TREES

Training for Renovated Energy Efficient Social housing

Intelligent Energy -Europe programme, contract n° EIE/05/110/SI2.420021

Section 2: Tools

2.4 Sustainability in building construction

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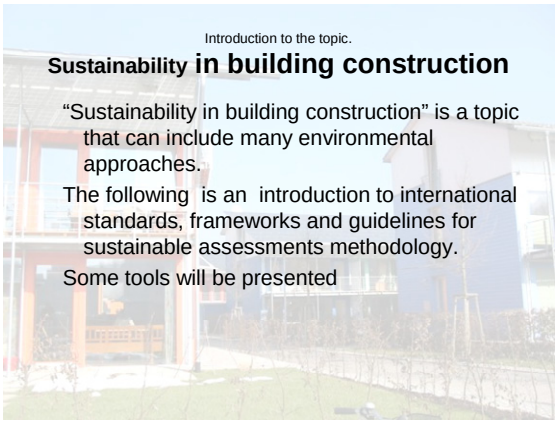
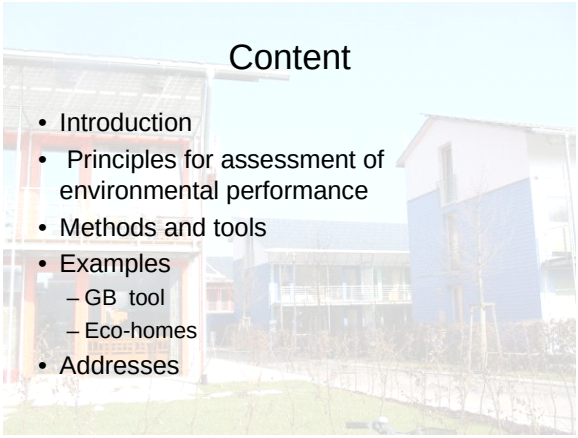
INTRODUCTION

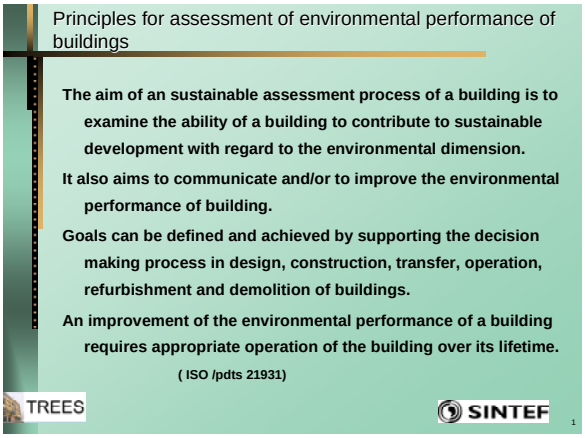
This paper gives additional comments to each slide to help the lecturer in the issues that are presented. More detailed information can also be collected from papers or reports also included at the CD.
First twoslides with introduction to the topic:

Slide 1 and 2:
These slides give a short introcuction to the topic:

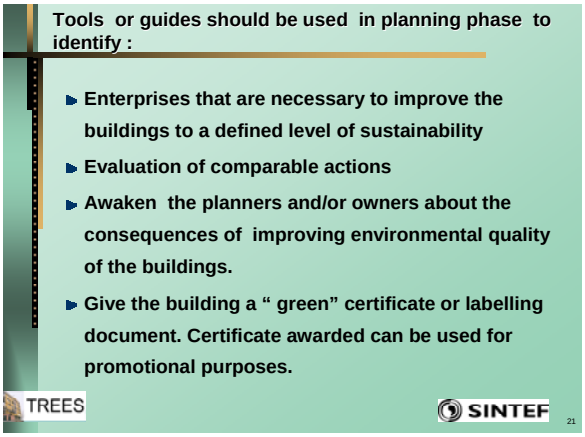




Slide3:
Assessment methods for the environmental performance of buildings are the basis for demonstrating and communicating the extent of proactive commitment of buildings' suppliers toward achieving higher levels of environmental performance. The methods attempt to establish an objective and comprehensive means of simultaneously assessing a broad range of environmental considerations against explicitly declared criteria, and to offer a summary of environmental performance.



Slide 4:
Life-Cycle approaches will inevitably play a greater role for setting performance criteria within methods of assessment of overall environmental performance of buildings. However, the collection and maintenance of current data sets for the multitude of systems and elements are not practically achievable at the moment. Consequently, to achieve the practical goals noted above, assessment methods for the environmental performance of buildings need to refer to a limited number of criteria and seek a balance between rigor and practicality. This means that the deployment of sustainable thinking within the methods of assessment of overall environmental performance of buildings must consider the significance of the individual performance criterion within the context of the overall building performance.

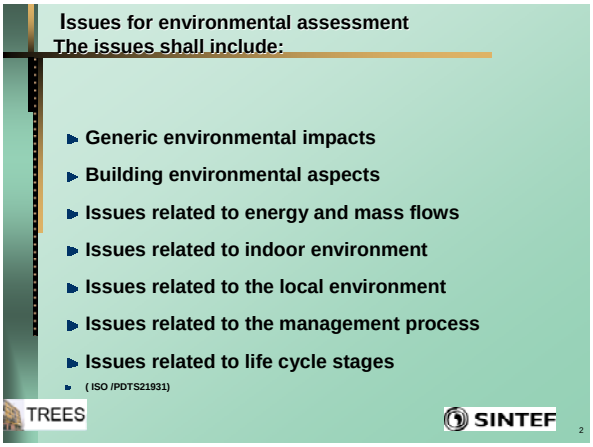


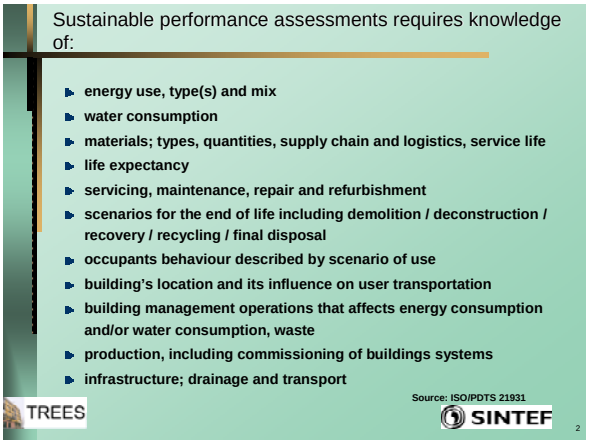
Assessment methods for the environmental performance of buildings:

- Provide a common and verifiable set of criteria and targets so that building owners striving for higher environmental standards have a means of measuring, evaluating and demonstrating that effort.
- Provide a common basis from which building owners, design teams, contractors and suppliers, can formulate effective environmental performance improvement strategies.
- Gather and organize detailed information on the building that it can be used to lower operating, financing and insurance costs, lower vacancy rates and increase marketability.
- Assist the design process by providing a clear declaration of what are considered as the key environmental issues and their relative importance**.**

Slide 5 +6 :

The environmental performance of buildings can be assessed according to the environmental issues that are of concern to the various interested parties. These issues shown in the slides, used to assess environmental performance, should be presented as structured lists in the documentation of the assessment method.

