Part A, User Guide to the SBTool 2012 assessment framework

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A. Introduction to SBTool 2012

The *SBTool Generic* system is a generic framework for building performance assessment that may be used by third parties to develop rating systems that are relevant for a variety of local conditions and building types. It may also be thought of as a rating system toolbox.

The SBTool is based on the philosophy that a rating system must be adapted to local conditions before its results can become meaningful. The system is therefore designed as a generic framework, with local non-commercial organizations being expected to define local context conditions and to develop appropriate weights and benchmarks. The system has been designed to facilitate such a regional calibration; in fact, the system requires the insertion of regionally meaningful benchmarks.

> *It is important to understand that benchmark text and other data will be found in the generic files, but their purpose is only to demonstrate how the system works. Local authorized third parties should thereofre replace this material with more locally relevant information.*

Key features of the system include the following:

■ SBTool 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, ranging from 120 criteria to half a dozen;

■ The system 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, in local languages. Thus, many versions can be developed in different regions that look quite different, while sharing a common methodology and set of terms. The main advantage, however, is that an SBTool version developed with local knowledge is likely to be much more relevant to local needs and values than other systems;

■ The system provides separate modules for Site and Building assessments, with Site assessments carried out in the Pre-design phase and Building assessments carried out in Design, Construction or Operations phases;

■ SBTool takes into account region-specific and site-specific context factors, and these are used to switch off or reduce certain weights, as well as providing background information for all parties. Weights for criteria that remain active are re-distributed, so that the total always remains 100%.

■ There is a capacity to carry out assessments at four distinct stages of the life-cycle and the system provides default benchmarks suited to each phase;

■ Parameters can be calibrated for up to three occupancy types, within a single building or as separate structures in a large project;

■ The system handles large projects or single buildings, residential or commercial, new and existing construction, or a mix of the two.

■ Designers can specify performance targets and can score self-assessed performance;

■ Assessors can accept self-assessed performance scores submitted by designers, or can modify them.

The system is provided as a set of two Excel files. Any of the variations described above are accommodated within the standard file set, by means of disabling various fields.

B. Detailed description of SBTool 2012

B1. Structure

The SBTool system consists of two distinct assessment modules that are linked to phases of the life-cycle; one for Site Assessment, carried out in the Pre-Design phase; and another for Building Assessment, carried out in the Design, Construction or Operations phases. Each of these assessment modules is further divided into two files, File A related to settings relevant to the generic project type in a specific region, and one or several File Bs which take their values from the single File A. Thus, one File A can be established that will set weights and benchmarks for many projects, with each one described in a separate File B.
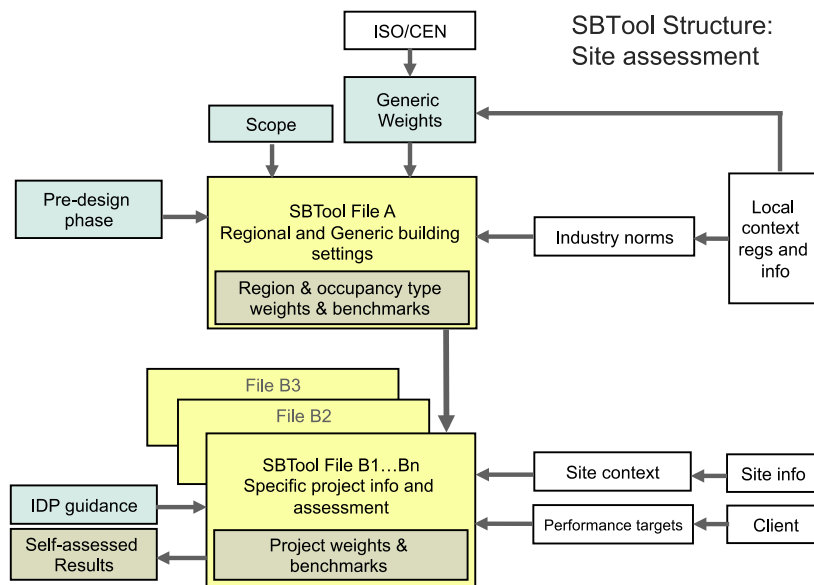

Figure 1:
Components used for locational and site assessments, if the Pre-Design phase is selected. File A is used to establish regionally relevant benchmarks, while one or more File Bs allow assessment to be made for a specific project.
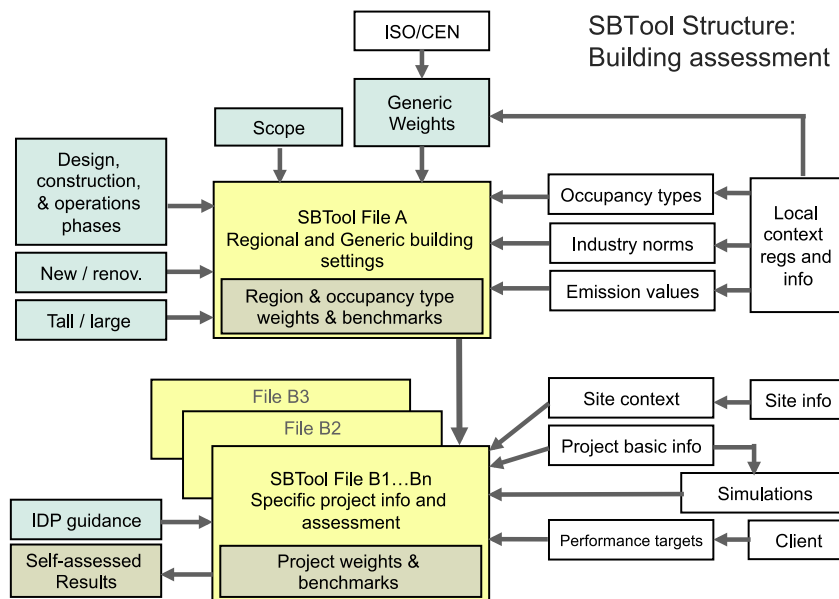

Figure 2:
SBTool File B structure applicable to assessment of projects in Design, construction or operations.

Figure 3 shows the relationship of system elements used for Building assessments. As with site assessments, File A is used to set regional benchmarks, but for the case of building projects the Design, Construction or Operations phases are applicable. Also in the Building assessment case, more factors are considered, including specifics related to occupancy types, whether the settings are to be suited for new v. renovation projects and if the settings are to be suited for tall buildings, with the height threshold set by the authorized third parties.

For Project assessments, File B is also used to describe and assess specific projects that may contain any of the occupancies defined in File A, all assessed against the benchmarks and weights set in File A. Each File B contains added information related to the multiple characteristics that are needed to describe a building project, including basic data on number of occupancies, area, number of floors, and more detailed data on population, floor heights, area of naturally ventilated and mechanically conditioned space, and results of external calculations of energy performance. Performance assessments are subject to weights and benchmarks established in File A and include Target settings, self-assessed values and (optionally) third party verification. Procedurally, designers or clients enter target values for scores, in 1/2 point increments up to +5, and then enter self-assessed values based on analysis data available when contract documentation is completed.

SBTool also includes a section in File B on the integrated design process (IDP) that will be useful guidance to designers working their way through the design process. The IDP parameters are not functionally linked to scoring but are linked for information purposes only to appropriate scoring benchmarks.

B2. Scope

The system is designed to permit authorized third parties to select one of four scope options, which determine the number of active generic criteria. All of these have been developed as generic defaults, and all users must review and modify or replace these as required to produce locally relevant versions. Note that criteria can be turned off in the Weights worksheets to further reduce the number of potentially active generic criteria, with the exception of a small number of mandatory criteria. The generic criteria potentially active in this version are shown in Figure 4, and the features of the scope variants are explained below.

