption reduced through use of rainwater

Criteria: Systems for capturing, storing and using rainwater

EN1.2 Water use
Water consumption reduced through efficient delivery devices:

Criteria: Specification of water efficient delivery devices.

EN1.3 Grey water
Water consumption reduced through reuse

Criteria: Use of grey water systems

EN1.4 Runoff
Runoff and storm water run off minimised

Criteria: Design and specification to minimised runoff: Specification of pervious or absorbent materials for hard external surfaces.

EN1.5 Planting
Water consumption and existing ground water (water table etc) maintained.

Criteria: Low water requirement landscaping/planting scheme.

EN2 Energy
Buildings consume a large proportion of all energy produced. Conventional energy production is responsible for making a large contribution to environmental damage and non-renewable resource depletion. Using less energy or using renewable energy in buildings therefore can make a substantial contribution to sustainability.

EN2.1 Location
Building located to minimise transport energy requirements of users

Criteria: Building located within 400m of public transport

EN2.2 Ventilation System
Ventilation design and management to minimise energy requirements

Criteria: All ventilation requirements met through passive systems.

EN2.3 Heating and Cooling System
Environmental control system design to minimise requirement for non-renewable energy

Criteria: Heating and cooling requirements met through passive environmental control design

EN2.4 Appliances and Fittings
Energy requirements of appliances, plant and fittings minimised

Criteria: Specification of energy efficient fittings, appliances, plant and lighting

EN2.5 Renewable Energy
Energy consumption of building supplemented / sourced from renewable sources

Criteria: Ten per cent of energy required for building obtained from renewable source

EN3 Waste
Raw materials and new components used in buildings consume resources and energy in their manufacture and processes. Buildings accommodate activities that consume large amounts of resources and products and produce large amounts of waste. Reducing the use of new materials and components in buildings and in the activities accommodated supports sustainability by reducing resource and energy consumption. Limiting waste and pollution in building and the activities accommodated in buildings reduces energy consumption and environmental damage.

EN3.1Toxic waste
Toxic waste processed safely and with minimal environmental impact

Criteria: Design and management for the safe disposal / recycling of toxic/harmful substances such as batteries, printer toners and vehicle oil.

EN3.2 Organic waste
Organic waste recycled locally

Criteria: Design and management that ensures 100% of organic waste produced, reused on site / arrangements made for local provider to carry this out.

EN3.3 Inorganic waste
Inorganic waste recycled locally

Criteria: Design and management that ensures a minimum of 30% of inorganic waste produced is recycled – arrangements made to sort, store and transport waste

EN3.4 Sewerage
Contribution to mains sewerage minimised

Criteria: Use of compost toilets, and other 'local' systems.

EN3.5 Construction waste
Construction waste minimised

Criteria: Design which minimises waste production ie prefabrication/using planning grid generated by component dimensions. Requirement for construction waste minimisation detailed in tender documentation.

EN4 Site

Buildings have a footprint and a size that take up space that could otherwise be occupied by natural ecosystems which contribute to sustainability by helping to create and maintain an environment that supports life. (By, for instance, controlling the carbon dioxide and oxygen balance and maintaining temperatures within a limited range). Buildings can support sustainability by, limiting development to sites that have already been disturbed, and working with nature by including natural ecosystems within the development.

EN4.1 Brownfield site
Building occupies already disturbed site

Criteria: Site has been previously built on / developed.

EN4.2 Neighbouring buildings
Building does not have harmful affect on neighbouring buildings

Criteria: No / minimal reduction to neighbouring building's access to sunlight and natural ventilation

EN4.3 Vegetation
Building and site supports vegetation

Criteria: Area of vegetation provided and maintained equivalent or greater than that of the footprint of the building and hard surfaces.

EN4.4 Habitat
Building supports diversity of plant and animal life

Criteria: Number and range of different species supported.

EN4.5 Landscape inputs
Landscapes designed to function naturally

Criteria: No or minimal artificial inputs (fertilizer, pesticides etc) required to maintain landscape.