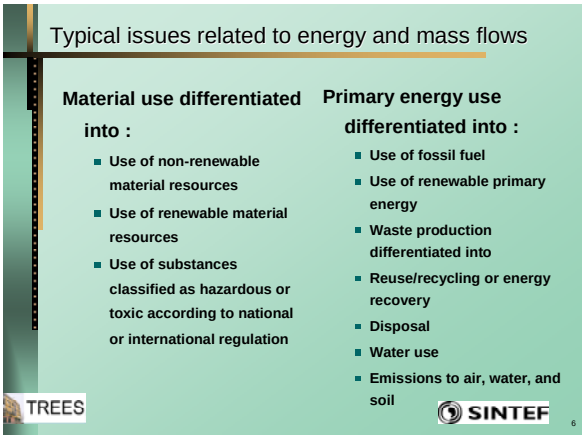




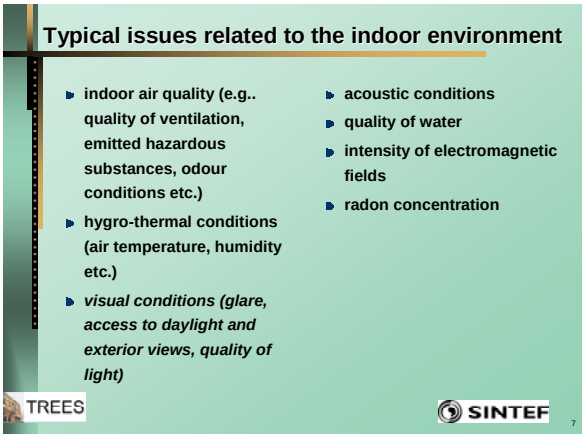
Slide 7:
Typical characteristics that empirical have interest for the stakeholders, residents and tenants.

Slide 8:
Multi- criteria assessment is needed to evaluate the sustainability performance of both new buildings and buildings for renovation. Balancing simplicity and completeness has therefore led to various approaches. Aggregating quantitative and qualitative information requires rating systems at different levels; both environmental and social issues.

Slide 9:
The range of sustainability issues to be included can be long. Energy use and mass flows are included in all tools. Resource- and energy use can include some measures of raw materials, primary energy, water or land use.



Slide 10:
Air quality has been ranked as one of the most important aspects of environmental sustainability by stakeholders. But also social issues as well being and user comfort have been ranked high. It involves various issues of indoor air quality and indoor thermal-, visual- and acoustic comfort.



Slide 11:
SWOT matrices can be used to show the differences between Sustainability assessment methods and Life Cycle Assessments methods (LCA).

SWOT matrix of Sustainability assessment methods
Source: LEnCE

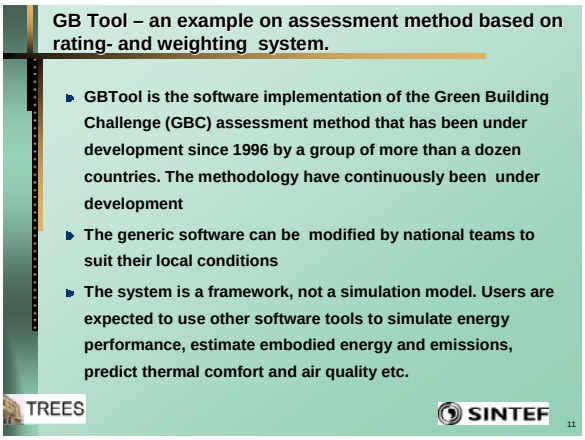
Strengths	Weaknesses
■ Rating tools include more easily all kind of issues (social, economic, environmental), including qualitative issues ■ Rating tools are generally user friendly, the input and output being adapted to both building professionals and clients ■ Some rating tools are partly based upon LCA, which may increase their reliability ■ Some tools are widely used (e.g. 25,000 accredited LEED professionals in the U.S., over 1,000 BREEAM assessors)	■ Qualitative evaluation is very difficult to validate: the confidence in the result of a rating tool is sometimes limited ■ Many tools exist, which can be very different in their structure and content
Opportunities	**Threats**
■ An increasing number of owners apply for "green labelled" buildings ■ A harmonised methodology can emerge from European research and standardization activities	■ Labelling low performance buildings reduces the credibility of labelling ■ Agreeing on a common qualitative assessment method may be difficult, and the result may depend a lot on the assessor

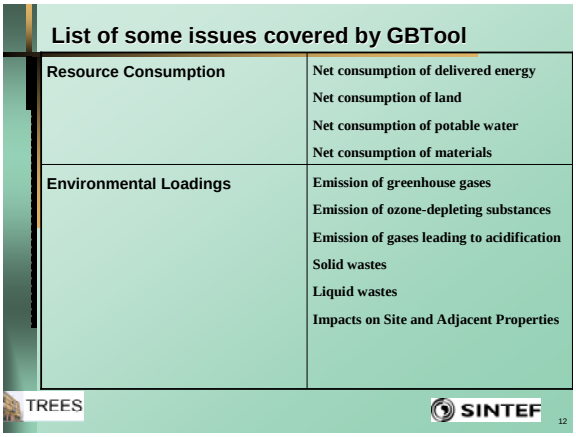
SWOT matrix of LCA methods
Source: LEnCE

Strengths	Weaknesses
■ LCA tools are based upon a standardised methodology (ISO 14 040) ■ The results can be checked as far as the assumptions are published ■ Validation work exist, e.g. 8 tools have been compared in the PRESCO thematic network, showing a +/- 10% discrepancy on CO2 emissions of the studied cases ■ Some tools are user friendly, making the assessment as easy as using simplified methods ■ Some tools have a large number of users (e.g. ENVEST : 233 registered users) ■ Some tools are linked with economic or social issues (LEGEP with life cycle cost, EQUER with thermal comfort)	■ LCA concerns only some environmental issues, that can be evaluated in a quantitative way ■ Some harmonisation work is still needed among the different tools in Europe ■ LCA tools require data that may not be available (e.g. life cycle inventories of locally produced materials, or technical innovation) ■ The number of users of LCA tools is generally limited (still more researchers than professionals)
Opportunities	**Threats**
■ A European project aims to develop a data base including life cycle inventories of building materials (JRC, Ispra) ■ LCA is considered in the CEN technical committee in charge of sustainable building (TC 350) ■ Incentives could be provided according to environmental performances evaluated using LCA ■ Continuing education could allow building professionals to be trained	■ LCA could be rejected as being too complicated by building professionals ■ The cost of an assessment must remain low to ensure the acceptance of a labelling process

Slide 12:
Today the main barrier to more use of environmental tools is the large amount of data and information needed to use the methodology. For some tools you need to be an expert. Others are for “common users” as architects, planners and project developers.