Developer scope

The Developer version contains all criteria that have been developed, or are under development, and is for the use of the core development team, or for reference by others. This version is not shown in Figure 4.

Maximum scope

The Maximum version contains all criteria that have been fully developed with benchmarks and that could be used in assessments.

Mid-size scope

The Mid-size version is suggested as a version that covers most important performance issues, while remaining reasonably workable for those who are faced with the task of modifying the generic criteria with others that are specifically suited to their region. This version is issued with 54 active criteria for the Design phase version, 11 for Construction phase and 55 for Operations. However, this the most flexible of the variants and can easily be scaled down or up in scope.

Minimum Scope

The minimum scope version contains what the development team considers to be the minimum number of criteria to cover key issues. Clearly, this may be too limited for some, but it does offer a quicker and less complex route to assessment. The version issued contains 14 active criteria, of which 9 are mandatory for all versions.

Figure 3: *The recommended Minimum scope version*

■	A2.3	Impact of orientation on the passive solar potential of building(s).	3.27%
■	A3.13	Provision of on-site parking facilities for private vehicles.	2.62%
■	B1.1	Embodied non-renewable energy in original construction materials.	16.35%
◆	B1.3	Consumption of non-renewable energy for all building operations.	16.35%
◆	B3.1	Degree of re-use of suitable existing structure(s) where available.	6.54%
◆	B4.2	Use of water for occupant needs during operations.	7.85%
◆	C1.3	GHG emissions from primary energy used for all purposes in facility operations.	27.25%
■	C5.1	Impact on access to daylight or solar energy potential of adjacent property	9.81%
◆	D1.5	CO2 concentrations in indoor air.	1.31%
◆	D3.1	Appropriate daylighting in primary occupancy areas.	1.31%
◆	E1.8	Occupant egress from tall buildings under emergency conditions.	2.18%
■	E4.5	Adaptability to future changes in type of energy supply.	1.96%
◆	F1.1	Access for mobility-impaired persons on site and within the building.	2.62%
◆	G1.5	Affordability of residential rental or cost levels.	0.58%

Note that red diamonds indicate mandatory criteria, also that third parties can enable or disable other criteria.

B3. Phases for assessment

The SBTool system allows assessments to be made in four distinct phases.

Pre-design phase: this phase is relevant to the selection of a project site and its characteristics. In SBTool, this is a separate assessment and it is assumed that there is no information available about the nature of the subsequent project development.

Design phase: assessments of the potential operating performance of the project are carried out in this phase, based on pre-construction documents and data.

Construction phase: assessment in this phase covers the process of construction and does not result in an assessment of the potential operating performance.

Operations phase: assessment in this phase focuses on the actual operating performance of the project, assessed at a time that is at least two years after occupancy. Many criteria active in the Design phase are also active in this phase, but different methods are used to assess performance – for example, potential operating energy consumption may be simulated in a Design phase assessment, but in an Operations phase assessment, actual operating energy consumption is based on momitored real data.

B4. Organization of Criteria

Figure 4 specifies the number of criteria that are active in File A, according to the scope or size of the system, the Phase (Pre-Design, Design, Construction or Operations) and the 8 Issue types in the system.

The Pre-Design phase contains from 8 to 35 active criteria, depending on the scope of the system. This is a much smaller number of criteria than those active for other phases, and reflects the fact that this phase is only applicable to Site Assessment, which is less complex than assessment of a building.

It should be noted that the Maximum scope versions show all the criteria that are currently operational. The Minimum versions show the smallest number of criteria that are considered by the system developers to be needed for a meaningful assessment, and it consists mainly of criteria that are mandatory for all versions. The Mid-size scope version consists of about 50 criteria in order to maintain a system of manageable scope, but this version can be easily be expanded or reduced.

Figure 4: All active criteria by Scope, Issue and Phase, excluding Developer version

Issue area	Scope	Pre-design	Design	Construction	Operation
Site Location, Available Services and Site Characteristics	Max.	35			
	Mid.	20			
	Min.	8			
Site Regeneration and Development, Urban Design and Infrastructure	Max.		22	0	21
	Mid.		12	0	11
	Min.		2	0	2
Energy and Resource Consumption	Max.		10	6	10
	Mid.		8	4	7
	Min.		4	2	3
Environmental Loadings	Max.		19	7	18
	Mid.		6	1	6
	Min.		2	0	2
Indoor Environmental Quality	Max.		18	0	19
	Mid.		10	0	10
	Min.		2	0	2
Service Quality	Max.		20	9	25
	Mid.		10	4	13
	Min.		2	1	2
Social, Cultural and Perceptual Aspects	Max.		10	2	10
	Mid.		5	1	5
	Min.		1	0	1
Cost and Economic Aspects	Max.		4	1	4
	Mid.		3	1	3
	Min.		1	0	1
Total System	Max.	35	103	25	107
	Mid.	20	54	11	55
	Min.	8	14	3	13

B5. Criteria Framework

As previously outlined, the SBTool system provides separate assessments for Site and for Buildings. All criteria used in SBTool are stuctured under Issue and Category headings that are related to impact categories to the extent possible. For example, *Energy and Resource Consumption* is related to resource depletion, while *Environmental Loadings* is related to impacts on human health, ecological and climate systems.

Issues and Categories S, Pre-design phase only

S   Site Location, Available Services and Site Characteristics
S1   Site Location
S2   Off-site service available
S3   Site characteristics

Issues and Categories A to G, Design, Construction and Operations phases

A   Site Regeneration and Development, Urban Design and Infrastructure
A1   Site Regeneration and Development
A2   Urban Design
A3   Project Infrastructure and Services
B   Energy and Resource Consumption
B1   Total Life Cycle Non-Renewable Energy
B2   Electrical peak demand for facility operations
B3   Use of Materials
B4   Use of Potable Water, Stormwater and Greywater
C   Environmental Loadings
C1   Greenhouse Gas Emissions
C2   Other Atmospheric Emissions
C3   Solid and Liquid Wastes
C4   Impacts on Site
C5   Other Local and Regional Impacts
D   Indoor Environmental Quality
D1   Indoor Air Quality and Ventilation
D2   Air Temperature and Relative Humidity
D3   Daylighting and Illumination
D4   Noise and Acoustics
D5   Control of electromagnetic emissions
E   Service Quality
E1   Safety and Security
E2   Functionality and efficiency
E3   Controllability
E4   Flexibility and Adaptability
E5   Optimization and maintenance of environmental operating performance.
F   Social, Cultural and Perceptual Aspects
F1   Social Aspects
F2   Culture & Heritage
F3   Perceptual
G   Cost and Economic Aspects
G1   Cost and Economics

B6. Occupancies and benchmarking

File A is intended to establish context information, weights and benchmarks related to a generic project type in a specific region. In a setting where SBTool is used for commercial assessment, the information required for File A is to be provided by parties who have no connection with or interest in a specific project. Another aspect of the nature of SBTool is that the default values used in the system (to show how it works) are meaningless for a particular application unless the system is first calibrated for the specific region and building type. This feature of SBTool means that there is extra work to do before it is used. On the other hand, it also means that the A file can be used to assess many projects within a region, and the results will be more relevant as a result of the calibration process.