EN5 Materials and Components
The construction of buildings usually requires large quantities of materials and components. These may require large amounts of energy to produce. Their development may also require process that are harmful to the environment and consume non-renewable resources.

EN5.1 Embodied energy
Majority of building materials and components used to have low embodied energy.

Criteria: Embodied energy of materials

EN5.2 Material / component sources
Majority of building components used are from 'grown' or renewable (ie timber, thatch) sources.

Criteria: Proportion of materials used from grown sources

EN5.3 Manufacturing processes
Processes for processing / manufacturing materials has minimal negative impact on the environment.

Criteria: No materials used whose production involves large-scale direct pollution of the environment, and direct release of greenhouse gas emissions.

EN5.4 Recycled / reused materials and components
Materials and components used in the building are from recycled sources

Indicator: Percentage of building materials (by volume) that are from recycled sources.

EN5.5 Construction processes
Building design and construction developed to minimally affect the environment

Criteria: Building and construction process designed to minimally impact the environment. Requirement for large-scale vegetation clearing and earth movement minimised.

8 Resources

GB Tool
Cole, R., and Larsson, N. 2000. *GBC 2000 Assessment Manual: Volume 2: Office Buildings*. Green Buildings Challenge 2000. http://greenbuilding.ca/.

BREEAM
Baldwin, R., Yates, A., Howard, N., and Rao, S. 1998. *BREEAM 98 for offices*. Construction Research Communications. London.

LEED
US Green Building Council 2000 *Green Building Rating System Version 2.0 Leadership in Energy and Environmental Design* http://www.usgbc.org/.

6.2. Addressing Hypothesis Five

6.2.1. Introduction

In this section the hypothesis set, namely 'that a specification for an assessment tool, which aims to ensure that sustainable development, is addressed and incorporated in the briefing and design of buildings in developing countries can be developed' will be discussed. In order to undertake this, the specification will be compared to the Sustainable Building Assessment Tool. This comparison will allow the findings of the study described in the specification, to be tested and validated. It will also enable the different aspects of the SBAT to be explored in some detail, allowing weaknesses and strengthens to be hi-lighted. This will contribute to Chapter seven of the study in which conclusions and recommendations are made. The form of the discussion will follow the structure developed in the specification of the tool. It will therefore have the following sections:

- Purpose of the Tool
- Scope of the Tool
- Components of the Tool
- Assessment Framework
- Structured Process
- Evaluation Criteria

6.2.2. Purpose of the Tool

The specification lists five key goals for the assessment tool. Of these, it is suggest, two are of key importance. The first is to ensure that there is adequate understanding about sustainable development and buildings amongst stakeholders, to enable informed discussion, and the development, and agreement, of sustainable development performance targets for the building.

The second is to ensure that the relationship between sustainable development and buildings and construction is made explicit and understandable. This includes understanding how buildings and construction can be used to support sustainable development. It encompasses a process of prioritising aspects of sustainable development and ensuring that these are reflected in the building performance targets set for the building. The specification proposes that once set, these targets should guide the design process and be used to monitor progress towards achieving targets.

The introduction to the SBAT does not make the purpose of the tool explicit. Although it does point out the importance of design decisions and suggests that SBAT can provide decision support, it does not make it clear that a key purpose of the tool is to *integrate sustainability*

into building briefing and design processes. The SBAT also does not hi-light the value of developing awareness and support for sustainable development in building stakeholders. The specification therefore implies that although the SBAT may achieve many of the objectives listed for an assessment tool, it would benefit by making these explicit in the introduction to the tool.

6.2.3. Scope of the Tool

The specification of the tool includes a description of the scope of the tool, and suggests that this should be limited to: buildings, the design stage and architects. The SBAT does not define the scope of the tool. This is risky as it could lead to inappropriate use of the tool. It is clear however, that the tool has been developed specifically for developing countries.

It is suggested that the introduction to the SBAT describe the function and use envisaged for the tool. It should also express who the tool is aimed at. Finally, the SBAT should describe a scoped for the tool and include a warning that indicated that use of the tool beyond this scope would require more care and possible adaptation of the tool.