Slide 13 and 14
For more information we recommend to study the Demo- version on CD or
http://www.greenbuilding.ca/down/gbc2005/GBtool_2k5_Demo_unlocked/





Slide 15 and 16

Performance criteria and weighting

- The relative importance of criteria for environmental performance must lead to the use of a weighting system for aggregation
- The weighting system varies depending on national, regional or local contexts and conditions and should provide a method for addressing such variances.
- The underlying data of the method shall be documented.
- The weighting factors shall appear explicitly in the assessment method documentation.

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The weighting process need benchmarking to common practice or mean local values.

B	**Energy and Resource Consumption**	**2,6**	21 %	**0,5**
B1	**Total Life Cycle Non-Renewable Energy**	**4,7**	32,8%	**1,5**
B1.1	Predicted non-renewable primary energy embodied in construction materials	Active	25,0%	

Intent	*To minimize the embodied primary energy used in the building, annualized over the estimated lifespan of the building.*	Applicable phases (Active if green)		
Indicator	Estimate of embodied primary energy used for structure, envelope (excl. glazing), and major interior components, as determined by a program designed to estimate embodied energy and emissions through Life Cycle Analysis; also, estimate of lifespan.	Dsn	-	
Information sources and notes	Note that minimization of embodied energy may not always be optimal. For example, the greater embodied energy associated with high thermal mass will, in most cases, reduce operating energy, and the total net lifecycle energy could then be reduced.	Occupancies used		
Applicability	For Total building, all sizes.	-	Office	Retail
Relevant Design information	Office	MJ/m2 per yr.	Perform. Score	Wtd. Score
	Office Occupancy net area =4400 m2			
	Estimated building lifespan (see Basic worksheet) =50			
Design value (predicted)	The embodied energy used in the structure and building envelope of the Office Occupancy, as determined an acceptable LCA-based estimating method, is :			
Negative		BB		-1
Acceptable practice	The embodied energy used in the structure and building envelope of the Office Occupancy, as determined an acceptable LCA-based estimating method, is	BG		1
Good Practice		BG		2
Best Practice		BP		3

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Slide: 17and 18

Quick overview of the weighting system and presentation of performance results.

In the weighted summation approach, the score is calculated by first multiplying each value by its appropriate weight followed by summing of the scores for all criteria. If the scores are measured on different measurement scales, they must be standardized to a common dimensionless unit before weighted summation can be applied.

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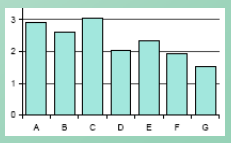
Example on performance results based on GBTool-weighting system

	To see a full list of issues go to the issues worksheet; to alter weights, go to the Weights worksheets.	Active Weights	Weighted scores
A	Site Selection, Project Planning and Development	13 %	2,9
B	Energy and Resource Consumption	21 %	2,6
C	Environmental Loadings	21 %	3,1
D	Indoor Environmental Quality	17 %	2,0
E	Functionality and Controllability of Building Systems	8 %	2,3
F	Long-Term Performance	8 %	1,9
G	Social and Economic aspects	13 %	1,5
	Total weighted building score		2,4

0= Acceptable practice
3_Good practice
5= Best practice



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Slide 19:

The method is flexible (List of other issues covered by GBTool)

- **Service Quality**
  - Air Quality and Ventilation
  - Day lighting, Illumination and Visual Access
  - Noise and Acoustics
  - Flexibility and Adaptability
  - Maintenance of Performance
  - Controllability of Systems
- **Pre-Operation Planning**
  - Construction Process Planning
  - Performance Tuning
  - Building Operations Planning
  - Transportation Management Planning
- **Economics**
  - Life cycle costs
  - Capital Costs
  - Operating and maintenance costs

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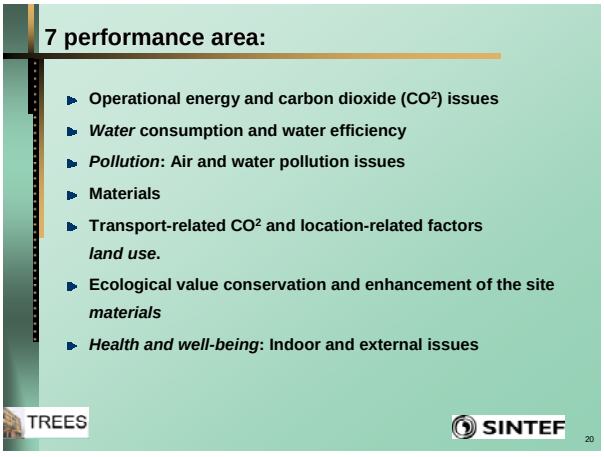
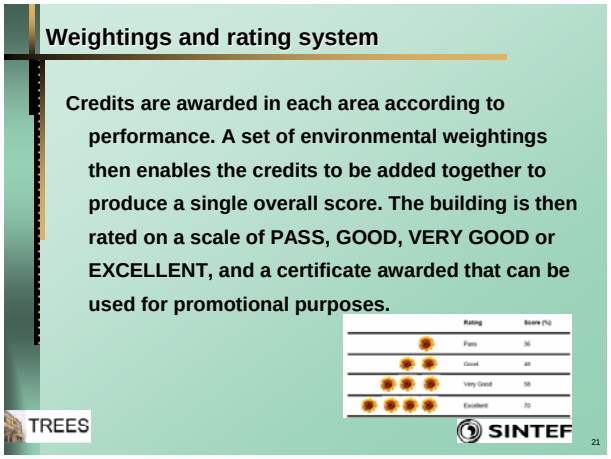
Slide 20 and 21: Example on a simplified building rating system – ECOHOMES developed by BRE- UK.