The system provides a pick list of 12 generic occupancies in File A from which up to 3 can be selected. Generic default benchmarks suited to residential or non-residential uses are automatically inserted. Data values for a small number of key numeric benchmarks are automatically selected from the *KeyBmk* worksheet, assuming that values appropriate to occupancy types in the region have been inserted.

B7. Weighting

The weighting system for SBTool 2012 can be described as quasi-objective, and is designed to strike a balance between scientific correctness and usability. SBTool follows the general principles of separating Loadings and Impacts; Loadings being inputs or outputs related to the project and Impacts being the effects on natural or human systems. There are complex cross-linkages between the two, but generally it can be said that a single project cannot be held responsible (positively or negatively) for impacts on the very much large human or natural systems. Despite this limitation, it has proven useful to organize Loadings on the basis of not only scientific logic but also the most relevant impact categories.

The main factors used in the SBTool weighting system include the following, which are given point scores and then multiplied together (see Fig. 7):

   a. Extent of potential effect
   b. Duration of potential effect
   c. Intensity of Potential Effect
   d. Importance of primary system directly affected
   e. Regional adjustment, which gives authorized third parties the ability to adjust the score factors derived from a*b*c*d up or down a maximum of 10%.

Factors included in sections (a), (b), (c) and (d) are automatically calculated, based on score allocations made by the development team. Factors included in section (d) are loosely derived from ISO impact categories.

It should be noted that the SBTool system allows authorized third parties to change or adjust the points related to each weighting factor. The current factors follow the general pattern of assigning more points for factors that are likely to have greater effect. For example, points for (a), (b) and (c) follow a scalar pattern from 1 to 5. In the case of (d), the points are allocated according to what the system developers consider to be more significant for individuals, society and nature. Thus, Global climate is allocated 5 points, given that climate change will have a serious impact on human civilization, human life and natural systems.

Figure 5: Weighting factors for SBTool (hidden in Weighting sheets)

Adjustable ← → | ← Pre-set values →

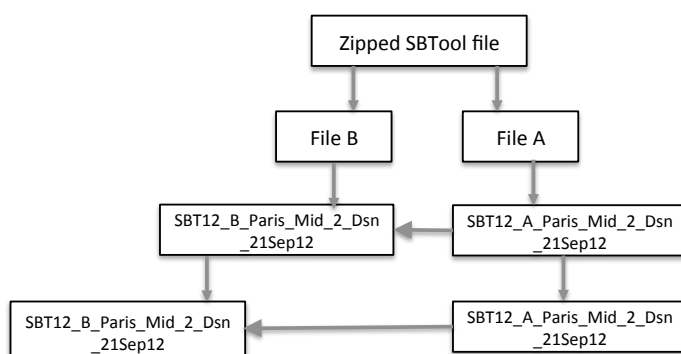| Local effects	Extent of potential effect (1 to 5 points)	Duration of potential effect (1 to 5 points)	Intensity of potential effect (1 to 3 points)	Primary system directly affected (1 to 5 points)
1 Much less	1 Building	1 1 to 3 years	1 Minor	1 Functionality and servicability
2 Less	2 Site / project	2 3 to 10 years	2 Moderate	1 Cost and economics
3 OK	3 Neighborhood	3 10 to 30 years	3 Major	2 Well-being, security and productivity of individuals
4 More	4 Urban / Region	4 30 to 75 years		2 Social and cultural issues
5 Much more	5 Global	5 >75 years		3 Land resources
				3 Non-renewable material resources
				3 Non-renewable water resources
				4 Non-renewable energy resources
				3 Ecosystem(s)
				4 Local and regional atmosphere
				5 Global climate

C.   Information and procedures related to File A

This file is used by authorized third party organizations to establish and/or adjust benchmarks, weights and other information to represent, as objectively as possible, for the region and generic building type(s) of application.

It is important to note that a project owner, designer or assessor should never be permitted to take part in this process, except where the application is for a pilot project. As the diagrams following indicate, specific projects are assessed using File B, which contains settings that are determined by settings in File A.

C1. Procedures related to setting up the system

1. After having selected the appropriate version, open the two relevant files in sequence - A, then B. You will need the 2011 Excel (xlsm) software, and you will have to allow the Macro option to be enabled.

2. Keep this set of two files always in the same folder, and re-name each file appropriately in sequence – remember that File B is always looking for information from the companion File A, so if you change the name of File A without having File B open at the same time, File B will lose the connections.

Zipped SBTool file

File B   File A

SBT12_B_Paris_Mid_2_Dsn _21Sep12   SBT12_A_Paris_Mid_2_Dsn _21Sep12

SBT12_B_Paris_Mid_2_Dsn _21Sep12   SBT12_A_Paris_Mid_2_Dsn _21Sep12

Make sure that the name for the A file contains the name of the region, while the B file contains the name of the specific project. For example, the A file might be called BT12_A_Paris_Mid_2_Dsn_21Sep12.xlsm *, while a B file might be titled* BT12_B_Paris_Project Alpha_21Sep12.xlsm.

3. Become familiar with the file structure.

    Each of the files contains many worksheets, and users should browse through the system to become familiar with their location and content. We have made extensive use of the Excel feature of grouping rows and columns, to allow users to see information at high levels and also at lower and more detailed levels

Now start to work with File A, leaving File B open but untouched for the time being. We suggest the following sequence, after you look at Fig. 6 on the next page:

4. If you wish to carry out a **Project Assessment** go to **BasicA** and identify the location, selecting the scope, content type and up to three occupancies, and setting other parameters that are described on C2;

    ■   Modify the **WeightA** worksheet to turn off non-mandatory weights that are inappropriate and where you can adjust the criteria weight with Regional adjustment; If you eliminated some criteria by setting their weights to zero, go back to the BasicA worksheet and use the Macro button to hide all inoperative rows.

    ■   Provide information for the **ContextA** worksheet.

    ■   Provide information for the **KeyBmks** worksheet

    ■   Provide the benchmarks required in the **Bmk worksheets**, starting with BmkA and ending with BmkG This is a major part of the work and requires work with scientific authrities to determine valid and objective information related to Minimum (0) and Best Practice (+5) performance levels for all active criteria. For Minimum performance values, building stock and industry norms can be used, but for Best Practice, it is likely that expert panels will be required.

    If you have chosen to use Local Content on BasicA, you will have to insert the relevant text or data in the Local Content column of each Bmk worksheet, usually located in Column G (see pg. 22). Doing this will require that you give the password ("SBTool") and then open up the worksheet horizontally.

    ■   Obtain relevant information about the mix of fuels used to generate electricity in your region and enter it in the **Emission** worksheet.

    ■   Check that relevant information from File A has been captured in the corresponding locations in File B. If it has not, it may mean that you changed the name of File A while File B was closed, and that File B is now confused.

5. If you want to carry out a **Site Assessment**, start with the **BasicA** worksheet (see C2) and select the Pre-Design phase, which is limited to Site assessment. Note that the selection of Pre-Design activates the Site section of the WeightA worksheet and de-activates all weights and benchmarks for project information. And vice-versa. Other actions required are similar to a Project Assessment except for the fact that the number of criteria in a Site Assessment are fewer, and they are all located in the **BmkS** worksheet.

Figure 6: *Overview of Worksheet Relationships in File A*

The figure below shows the relationship of all user-accessible worksheets in File A. Note that the file names shown are purely notional.