6.2.4. Components of the Tool

The specification of the tool makes it clear that there should be two components to the tool; an assessment framework and a structured process. The SBAT is not explicit about these components. However, implicit reference is made to a structured process in the guidelines included for use of the tool. This however does not provide a high level of detail. For instance there is no guidance on how to set up and run a target setting workshop with stakeholders.

The effectiveness of the tool, it is suggested, could be improved by showing how the tool could be integrated and used within conventional briefing and design processes. One way of addressing this would be to be to include a guide that showed how the use of the tool could be integrated into conventional architects' work stages such as those outlined by the Royal Institute of Architects or the South African Institute of Architects.

6.2.5. Assessment Framework

The specification states that it is important that the assessment framework provides a clear explanation of its theoretical foundation. It also suggests that a description of the development process of the tool would enable users to gain a better understanding of the tool.

The SBAT does not explain why it was developed. It also does not describe the basis and assumptions used in its development. No definitions for sustainability, sustainable development or sustainable buildings are included.

Explaining why the tool was developed would help justify the need for the tool and explain why a different approach was developed relative to other tools such as BREEAM and the

GBTool. A clear definition of sustainable development would also help clarify the theoretical basis for the tool.

The SBAT claims it has been designed for developing countries. The introduction hints at some of the differences between developed and developing countries, this however could be more comprehensively described. This, it is suggested, would help ensure that users of the tool consider, and take into account, the local context.

The specification provides an outline structure for the assessment tool. Aspects of this can be found in the SBAT, such as the hierarchy of objectives and sub-objectives. This could however be developed further. For instance the SBAT could include an overarching goal that should be aimed at. This would provide the focus from which objectives and sub-objectives would then cascade.

The objectives generated in the specification can be compared with the objectives described in the SBAT. This is a valuable test of the comprehensiveness of the SBAT. This comparison has therefore been carried out and the detailed results can be found in the Appendix ten. The findings of this comparison indicate the following:

- **Location:** Many of the objectives that relate to location are not addressed in the SBAT. This may be beyond the scope of the SBAT. However it would be useful if the SBAT could hi-light the substantial impact that buildings and construction can make to sustainable development through providing employment and access to education, *if deliberately located in areas of high need*.

- **Site:** Many of the objectives that relate to site are not addressed in the SBAT. This area therefore should be investigated in more detail. For instance, the tool could hi-light the potential contributions that a site could make to the development of effective water and waste management and recycling systems.

- **Management**: The SBAT does not make reference to environmental management. This should be addressed by ensuring that the criteria on materials and components requires all “grown” materials come from managed sources.

- **Furniture and Fittings:** This aspect is only referred to in passing in the SBAT. In order to ensure that this area is included, the SBAT should broaden the ‘Materials and Components’ set of criteria to include furniture and fittings.

- **Demolition and Refurbishment**: This aspect is not addressed in detail in the SBAT. It is suggested that should be included as an aspect within the EC criteria. In addition

it is suggested that one of the requirements of the building user manual should be to provide information that will enable the building to be easily refurbished or demolished with a minimum amount of waste.

- **Waste Management:** The comparison hi-lights the need in the SBAT for more detail on the design and management of waste management systems. In particular it would be useful if more information on system requirements could be provided such as space and service allocations.

- **Water**: This aspect is addressed in detail within the SBAT. However the SBAT does not have any criteria, which cover the consumption of water in the production or processing of materials and components. It also does not cover consumption of water during construction. With the increasing scarcity of water in some areas, these aspects may be increasingly important. It is therefore recommended that this be investigated for possible inclusion in the SBAT.

- **Labour intensive processes**: The comparison suggests that the SBAT does not address this aspect comprehensively enough. It is therefore suggested that this is addressed more thoroughly. For instance, labour intensive processes should be addressed in materials and components, construction, and building operation criteria.

- **Construction energy efficiency:** The SBAT does not address this, although it does include criteria for embodied energy. It is suggested that this area should be investigated to see whether this should be included in the SBAT.