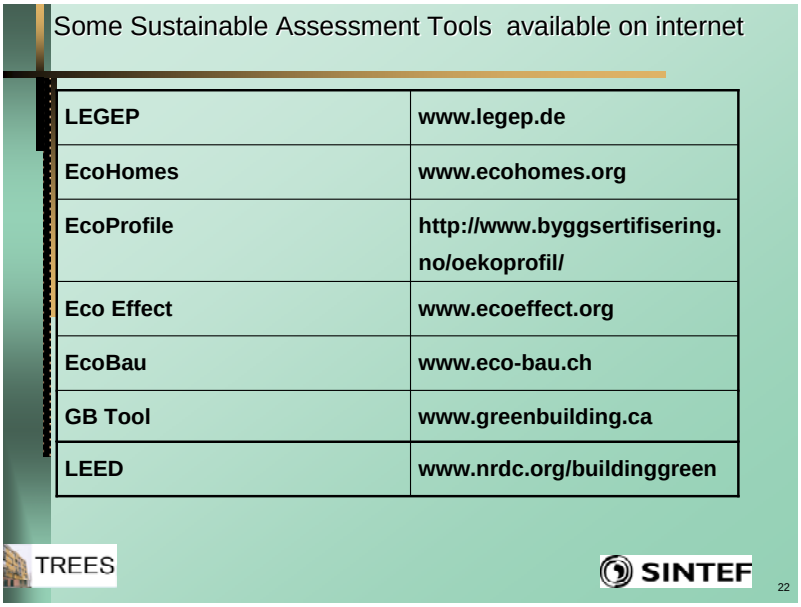
For more information we recommend to study the Demo- version on internet
http://www.breeam.org/ecohomes.html

Slide 22 and 23: Tells about the priority areas in the tool





Slide 24:
Useful list for Sustainable assessment methods and tools.



Main references:

- **ISO/TC59/SC17N189 : Sustainability in Buildings – Framwork for methods of assessment for the environmental performance of construction work. Part 1: Buildings**
- **LEnCE: Sustainability assessment of buildings. Stepping stone 1. www.lencebuildings.com**

An Overview of the GBC Method and GBTool

May 24, 2005

See also: http://www.greenbuilding.ca/down/gbc2005/GBtool_2k5_Demo_unlocked/

This document describes the structure and function of GBTool, a software system for assessing the environmental and sustainability performance of buildings. GBTool is the software implementation of the *Green Building Challenge* (GBC) assessment method that has been under development since 1996 by a group of more than a dozen teams. The GBC process was launched by *Natural Resources Canada*, but responsibility was handed over to the *International Initiative for a Sustainable Built Environment* (iiSBE) in 2002. The generic method and software is calibrated by national teams to suit their local conditions, and is then tested on case study buildings. Currently, some 15 teams from 12 countries are involved in preparing assessments that will be exhibited at the global Tokyo SB05 conference in late September 2005.

The GBC assessment method is one of several systems that have been implemented around the world. The best-known systems are undoubtedly BREEAM, a system primarily used in the UK, and LEED, a system mainly confined to North America. BREEAM was the first system of this type and has been very influential since its development in the early 1990's. LEED is now growing at a very rapid rate and has undoubtedly been responsible for a major shift in industry attitudes in North America.

The GBC method and GBTool represents another approach. The system places emphasis on the ability to have the system reflect the relative importance of performance issues in a particular region, and also to contain regionally relevant benchmarks. By replacing the generic benchmarks provided in the system with their own, regional authorities can ensure that the system will be relevant to their unique local conditions.

IiSBE is primarily involved in R&D and in helping participating teams to come to grips with performance assessment, but we are also prepared to undertake large projects on a commercial basis.

Features of GBTool

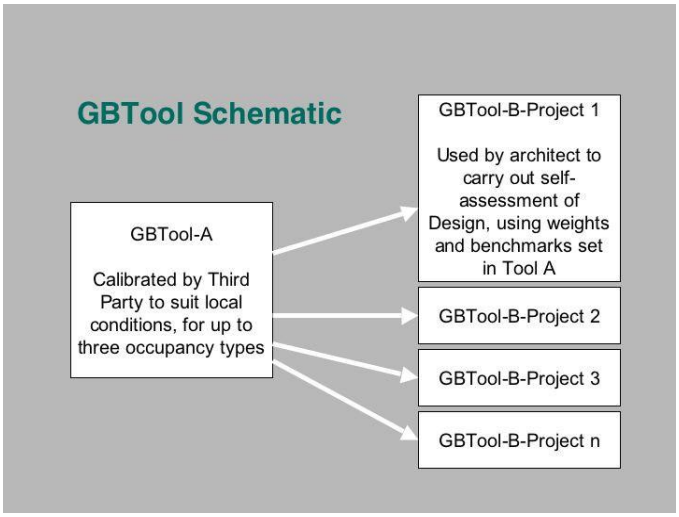
- **The system covers a wide range of sustainable building issues, not just green building concerns, but the scope of the system can be modified to be as narrow or as broad as desired;**
- **Allows third parties to establish parameter weights that reflect the varying importance of issues in the region, and to establish relevant benchmarks by occupancy type;**
- **Allows generic benchmarks to be replaced by local ones, in local languages;**
- **Allows assessments to be carried out at four distinct stages of the life-cycle and provides benchmarks suited to each phase;**
- **Handles up to three building types, separately or in a mixed-use project;**
- **Handles new and existing construction, or a mix of the two;**
- **Allows comparisons to be made with LEED and Green Globes.**

Overview

This system is split into two parts. Module A includes Benchmarks and Weights, and iis intended to be adjusted by third parties to suit local conditions. Module B is designed to be used by designers to carry out self-assessments within the terms established in Module A. Settings that have been established in Module A cannot be changed by users of Module B.

Figure 1:

Overview of the file structure. After Module A at the left is calibrated for a particular region, designers can then assess their projects using Part B.