Figure 7: *Overview of Worksheet Relationships in File B*

The figure below shows the relationship of all user-accessible worksheets in File B. Note that the file names shown are purely notional.
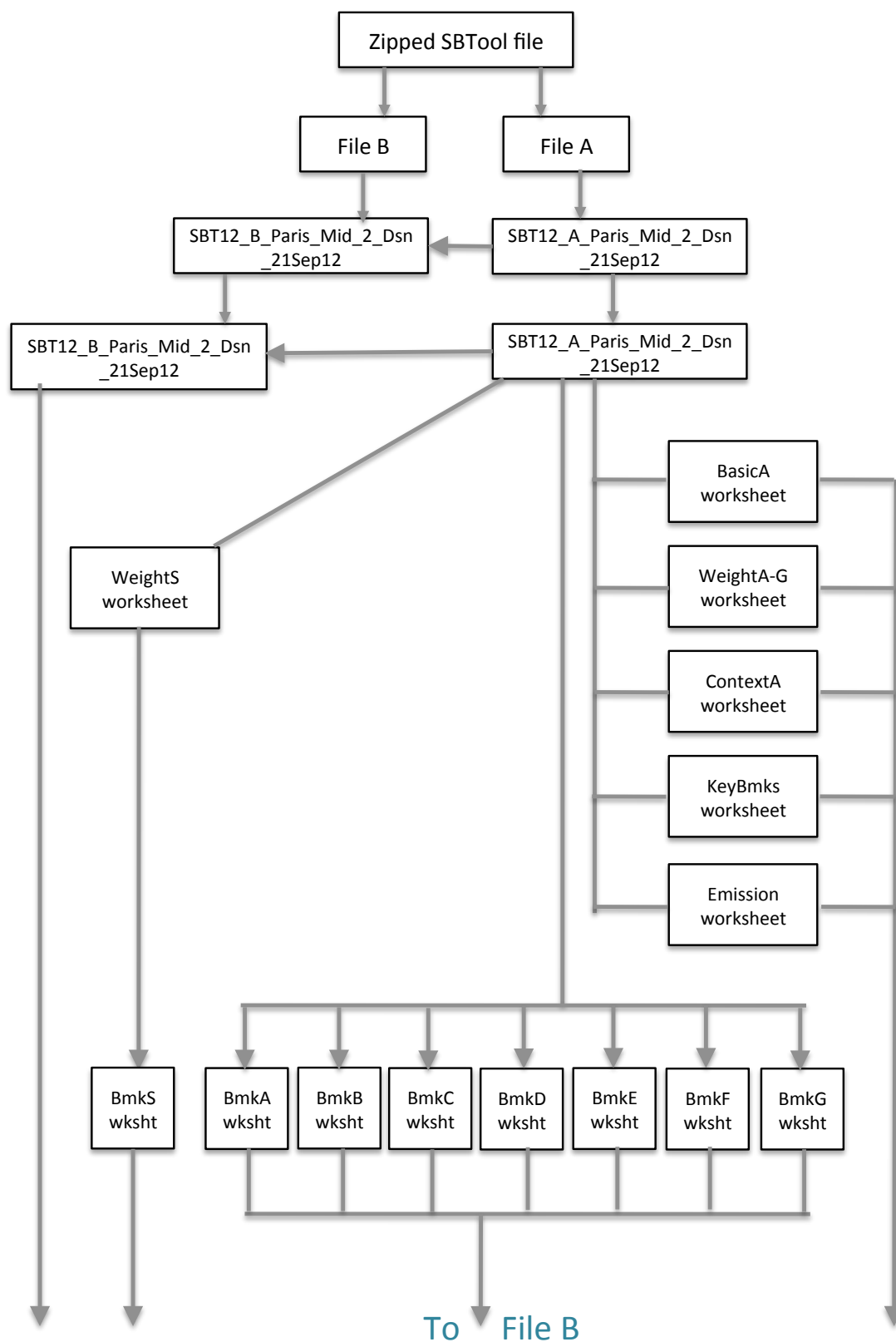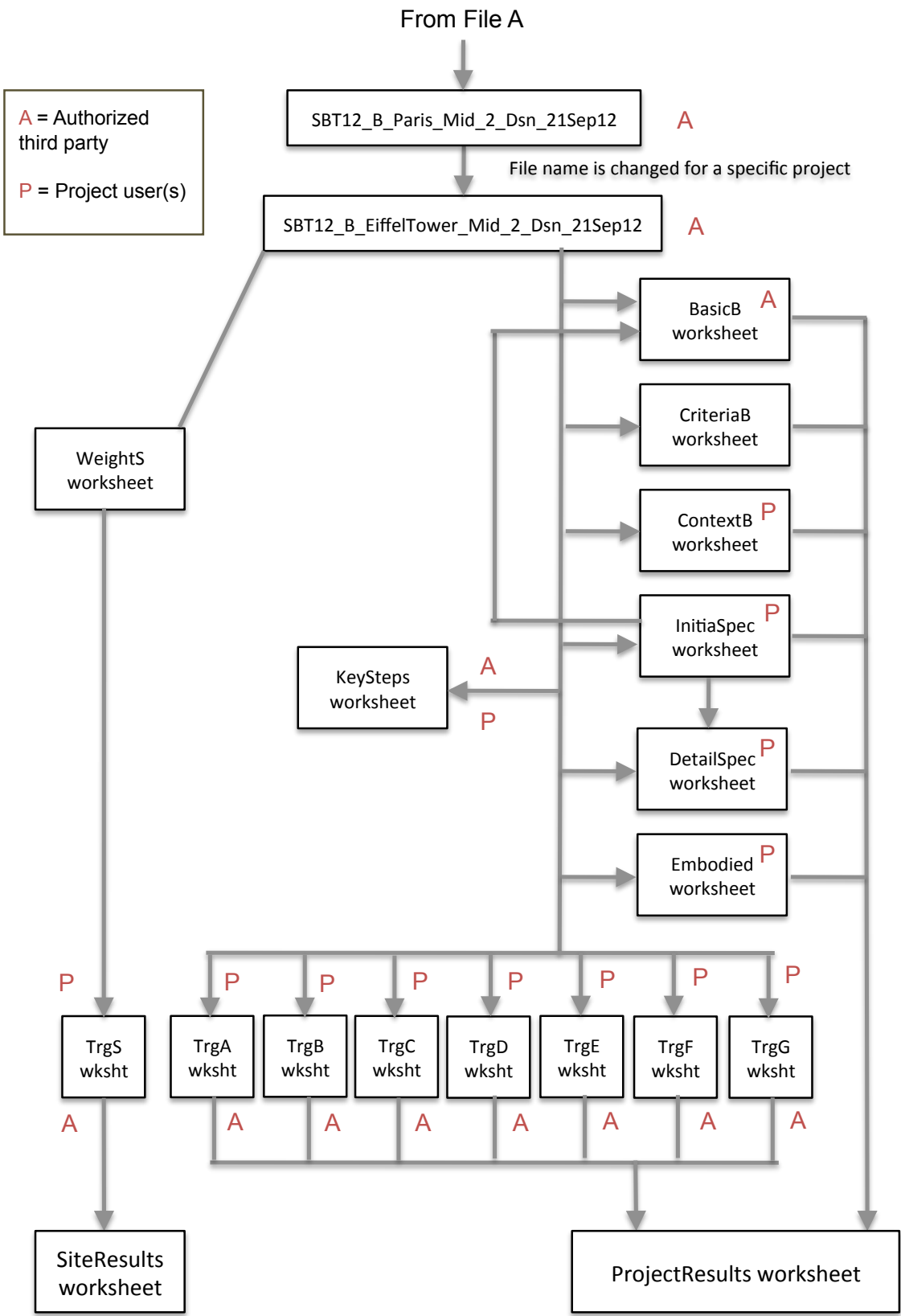
C2. The *BasicA* Worksheet

Figure 8 shows the BasicA worksheet in File A. This is an important worksheet, because many settings can be made here that affect worksheets throughout File A and File B. The worksheet also shows how all user-accessible fields in the system are are designed to either accept text or data, or else to have a value selected from a pick list accessible from blue click buttons. Fields that are grey or without colour are locked and not accessible, unless you use the password "SBTool" which is also standardized throughout the system.