- **Design process:** The comparison indicates that the design process may also have a role in supporting a number of sustainable development objectives. For instance this could support the development of a local, diverse economy, participation and education. This aspect is unlikely to have a high impact so should not be addressed as a high priority in terms of inclusion in the SBAT

- **Efficiency**: This aspect is not addressed as a specific issue in the SBAT, but is referred to under a number of criteria. It is recommended that the criteria in the SBAT be reviewed in order to ensure that they have a strong emphasis on efficiency.

- **Indigenous technology**: This aspect is not addressed at all in the SBAT. This should be investigated for possible inclusion.

- **Evaluation and monitoring systems**: The comparison indicates that the SBAT could have a stronger role in encouraging the development and implementation of

ongoing performance management systems in order to ensure that sustainable development issues are addressed throughout the life of the building.

- **Enabling environment**: The comparison suggests that the design and construction process could, in a small way, support an enabling environment for sustainable development. It could do this by including criteria that support transparent, equitable and inclusive contract and tender processes and documentation.

- **Services**: Objectives generated by the matrix indicate that buildings may be able to support sustainable development within the services (ie energy, water) area. It would do this by supporting local, labour intensive, environmentally sound service providers. This may not be possible in South Africa or many developing countries currently as there are a limited number of service providers, however the inclusion of this aspect into the SBAT could be investigated at a later stage when this becomes a possibility.

- **Education for construction workers:** The comparison indicates that there are opportunities for education during the construction process. This should be investigated for inclusion in the SBAT.

- **Briefing and design process should be inclusive:** The SBAT process is participatory, but no reference is made to making sure that it is inclusive. This should be addressed in the SBAT.

- **Inclusive building envelope:** The comparison indicates that the building envelope should be designed to be inclusive. This is currently not adequately covered by the existing criteria with the SBAT and it is recommended that this is addressed, and reference made to ensuring that views, window opening controls and so on are able to be accessed easily by everyone, including disabled people.

- **Inclusive construction processes:** The SBAT does not currently have a criterion requiring that the construction process is inclusive. This should be addressed, by ensuring that there are criteria to ensure inclusion, by for instance, requiring the appropriate involvement of youth, women and disabled people.

- **Healthy location:** The comparison indicates that it is important that the building is located in areas conducive to human health. This is not addressed by the SBAT and should be investigated for future inclusion.

- **Healthy and safe construction practices:** The SBAT does not include criteria in this area. It is therefore suggested that this is considered for inclusion.

- **Participative sites:** The role of sites in contributing to participation and social cohesion is not addressed in the SBAT. This area should be considered for future inclusion.

- **Participative operation:** The role of building management in supporting participation and social cohesion is not explored in the SBAT. It is recommended that this investigated for possible inclusion under the SO criteria.

In addition, the specification provides a method for prioritising objectives. This has been applied to the objectives generated by the specification and the results are also illustrated in Appendix eleven. This indicates that the following objectives should be prioritised in buildings in developing countries.

- **Water:** Ensure that development manages the extraction, consumption and disposal of water in order not to adversely affect the bio-physical environment

- **Employment and self-employment:** Ensure that development supports increased access to employment and supports self employment and the development of small businesses

- **Small-scale, local and diverse economies**: Ensure that development supports the development of small scale, local and diverse economies

- **Access:** Ensure that development support increased access to land, adequate shelter, finance, information, public services, technology and communications where this is needed.

- **Education:** Ensure that development improves levels of education and awareness, including awareness of sustainable development

- **Health, Safety and Security:** Ensure that development considers human rights and supports improved health, safety and security.

The SBAT does not have prescribed priorities, as users of the tool set these. This is a useful feature for helping ensure effective participation in the use of the tool. This benefit, it is suggested, should not be lost. A way of continuing to achieve effective participation while making recommendations about priorities would be through the inclusion of case studies and sample target ‘foot prints’ that could be aimed for. This would support a better understanding

of how buildings can be developed to support sustainable development and help ensure that prioritisation of objectives was appropriate.