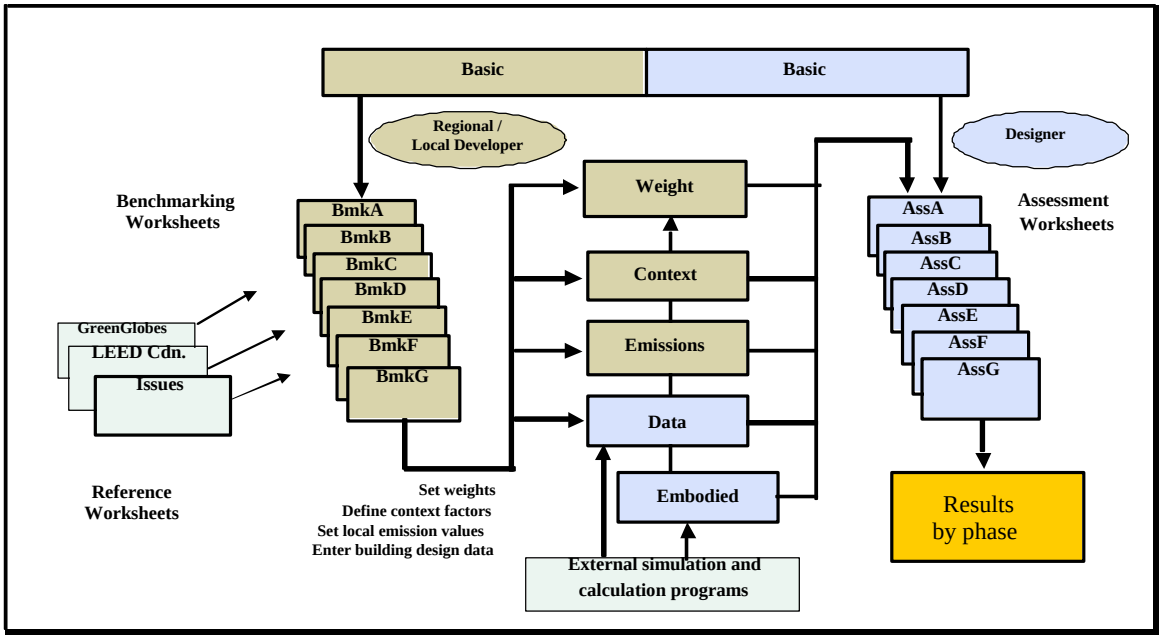


Figure 2: **Overall schematic of system elements**

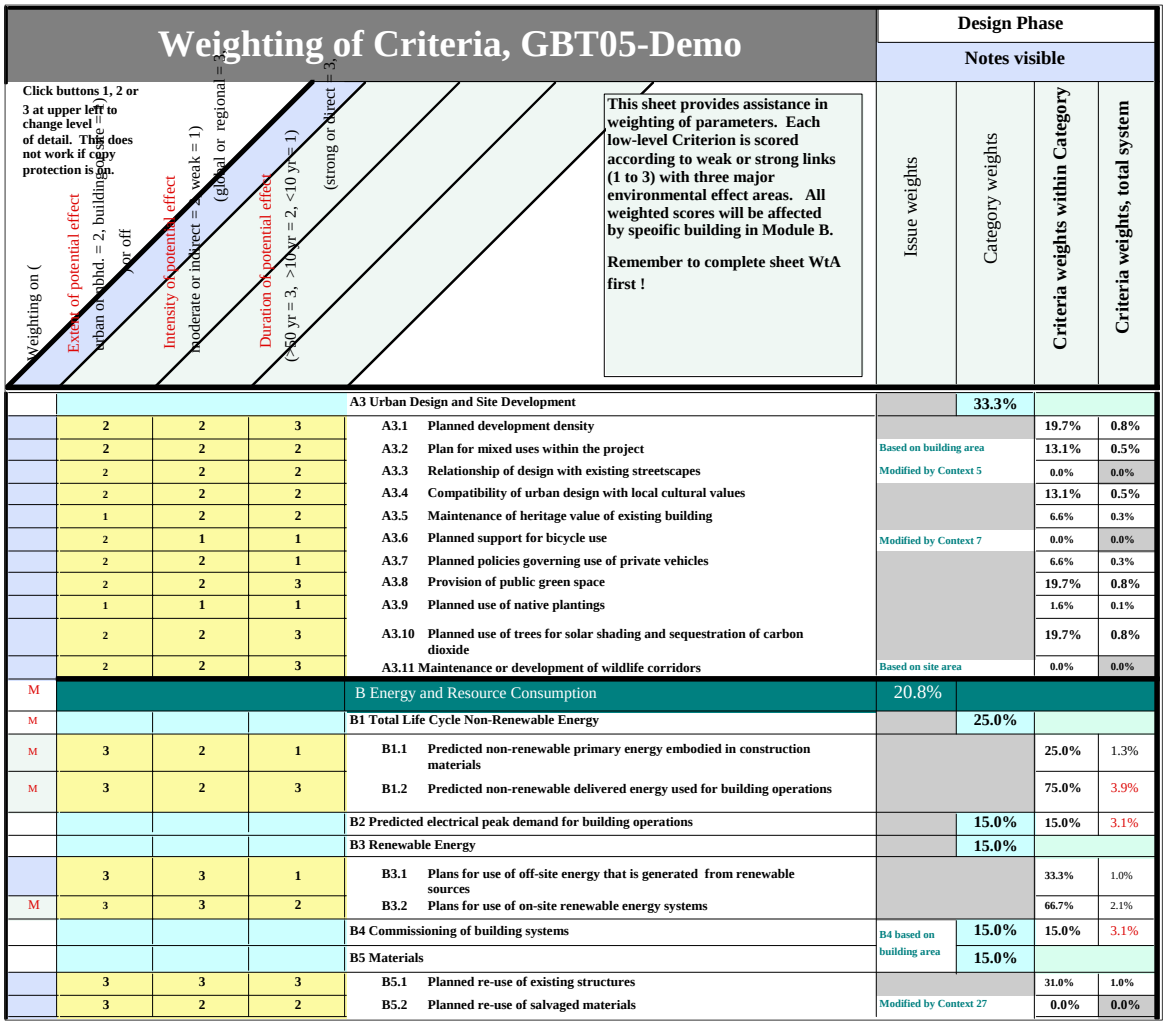
GBTool is designed to allow assessments to be carried out at various phases of the life cycle of a project. Parameters included within the system cover sustainable building issues within the three major areas of environment, social and economic sectors.

A distinguishing feature of GBTool is that it is designed as a generic framework, and requires a third party to adjust it to suit the unique conditions applicable to certain building types in various regions. This means that an assessment carried out using the system has little validity unless such a calibration feature is first carried out. Third parties are expected to adjust default weights, benchmarks and emission values throughout the system.

Default weights have been established by identifying strong, moderate or weak links between GBTool Criteria (the lowest level parameter type) and a small group of broad sustainability issues. These links are then weighted according to the apparent relative importance of the sustainability issue. All of these numbers (in yellow) are user-adjustable.