Figure 8: The BasicA worksheet

When opening the set of two files, allow the Macro option to be activated.

Go to the **BasicA** worksheet in File A. Note that this worksheet and all others in the workbook contains dummy or hypothetical values to demonstrate how the system works, but users are expected to insert or select content that is relevant for thieir region and occupancy types.

In the yellow fields, provide the requested information.

The file selected in this example is for a **Mid-size *** version, which comes with 50 active criteria. You can reduce the number of criteria in this version by going to the **WeightsA** sheet.

The **Design Phase** is active. Alternatives include **Pre-Design, Construction** and **Operations *.**

The example file is set for **Generic content**. If you want to use different content or language (e.g. to establish different benchmarks in Danish), select the **Local Content** option.

The example is set up for **New Construction**, but you can change this to **Renovation**.

You can change the number of floors above grade that is used in the system to define Tall buildings. The deafult shown here is 25 floors.

The assumed longevity for the building is assumed here to be 75 years, but can be changed.

* If you want to change these basic settings, we suggest that you open another zipped set of files instead of trying to modifying this one.

The system contains fields that are hidden under various circumstances. Macro buttons are used to unhide or hide rows as needed. When changing settings, first unhide all, then hide to suit the changed configuration – but hiding takes time !

Select also up to three (3) occupancy types that will be used throughout the system to define the project. These are selected from a pick list that shows 12 potential occupancies. The first position is reserved for residential occupancies.

This number sets the minimum score needed for mandatory items.

The currency type used can be changed

The size of projects defined as "large" can be changed.

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C3. The SBTool *WeightA* Worksheet

The way in which these factors are presented in the SBTool system is shown in Figure 9a and 9b. The four columns at the left show which criteria are active in the various scope options. Criteria can be turned off by authorized third parties (clickable blue box) except for red diamonds which indicate criteria which are mandatory for assessment in all versions. The total of all active weights is 100%, since weights for inactive criteria are redistributed amongst others.

Go to the **Weights** worksheet.

The information box shows the version and the number of criteria that are potentially active for the generic project in this phase and in this region. This number may be reduced when applied to the specific project in File B, depending on the characteristics of the project.

Only part of the Weights sheet is shown.

The graphic shows the breakdown of weights within 7 pre-defined performance Categories:
- Urban Design
- Energy and resources
- Environmental loadings
- Indoor environmental quality
- Service quality
- Social and perceptual issues
- Cost and economic issues

The 3 information boxes at the top show options selected in the BasicA worksheet for content type, phase and new construction v. renovation.

Figure 9a: SBTool WeightA Worksheet

Go to BasicA worksheet to select different versions of the system.

Generic weightings for occupancy types listed, in Arniel, Atlantis

Generic

Design Phase

Renovation

Mid-size Version
50 active parameters
Design Phase

- A. Urban design ... Site
- B. Energy and resources
- C. Environmental loadings
- D. IEQ
- E. Service quality
- F. Social and perceptual
- Economic

Issue weights are the sum of Category weights in that Issue.

The active criteria for the four Scope versions are shown in the 4 columns at the left. the active version, in this case Mid-size, is marked with an orange bullet.

Category weights are the sum of criteria weights in that Category.

The green bullets indicate that the criterion is active for this Scope version – in this case, Midsize.

The right-hand column shows the percentage weight for each active criterion. The sum of all active criteria weights always add up to 100%, being adjusted for criteria weights that are turned off.

Parameters active in Issues A = 43				A	Site Regeneration and Development, Urban Design and Infrastructure	**18.7%**	
				A1	Site Regeneration and Development	**9.9%**	
	■	■	■	A1.5	Remediation of contaminated soil, groundwater or surface water.		2.24%
	■	■	■				2.69%
	■	■	■		...ling.		1.34%
	■	■	■		...e of native plantings.		1.34%
	■	■	■				0.45%
	■	■	■	A1.12	Provision and quality of bicycle pathways and parking.		0.90%
	■	■	■	A1.13	Provision and quality of walkways for pedestrian use.		0.90%
				A2	Urban Design	**6.2%**	
	■	■	■	A2.1	Maximizing efficiency of land use through development density.		3.36%
■	■	■	■	A2.3	Impact of orientation on the passive solar potential of building(s).		1.68%
	■	■	■	A2.5	Impact of site and building orientation on natural ventilation of building(s) during warm season(s).		1.12%
				A3	Project Infrastructure and Services	**2.7%**	
	■	■	■	A3.9	Provision of surface water management system.		1.34%
■	■	■	■	A3.13	Provision of on-site parking facilities for private vehicles.		1.34%
Parameters active in Issues B = 8				B	Energy	**35.0%**	
				B1	Total Li...	**16.8%**	
■	■	■	■	B1.1	...materials.		8.40%
◆	◆	◆	◆	B1.3	Consumption of non-renewable energy for all building operations.		8.40%

The active criteria for the four Scope versions are shown in the 4 columns at the left. the active version, in this case Mid-size, is marked with an orange bullet.

The red diamonds indicate criteria that are mandatory for all scope versions.
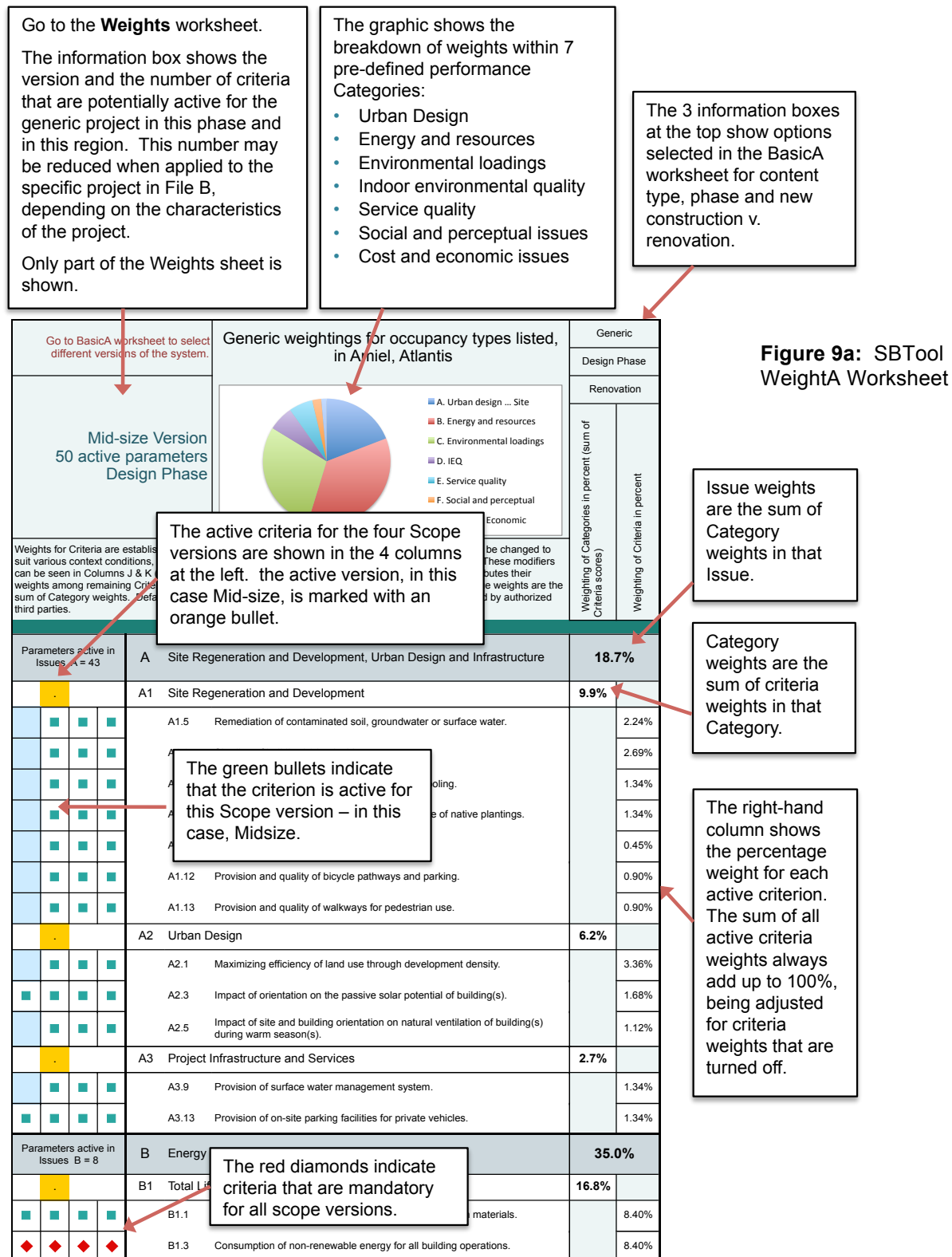
Figure 9b: SBTool WeightA Worksheet - details