The SBAT includes a set of indicators. However using the tool across a number of building types soon illustrates the need to alter these in order to make these more appropriate for the building and context in question. This flexibility is both a strength and a weakness. It is a weakness currently as comparisons of performance within a particular building type is difficult as indicators are not prescribed and particular targets are not set. This could change as a database of indicators and performance targets for a variety of building types and contexts is developed.

It is therefore suggested that the effectiveness of the SBAT could be substantially improved by developing an accompanying database of indicators and performance targets, which can be drawn on in setting targets. This should support design improvements in buildings over time as knowledge on indicators improves and performance targets are made increasingly challenging.

The lack of prescribed performance targets is also a strength. This is because the tool can be used in a much wider range of situations than similar tools such as BREEAM and the GBTool, which focus on particular building types such as office buildings, houses and schools. Avoiding prescribed targets, it is suggested, helps ensure that there is greater participation from all parties interested in the building process. By ensuring specific targets are considered for each building it encourages the development of an approach in which the local context is taken into account and there is continuous improvement.

The specification provides a number of criteria for the selection of indicators. These criteria have been applied to the objectives included in the SBAT. The results of this are shown in Appendix eleven. This suggests that the following sets of indicators work well:

- Occupant Comfort indicators (with the exception of thermal comfort and noise)
- Inclusive Environments
- Access to Facilities
- Participation and Control (with the exception of community involvement)
- Water
- Energy (with the exception of heating and ventilation)
- Site (with the exception of habitat and landscape inputs)

It however suggests that a number of sets of indicators included in the SBAT require further development. These are as follows:

- Education, Health and Safety (with the exception of smoking)
- Local economy
- Efficiency of Use (with the exception of space use)
- Adaptability and Flexibility
- Ongoing Costs (with the exception of user awareness)
- Capital Costs
- Waste
- Materials and Components

There appear to be a number of problems with these indicators. Many of these have not been reduced into simple criteria that do not require extensive additional modelling or data collection. They also concern aspects of buildings where the knowledge base is currently weak. For instance there is little available information on assessing the flexibility and adaptability of buildings. Clearly in order for the SBAT to be more effective additional work is required to develop more precise objective criteria and simple, quick methodologies for capturing performance information.

6.2.6. Structured Process

The specification for the tool provides a high level of detail on how the assessment tool should be used. This describes how the use of the assessment tool fits into conventional briefing and design processes. It also describes actions that need to be taken before the tool is used and how the tool can be used to involve all interested parties in setting sustainability performance targets for the building (target setting workshop).

The SBAT does include some explanation as how the tool should be used for setting targets in the briefing stages and for decision support in design. It is suggested that the explanation provided is adequate. It is recommended that more information on how to use the tool could help increase it’s effectiveness. This information however should be packaged separately, allowing users to refer to this if they so wished.

Finally, the specification provides a set of principles that the tool should be aligned with. The SBAT is examined with respect to these principles and the results of this can be found in Appendix thirteen. A review of this suggests that, on the whole, the SBAT is in line with the principles outlined however there are a number of aspects that can be commented on:

- **Overarching goal:** The review indicates that the SBAT should provide a clear goal that buildings and construction processes should aim for in order to support sustainable development.

- **Tool development:** The review suggests that the SBAT would benefit from a short description of the background to the development of tool. This would help explain the design of the SBAT and help ensure that it was used correctly.
- **Assumptions and definitions:** The review suggests that the SBAT should list assumptions made, include definitions, references and differentiate between areas where there is strong knowledge and weak knowledge.

6.3. Concluding Hypothesis Five

The hypothesis that a specification for an assessment tool, which aims to ensure that sustainable development, is addressed and incorporated in the briefing and design of buildings in developing countries can be developed is demonstrated. The specification is shown to be both comprehensive and robust through a detailed comparison with the Sustainable Building Assessment Tool. It proves to be an effective framework that enables a thorough review of the SBAT. The comparison process highlighted ways that the Sustainable Building Assessment Tool and the specification could be improved. Broad recommendations from this review will be included as recommendations in the next chapter, Chapter seven, Conclusions and Recommendations.