Weighting of Issues and Categories GBT05-Demo		English Interface		Design Phase is active		
	Values range from 0 (not applicable) to 5 (most important), with the value 2 representing the normal default or null value, except for Mandatory parameters, which range from 3 to 5. Click on box at right to select Default or your own weighting values.	Using Defaults				
	Instructions: **First decide if you want to use the defaults** **If you want to set your own weights** **1. First set relative importance for highest level Issues** **2. Then set values for Categories within each Issue area** **3. To set lowest level weights, go to WtB worksheet**	Suggested Default values	Percent of grpup	Weighted percent	Select your own weighting values.	Mandatory
	Issues	Active				
A	Site Selection, Project Planning and Development	3	12.5%		3	
B	Energy and Resource Consumption	5	20.8%		5	M
C	Environmental Loadings	5	20.8%		5	M
D	Indoor Environmental Quality	4	16.7%		5	M
E	Functionality	2	8.3%		0	
F	Long-Term Performance	2	8.3%		0	
G	Social and Economic aspects	3	12.5%		0	
	Categories ***(note that some categories are only operative in certain phases)***					
A	***Site Selection, Project Planning and Development***					
A1	**Site Selection**	2	33%	4.2%	3	
A2	**Project Planning**	2	33%	4.2%	3	
A3	**Urban Design and Site Development**	2	33%	4.2%	3	
B	***Energy and Resource Consumption***					
B1	**Total Life Cycle Non-Renewable Energy**	5	25%	5.2%	5	M
B2	**Predicted electrical peak demand for building operations**	3	15%	3.1%	3	
B3	**Renewable Energy**	3	15%	3.1%	3	
B4	**Commissioning of building systems**	3	15%	3.1%	3	
B5	**Materials**	3	15%	3.1%	3	
B6	**Potable Water**	3	15%	3.1%	3	M

Figure 3: **Partial view of worksheet WtA for establishing weights of Issues and Categories**



Weighting of Criteria, GBT05-Demo

Design Phase

Notes visible

Click buttons 1, 2 or 3 at upper left to change level of detail. This does not work if copy protection is on.

This sheet provides assistance in weighting of parameters. Each low-level Criterion is scored according to weak or strong links (1 to 3) with three major environmental effect areas. All weighted scores will be affected by speoific building in Module B.

Remember to complete sheet WtA first !

	Weighting on (	Extent of potential effect (urban or bldd. = 2, building = 1)	Intensity of potential effect (moderate or indirect = 2, weak = 1)	Duration of potential effect (>50 yr = 3, >10yr = 2, <10 yr = 1)	(strong or direct = 3, (global or regional = 3,) or off	Issue weights	Category weights	Criteria weights within Category	Criteria weights, total system
				A3 Urban Design and Site Development			33.3%		
	2	2	3	A3.1 Planned development density				19.7%	0.8%
	2	2	2	A3.2 Plan for mixed uses within the project		Based on building area		13.1%	0.5%
	2	2	2	A3.3 Relationship of design with existing streetscapes		Modified by Context 5		0.0%	0.0%
	2	2	2	A3.4 Compatibility of urban design with local cultural values				13.1%	0.5%
	1	2	2	A3.5 Maintenance of heritage value of existing building				6.6%	0.3%
	2	1	1	A3.6 Planned support for bicycle use		Modified by Context 7		0.0%	0.0%
	2	2	1	A3.7 Planned policies governing use of private vehicles				6.6%	0.3%
	2	2	3	A3.8 Provision of public green space				19.7%	0.8%
	1	1	1	A3.9 Planned use of native plantings				1.6%	0.1%
	2	2	3	A3.10 Planned use of trees for solar shading and sequestration of carbon dioxide				19.7%	0.8%
	2	2	3	A3.11 Maintenance or development of wildlife corridors		Based on site area		0.0%	0.0%
M				B Energy and Resource Consumption		20.8%			
M				B1 Total Life Cycle Non-Renewable Energy			25.0%		
M	3	2	1	B1.1 Predicted non-renewable primary energy embodied in construction materials				25.0%	1.3%
M	3	2	3	B1.2 Predicted non-renewable delivered energy used for building operations				75.0%	3.9%
				B2 Predicted electrical peak demand for building operations			15.0%	15.0%	3.1%
				B3 Renewable Energy			15.0%		
	3	3	1	B3.1 Plans for use of off-site energy that is generated from renewable sources				33.3%	1.0%
M	3	3	2	B3.2 Plans for use of on-site renewable energy systems				66.7%	2.1%
				B4 Commissioning of building systems		B4 based on building area	15.0%	15.0%	3.1%
				B5 Materials			15.0%		
	3	3	3	B5.1 Planned re-use of existing structures				31.0%	1.0%
	3	2	2	B5.2 Planned re-use of salvaged materials		Modified by Context 27		0.0%	0.0%

Figure 4: **Partial view of worksheet WtB for establishing weights of Criteria**

It should be noted that some low-level weights are set automatically by GBTool, depending on specific context factors or features of the design. For example, if there is no access to bicycle pathways in the area, then the criterion weight for providing bicycle facilities is set to zero; and in a similar way, criteria dealing with mechanical HVAC systems are set to zero if the building is naturally ventilated. In such cases, all weights in the applicable Category are re-distributed amongst other criteria that remain active.

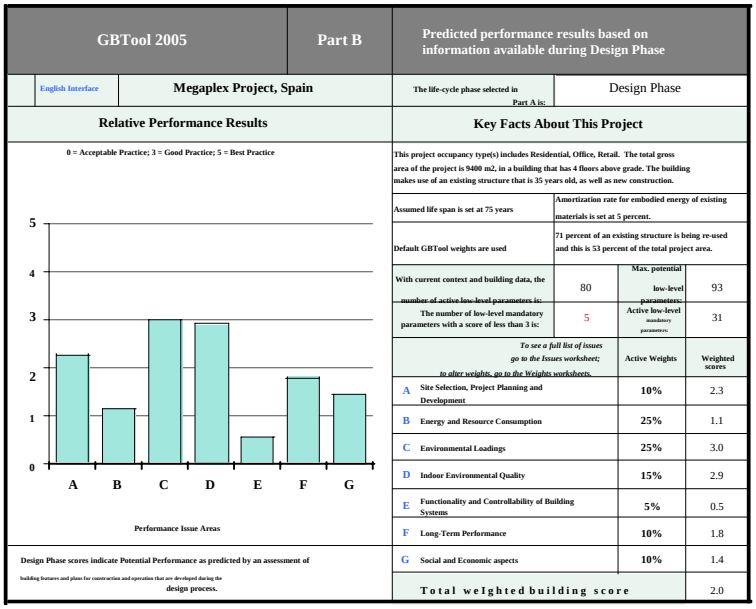
Performance by Phase

Four phases are included: Pre-Design, Design, Construction and Operations. The assessment in each phase is carried out using different data and produces different types of results.

- **The Pre-Design phase assessment is intended to indicate the future potential sustainable performance of the project, based on the information available at the end of the Pre-Design phase.**
- **The Design phase assessment is intended to indicate the future potential sustainable performance of the project, based on the information available at the end of the Design**

phase. Because the information available during the Pre-Design and Design phases are likely to undergo some changes during the evolution of the project, these two assessment modules are primarily intended for self-assessment purposes, and not for certification purposes.