The graphic below shows details of how the weights are established, using the same example as on the previous page.

The weighting system consists of 5 scalar factors that are used to construct final weights for criteria. Each factor is assigned a score, depending on which position on the scale is chosen. The algorithm is:

Weight score = Primary issue x Intensity x Duration x Extent x Adjustment factor

The Weight score is then normalized to keep the sum of all active weights = 100%.

Primary Issue scale (scores at left):

1 Functionality and servicability
1 Cost and economics
2 Well-being, security and productivity of individuals
2 Social and cultural issues
3 Land resources
3 Non-renewable resources
3 Ecosystem(s)
4 Local and regional atmosphere
5 Global climate

Intensity scale (scores at left):

1 Minor
2 Moderate
3 Major

Duration scale (scores at left):

1 1 to 3 years
2 3 to 10 years
3 10 to 30 years
4 30 to 75 years
5 >75 years

Extent scale (scores at left):

1 Building
2 Site / project
3 Neighborhood
4 Urban / Region
5 Global

Extent scale (scores at left):

1 Much less
2 Less
3 OK
4 More
5 Much more

Figure 9c below gives an indication of the effect that changes in the regional adjustment button has on the final weighting of a mid-size scope version. In the example shown, when the weight adjustment for Criterion D1.5 (CO_2 concentrations in indoor air) is set to "Much more", which is a 10% increase, the resulting final weight increases from 1.24% to 2.05%.

Obviously, there must be a clear rational for making use of the regional weight adjustment button, but it does allow the system to be fine-tuned to particular local conditions.

Figure 9c: Use of regional weighting adjustment (example)

D1.5	CO_2 concentrations in indoor air.		0.34%	3	OK
D3.1	Appropriate daylighting in primary occupancy areas.		0.34%	3	OK

D1.5	CO_2 concentrations in indoor air.		0.57%	5	Much more
D3.1	Appropriate daylighting in primary occupancy areas.		0.34%	3	OK

C4. *ContextA* worksheet

Existing commercial rating system take little account of context factors, but this is an important feature of SBTool. In File A, a *Regional Context* worksheet permits the identification of regionally-relevant context factors, such as solar hours, degree of urbanization, water scarcity, winter design temperatures etc. Similarly, File B contains a *Project Context* worksheet that allows factors specific to the project to be identified. The Context information is included on the grounds that many context factors can affect a decision on whether or not a performance criterion should be active or inactive. For example, the effective re-use of an existing structure on the\ site is certainly very important, as is preservation of its heritage value, but these become moot if there is no existing structure or if it has no heritage value. Other site-related context factors include the ecological or agricultural value of the site before development, soil contamination and factors that may affect the possibility of using solar technologies.

Regional Context for Amiel, Atlantis

	Context Issue	Click blue
	Click 1 or 2 at upper left to show details	*The purpose of this worksheet is to characterize aspects of urban surroundings that may support or limit the performance of the building. Go to Level 2 to see availabl...*
1	Urban area type	Small city of 10,000
2	Seismic zone type (Uniform Building Code, USA)	Zone 3
3	Climate zone (based on Köppen)	Cfa, Cwa: Humid su... Hong Kong)
4	Winter Design temperatures	2 1/2% Winter Desig...
5	Average annual soil temperature 2m. below grade in ºC	
6	Average difference, max. and min. diurnal temperatures in warm season, ºC	
7	Annual heating degree days below 18ºC.	
8	Annual cooling degree days above 18ºC.	
9	Average relative humidity during warm season	
10	Average relative humidity during warm season	
11	Annual precipitation, mm	
12	Solar irradiance, kWh/m2 per year on horizotal surface	

Regional Context for Amiel, Atlantis

	Context Issue	
	Click 1 or 2 at upper left to show details	*The purpose of this worksheet is to characterize aspects of urban surroundings that may support or limit the performance of the building. Go to Level 2 to see available text to make y our choice, or change those choices.*
	Comment	Descriptors of condition
1	Urban area type	Small city of 10,000 to 50,000 population
		Rural setting
		Community of 1,000 to 10,000 population
		Small city of 10,000 to 50,000 population
		City of 50,000 to 250,000 in population
		City with population of more than 250,000
2	Seismic zone type (Uniform Building Code, USA)	Zone 3
		Zone 4
		Zone 3
		Zone 2
		Zone 1
3	Climate zone (based on Köppen)	Cfa, Cwa: Humid subtropical (Houston, Milan, Okinawa, Sao Paulo, Hong Kong)
		A1: Tropical rainforest (Kuala Lumpur, Singapore)
		A2: Tropical Monsoon (Bangladesh, Miami)
		A3: Tropical wet and dry or svanna (Rio de Janeiro, Mumbai, Veracruz)
		BW: Dry, desert climate
		BWh: Dry, desert, warmest month >0ºC
		BWk: Dry, desert, warmest month <0ºC
		BS: Dry, steppe climate
		BWh: Dry, steppe, warmest month >0ºC
		BWk: Dry, steppe, warmest month <0ºC
		C: Temperate / mesothermal (avg. temperature >10ºC in warmest months, from -3ºC to 18ºC in warmest months.
		Cs: Dry-summer subtropical or Mediterranean (Madrid, Marseille, San Francisco)
		Cfa, Cwa: Humid subtropical (Houston, Milan, Okinawa, Sao Paulo, Hong Kong)
		Cfb: Maritime Temperate or Oceanic (Bergen, Melbourne, Vancouver)
		Cwb: Temperate climate, dry winters (Mexico City, Johannesburg)
		Cfc: Maritime subartctic or Subpolar (Reykjavik)
		D. Continental / microthermal (hot summer continental, warm summer continental, continental subarctic, continental subarctic)
		Dfa, Dwa, Dsa: Hot summer continental (Chicago, Toronto, Beijing)
		Dfb, Dwb, Dsb: warm summer continental or Hemiboreal (Minsk, Helsinki, Fargo)
		E. Polar (Tundra, Ice cap)
		H. Alpine
4	Winter Design temperatures	2 1/2% Winter Design Temperature is below 0 Deg. C.
		2 1/2% Winter Design Temperature is above 0 Deg. C.
		2 1/2% Winter Design Temperature is below 0 Deg. C.