- **The Construction phase assessment is intended to provide a relatively factual assessment based on performance indicators available at the end of the construction and commissioning phase, but before occupancy. However, relatively few indicators are available in this phase.**
- **Assessment during the Operations phase is intended to provide an objective and factual indication of the Actual performance of the project, and the results may be useful for certification purposes. We recommend that projects should be occupied for a period of at least one year before an Operations assessment is carried out.**



GBTool 2005 | Part B | Predicted performance results based on information available during Design Phase

English Interface | Megaplex Project, Spain | The life-cycle phase selected in Part A is: Design Phase

Relative Performance Results

0 = Acceptable Practice; 3 = Good Practice; 5 = Best Practice

Design Phase scores indicate Potential Performance as predicted by an assessment of building features and plans for construction and operation that are developed during the design process.

Key Facts About This Project

This project occupancy type(s) includes Residential, Office, Retail. The total gross area of the project is 9400 m2, in a building that has 4 floors above grade. The building makes use of an existing structure that is 35 years old, as well as new construction.

Assumed life span is set at 75 years

Amortization rate for embodied energy of existing materials is set at 5 percent.

Default GBTool weights are used

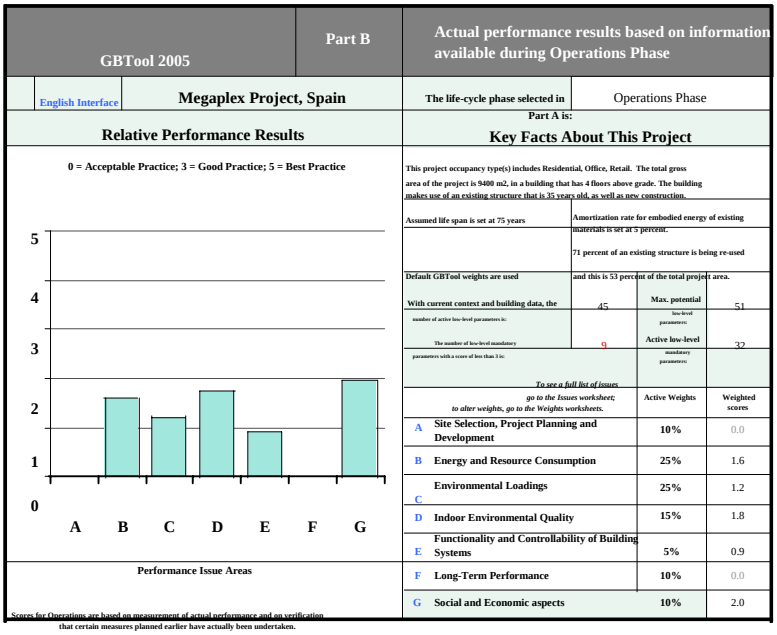
71 percent of an existing structure is being re-used and this is 53 percent of the total project area.

With current context and building data, the number of active low-level parameters is:	80	Max. potential low-level parameters:	93
The number of low-level mandatory parameters with a score of less than 3 is:	5	Active low-level mandatory parameters:	31

	To see a full list of issues go to the Issues worksheet; to alter weights, go to the Weights worksheets.	Active Weights	Weighted scores
A	Site Selection, Project Planning and Development	10%	2.3
B	Energy and Resource Consumption	25%	1.1
C	Environmental Loadings	25%	3.0
D	Indoor Environmental Quality	15%	2.9
E	Functionality and Controllability of Building Systems	5%	0.5
F	Long-Term Performance	10%	1.8
G	Social and Economic aspects	10%	1.4
	Total weighted building score		2.0

Figure 5:

Results worksheet in the Module B file, showing Relative Results for the Design Phase.



GBTool 2005 | Part B | Actual performance results based on information available during Operations Phase

English Interface | Megaplex Project, Spain | The life-cycle phase selected in Part A is: Operations Phase

Relative Performance Results

0 = Acceptable Practice; 3 = Good Practice; 5 = Best Practice

Scores for Operations are based on measurement of actual performance and on verification that certain measures planned earlier have actually been undertaken.

Key Facts About This Project

This project occupancy type(s) includes Residential, Office, Retail. The total gross area of the project is 9400 m2, in a building that has 4 floors above grade. The building makes use of an existing structure that is 35 years old, as well as new construction.

Assumed life span is set at 75 years

Amortization rate for embodied energy of existing materials is set at 5 percent.

71 percent of an existing structure is being re-used

Default GBTool weights are used

and this is 53 percent of the total project area.

With current context and building data, the number of active low-level parameters is:	45	Max. potential low-level parameters:	51
The number of low-level mandatory parameters with a score of less than 3 is:	9	Active low-level mandatory parameters:	32

	To see a full list of issues go to the Issues worksheet; to alter weights, go to the Weights worksheets.	Active Weights	Weighted scores
A	Site Selection, Project Planning and Development	10%	0.0
B	Energy and Resource Consumption	25%	1.6
C	Environmental Loadings	25%	1.2
D	Indoor Environmental Quality	15%	1.8
E	Functionality and Controllability of Building Systems	5%	0.9
F	Long-Term Performance	10%	0.0
G	Social and Economic aspects	10%	2.0

Figure 6:

Results worksheet in Module B file, showing Relative Results for the Operations Phase.

This feature will be fully implemented after GBC2005.

Despite the fact that all four phases have different applicable low-level indicators, the system provides consistency in the high-level Issues and second-level Categories. Results are therefore comparable across the four assessment phases. For the purposes of the GBC 2005 process, assessments will be carried out using the Design phase settings.

Structure of Benchmarks

Benchmarks are of two basic types: those that can be expressed as numeric values, and others that are best described in text form. In the GBTool system we have tried to express as many parameters as possible in a numeric form, but in some cases this would provide spurious results. In all cases, performance values are related to a scale that ranges from –1 to +5, with interpretation as follows:

-1 Negative
0 Minimum acceptable performance (usually but not always defined by regulation)
3 Good Practice
5 Best practice

Naturally, the performance levels tied to each score will vary by location and often by building type, which is why GBTool requires local third parties to define appropriate performance levels. In the case of numeric parameters, this is done by setting two numeric values at the 0 and +5 levels (see Figure 7), which then defines the slope of a line that sets the values for the –1 and +3 performance levels.

Figure 7: Typical Benchmark statement for a numeric-based parameter, showing two yellow cells for entry of local values.