Figure 10:
SBTool ContextA Worksheet. If there is a need to change the text, it is done (as in all other sheets) by unprotecting the sheet and then finding the Local Content column at the right.

C5.   The SBTool *KeyBmk* Worksheet

This worksheet allows users to enter benchmarks for key parameters – energy, emissions and water. These values are then copied into the relevant Bmk (Bemchmark) worksheets. For each type of performance factor, the Minimum (0) and Best Practice (+5) values are to be provided. As with other benchmarks, the value for Minimum can be obtained through building stock data and/or regulations, while the Best Practice should be established by a small expert group.

Figure 11: SBTool KeyBmk Worksheet
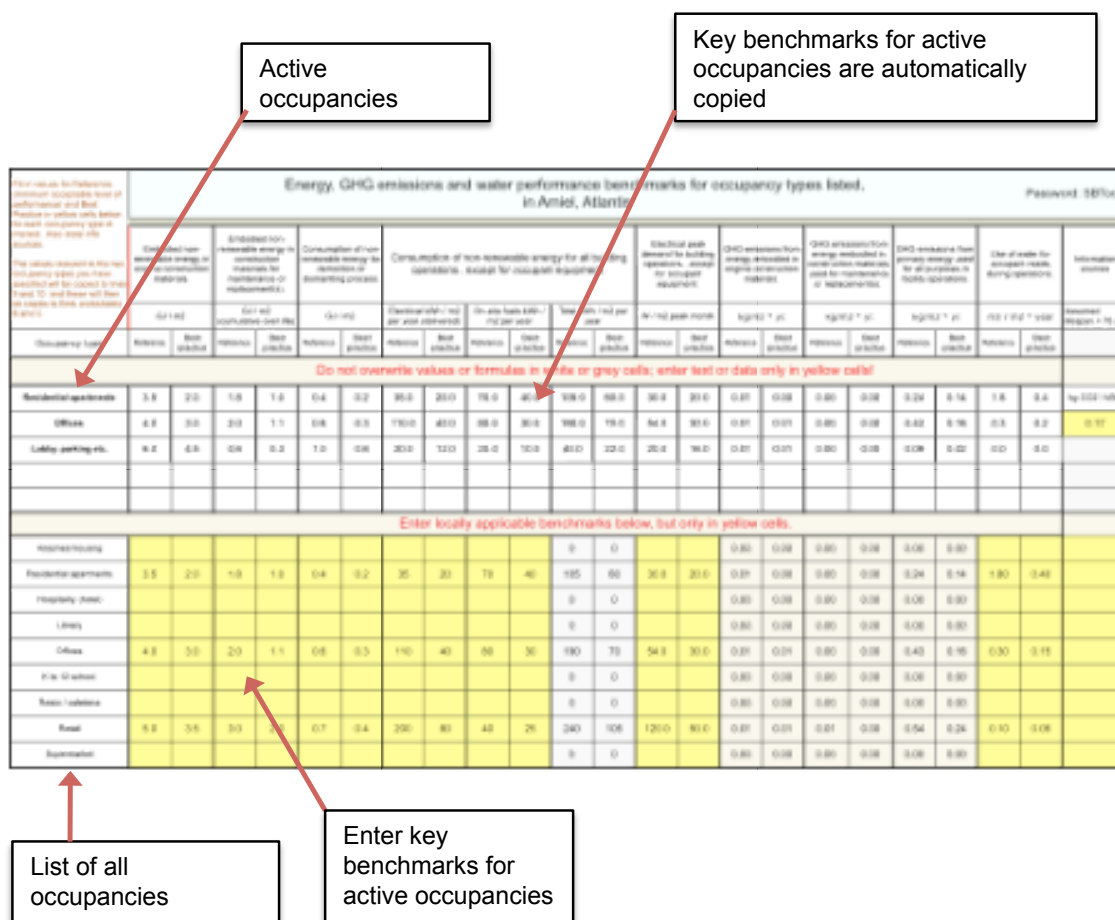
C6. The SBTool *Emission* Worksheet

This worksheet produces a gross-up factor for delivered electrical energy, so that the equivalent primary energy can be identified. The calculation is based the gross-up factor for each constituent fuel used in the power generation base load mix.

The example shown is in a region where the base load is generated by a mix of natural gas, oil, coal, nuclear and hydro. The calculation of the total electrical gross-up is as follows:

1 + (% Fuel A x GUF A) + (% Fuel B x GUF B) + (% Fuel n x GUF n), where:

GUF is the gross-up factor, derived from CO2 emission values for each fuel used, expressed in kg / GJ x transport energy losses per km. X distance/

(CO2 emission kg / GJ) + (CO2 emission kg / GJ) x percent el. transmission loss x distance in km.

In the example shown, the GUF is 2.12, which means that for every kWh delivered to the site, 2.12 kWh of fuel mix is consumed. The GUF is used to gross up the delivered electrical consumption values entered in TrgB worksheets.

Figure 12: SBTool Emission Worksheet

C7. Scoring, Benchmarks and the SBTool Bmk Worksheets

The scoring process in SBTool relies on a series of comparisons between the characteristics of object building and national or regional references for minimally acceptable practice, "good" practice and "best" practice.

This scheme allows an international comparison of buildings from different countries. 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.

This methodology attempt to develop a common approach has been aided by the work of standards bodies, including ISO[1-3] (International Standards Organization) and CEN[4-9], the European standards body.

Figure 13: SBTool Scoring schema

Figure 6:

Schematic of SBTool Scoring and Weighting
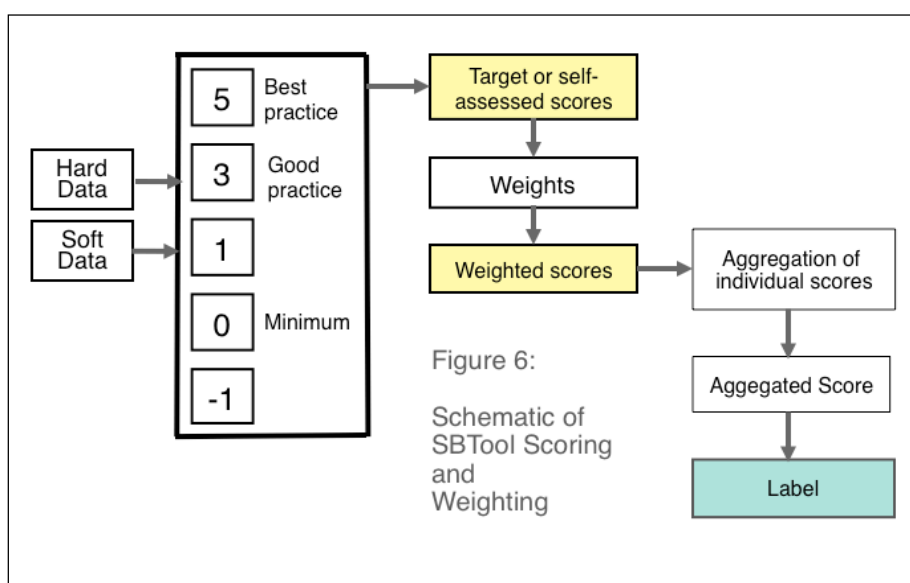
The SBTool approach to scoring requires the use of benchmarks to identify the level of performance for specific performance criteria for the generic building type in the region selected.