G1.4 Measures planned for affordability of residential rental or cost levels				
Intent	*To assess whether rents or costs of the Design will be affordable for the target market.*	Applicable phases (Active if green)		
Indicator	For Residential Occupancy, the prescribed total occupancy cost (rental cost or total carrying charges and upkeep of a purchased unit), as a percentage of modal household income in the urban region.	Dsn	Cps.	
Information sources and notes	For Office buildings, will the completed building be affordable for the target market? From a broader social perspective, the affordability of residential occupancy relative to average income is also a concern.	Euro		
Applicability	For Total Building, all sizes			
	Residential Occupancy	Percent	Score	
Negative	Analysis of design documentation indicates that the gross housing cost, including rent or financing costs plus basic utilities, as a percentage of gross income will exceed:	30%	-1	
Acceptable practice		30%	0	
Good Practice		25%	3	
Best Practice		22%	5	

The procedure for defining appropriate performance levels for text-based parameters consists of defining performance conditions that appear to be appropriate for each performance score. We have provided some suggested default statements, but third parties can revise this to suit local conditions, and can do so in their own language by using the Local Benchmark option. All benchmarks defined by third parties in Module A are automatically copied to Module B, for use by Designers.

Figure 8: Typical Benchmark statement for a text-based parameter.

D2.1 Design features to maximize effectiveness of ventilation in naturally ventilated occupancies				
Intent	*To ensure that the number, placement and type of windows or other openings in a naturally-ventilated building are capable of providing a high level of air quality and ventilation.*		Applicable phases (Active if green)	
Indicator	Area and location of windows that provide natural ventilation.		Dsn	Ops.
Information sources and notes	Cross-ventilation is defined as spaces where operable windows are located on at least two separate walls.			
	Whole Building Design Guide			
Applicability	Total Building, all sizes, under user-defined height limit.		Height limit, floors	20
	Total Project			Score
Negative	The aggregate area of openings from primary occupancy areas to the exterior is less than 5% of the aggregate primary floor area, and less than 50% of all primary spaces have cross-ventilation.			-1
Acceptable practice	The aggregate area of openings from primary occupancy areas to the exterior is at least 5% of the aggregate primary floor area, and more than 50% of all primary spaces have cross-ventilation.			0
Good Practice	The aggregate area of openings from primary occupancy areas to the exterior is at least 5% of the aggregate primary floor area, and at more than 75% of all primary spaces have cross-ventilation.			3
Best Practice	The aggregate area of openings from primary occupancy areas to the exterior is at least 10% of the aggregate primary floor area, and more than 90% of all primary spaces have cross-ventilation.			5

Assessments

For assessments of Design stage performance, Designers can carry out self-assessments using Module B, which takes its values for weights and benchmarks from a Module A file that has been calibrated by a credible third party. We do not suggest that Design-phase assessments should serve as the basis of certification, because of the changes that can occur before occupancy that will affect final Operating performance. The two figures below show the Assessment modules for the two Benchmark examples shown previously in Figures 7 and 8.

Figure 9: Assessment module for parameter D2.1

D2.1 Design features to maximize effectiveness of ventilation in naturally ventilated occupancies		Active	39.1%	
Intent	*To ensure that the number, placement and type of windows or other openings in a naturally-ventilated building are capable of providing a high level of air quality and ventilation.*	Applicable phases (Active if green)		
Indicator	Area and location of windows that provide natural ventilation.	Dsn	Ops.	
Information sources and notes	Cross-ventilation is defined as spaces where operable windows are located on at least two separate walls.	Occupancies used:		
	Whole Building Design Guide	-	Office	Retail
Applicability	Total Building, all sizes, under user-defined height limit.	Height limit, floors		20
Relevant Context Information				
	Total Project			
Designer notes				
Relevant Design Information	Total Building area naturally ventilated: >5200 m2		Performance Score	Wtd. Score
Actual Design value	The aggregate area of openings from primary occupancy areas to the exterior is at least 5% of the aggregate primary floor area, and at more than 75% of all primary spaces have cross-ventilation.		3.0	1.17
Negative	The aggregate area of openings from primary occupancy areas to the exterior is less than 5% of the aggregate primary floor area, and less than 50% of all primary spaces have cross-ventilation.			-1
Acceptable practice	The aggregate area of openings from primary occupancy areas to the exterior is at least 5% of the aggregate primary floor area, and more than 50% of all primary spaces have cross-ventilation.			0
Good Practice	The aggregate area of openings from primary occupancy areas to the exterior is at least 5% of the aggregate primary floor area, and at more than 75% of all primary spaces have cross-ventilation.			3
Best Practice	The aggregate area of openings from primary occupancy areas to the exterior is at least 10% of the aggregate primary floor area, and more than 90% of all primary spaces have cross-ventilation.			5

Figure 10: Assessment module for parameter F1.4

F1.4 Adaptability constraints imposed by building envelope and technical systems		Active	19.4%	
Intent	*To ensure that the building envelope, HVAC and electrical systems of the original occupancy offer a degree of flexibility that will allow occupancies to be changed with a reasonable level of renovation work.*	Applicable phases (Active if green)		
Indicator	The ease or difficulty in altering the building envelope or technical systems to suit a new occupancy type.	Can	.	
Information sources and notes	Reference A, Board C.	Occupancies used		
Applicability	Total building allocations.	.	Office	Retail
Relevant Context Information				
	Total Project			Score
Designers notes				
Relevant Design Information			Perform. Score	Wtd. Score
Design value (predicted)	Adaptation to another building use would require moderate renovation, but most of the HVAC systems can be salvaged and rebuilding of the exterior walls and fenestration would require only minor modification.		3.0	0.58
Negative	Adaptation to another building use is not possible.			-1
Acceptable practice	Adaptation to another building use would require extensive renovation, including replacement of most HVAC systems and rebuilding of the exterior walls and fenestration.			0
Good Practice	Adaptation to another building use would require moderate renovation, but most of the HVAC systems can be salvaged and rebuilding of the exterior walls and fenestration would require only minor modification.			3
Best Practice	Adaptation to another building use would require minor renovation, HVAC systems would require only minor modifications and exterior walls and fenestration remain appropriate to the new function.			5

Other aspects of GBTool

The GBC method assumes that some calculations, such as energy simulations, will be carried out in separate programs, with the results entered in the appropriate section of GBTool. In the case of embodied energy and emissions, a third-party program can be used, or the optional (crude) GBTool estimated values. The use of this feature requires the input of materials data as indicated. If the GBTool embodied estimating procedure is used, third parties also have the option of providing a discount rate for existing materials, to give credit to materials that have been produced

Because the re-use of existing buildings and materials, or renovation, are of increasing importance, GBTool allows users to enter data about Existing or New buildings, and therefore projects can be assessed that consist of existing structures or new ones, or a mixture of the two.