It should also be noted that the establishment of performance levels can be accomplished with numerical values in many cases (e.g. energy or water consumption), but there are others criteria for which performance levels can only be described in text statements.

SBTool Bmk (benchmark) worksheets in File A contain both types, as the examples on the following pages indicate. In the SBTool schema, that means that text benchmarks must be established for Minimum Practice (0), Good Practice (+3) and Best Practrice (+5), while data values can be set using Minimum and Best Practice values – in this case a formula determines the intermediate values.

Correspondances between numerical and letter scores are shown below.

>4.5	4.0-4.5	3.5-4.0	3.0-3.5	2.5-3.0	2.0-2.5	1.5-2.0	1.0-1.5	0.5-1.0	0.0-0.5	<0.0
A+	A	B+	B	C+	C	D+	D	E	F	G

C8. SBTool Bmk Worksheets

The example shown on this page shows a data-oriented benchmark.

Figure 14: Example of SBTool criterion with data benchmarks varying by occupancy

> The final weight for this criterion is shown in this cell.

> The applicable phase is shown here.

> Green square or red diamond indicates that the criterion is active.

B3.5	Use of finishing materials.	■	1.42%	Dsn.

Intent	*To estimate the amount of materials used for interior finishes, where functionally appropriate, in order to minimize the direct or indirect consumption of resources.*
Indicator	The percent of above-grade interior floor, wall or ceiling surface areas in which structural elements are left exposed.
Applicable project type	Any occupancy except for Indoor Parking
Information sources	Contract documentation and design documents of interior designer.
Relevant information	The elimination or reduction in use of finsihing materials, whether virgin, re-used or recycled, is an effective way of reducing the depletion of resources and the use of embodied energy for the production of new materials. It should be noted that special care will be needed to minimize acoustic problems in such an approach.
Assessment method	Review of design team analysis.
Standards or references	a b c d
Information Submittals	e f

> Individual occupancies can be de-activated if appropriate.

Occupancy 1	Assessment criteria for Residential apartments	on	Percent area	Score
Negative			6%	-1
Minimum practice	The percent of above-grade interior floor, wall or ceiling surface areas in which structural elements are left exposed is approximately :		10%	0
Good Practice			22%	3
Best Practice			30%	5

Occupancy 2	Assessment criteria for Offices	on	Percent area	Score
Negative			14%	-1
Minimum practice	The percent of above-grade interior floor, wall or ceiling surface areas in which structural elements are left exposed is approximately :		20%	0
Good Practice			38%	3
Best Practice			50%	5

Occupancy 3	Assessment criteria for Lobby, parking etc.	on	Percent area	Score
Negative			0%	-1
Minimum practice	surface areas in which		5%	0
			62%	3
			100%	5

> Yellow boxes show where values, in this case percentages, can be inserted to indicate performance levels appropriate to Minimum Practice (0) and Best Practice (+5). The two values entered define two points on a sloped line, and the values for Negative (-1) and Best Practice (+5) are interpolated from these valuies, but limited to a minimum of -1 and a maximum of +5.
>
> This procedure is done separately for each occupancy type.

The example in Fig. 15 below shows a criterion for which a whol-building benchmark is more logical than separate benchmarks by occupancy. In other words, the remediation of contaminated soil (see below) is a requirement that clearly relates to the project as a whole.

Fig. 15 is also an example of a case where text-oriented benchmarks are used, since these provide a better summary of various performance levels for the issue at hand.

Note that this criterion includes the same type of general information as the previous example: Intent, Indicator, Applicable project type, Information sources, Relevant information, Assessment method, Standards or references, and Information submittals required for assessment. The scale for assessment is also the same for all criteria, ranging from -1 to 0 to +3 and +5.

Figure 15: Example of SBTool criterion with text benchmarks, applicable at the building level.

A1.5 Remediation of contaminated soil, groundwater or surface water.	■	2.24%	Dsn.

Intent	*To assess the success of remediation of contaminated soil, groundwater, or surface water in the project.*
Indicator	Status of soil, groundwater, or surface water after treatment.
Applicable project type	Any project type with contaimnated soil, groundwater or surface water.
Information sources	Environmental agencies and NGOs.
Relevant information	Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long-term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.
Assessment method	Review of pre- and post-remediation site analysis report by a geophysical and soils chemistry specialist.
Standards or references	a
	b
	c
Information Submittals	d
	e
	f

	Assessment criteria for total project	Score
Negative	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present unacceptable risks to long-term human health or the ecology.	-1
Minimum practice	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present acceptable risks to long-term human health or the ecology.	0
Good Practice	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present low risks to long-term human health or the ecology.	3
Best Practice	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present no detectable risks to long-term human health or the ecology.	5

Figure 16 illustrates how all text content shown in the main page derives from three sub-areas, usually hidden to the right of the main page, but here shown separately for clarity. The text in the main page fields (marked A) derives from Col. B, which is in turn derived from the deafult content (Col. C) or the Local Content (Col. D). Users can select Generic or Local Content in the BasicA worksheet, and the appropriate content is then displayed in the main page of the criterion. The same criterion as on the previous page is used for illustration purposes.

A – display of selected content

| A1.5 | Remediation of contaminated soil, groundwater or surface water. | | 2.24% | Dsn. |

Intent	*To assess the success of remediation of contaminated soil, groundwater, or surface water in the project.*
Indicator	Status of soil, groundwater, or surface water after treatment.
Applicable project type	Any project type with contaimnated soil, groundwater or surface water.
Information sources	Environmental agencies and NGOs.
Relevant information	Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long-term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.
Assessment method	Review of pre- and post-remediation site analysis report by a geophysical and soils chemistry specialist.
Standards or references	a / b / c
Information Submittals	d / e / f

Assessment criteria for total project		Score
Negative	After treatment, the site is documented as having a level of sub-surface contamination that presents unacceptable risks to long-term human health or the ecology.	-1
Minimum practice	After treatment, the site is documented as having a level of sub-surface contamination that presents acceptable risks to long-term human health or the ecology.	0
Good Prac...		
Best Prac...		

B – selected content

Figure 16: Illustration of how Generic or Local content is inserted in the main page

B – selected content | **C – generic content** | **D – local content**

B – selected content	C – generic content	D – local content
To assess the success of remediation of contaminated soil, groundwater, or surface water in the project.	To assess the success of remediation of contaminated soil, groundwater, or surface water in the project.	To assess the success of remediation of contaminated soil, groundwater, or surface water in the project.
Status of soil, groundwater, or surface water after treatment.	Status of soil, groundwater, or surface water after treatment.	Status of soil, groundwater, or surface water after treatment.
Any project type with contaimnated soil, groundwater or surface water.	Any project type with contaimnated soil, groundwater or surface water.	Any project type with contaimnated soil, groundwater or surface water.
Environmental agencies and NGOs.	Environmental agencies and NGOs.	Environmental agencies and NGOs.
Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long-term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.	Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long-term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.	Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long-term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.
Review of pre- and post-remediation site analysis report by a geophysical and soils chemistry specialist.	Review of pre- and post-remediation site analysis report by a geophysical and soils chemistry specialist.	Review of pre- and post-remediation site analysis report by a geophysical and soils chemistry specialist.
a	a	
b	b	b
c	c	c
d	d	d
e	e	e
f	f	f

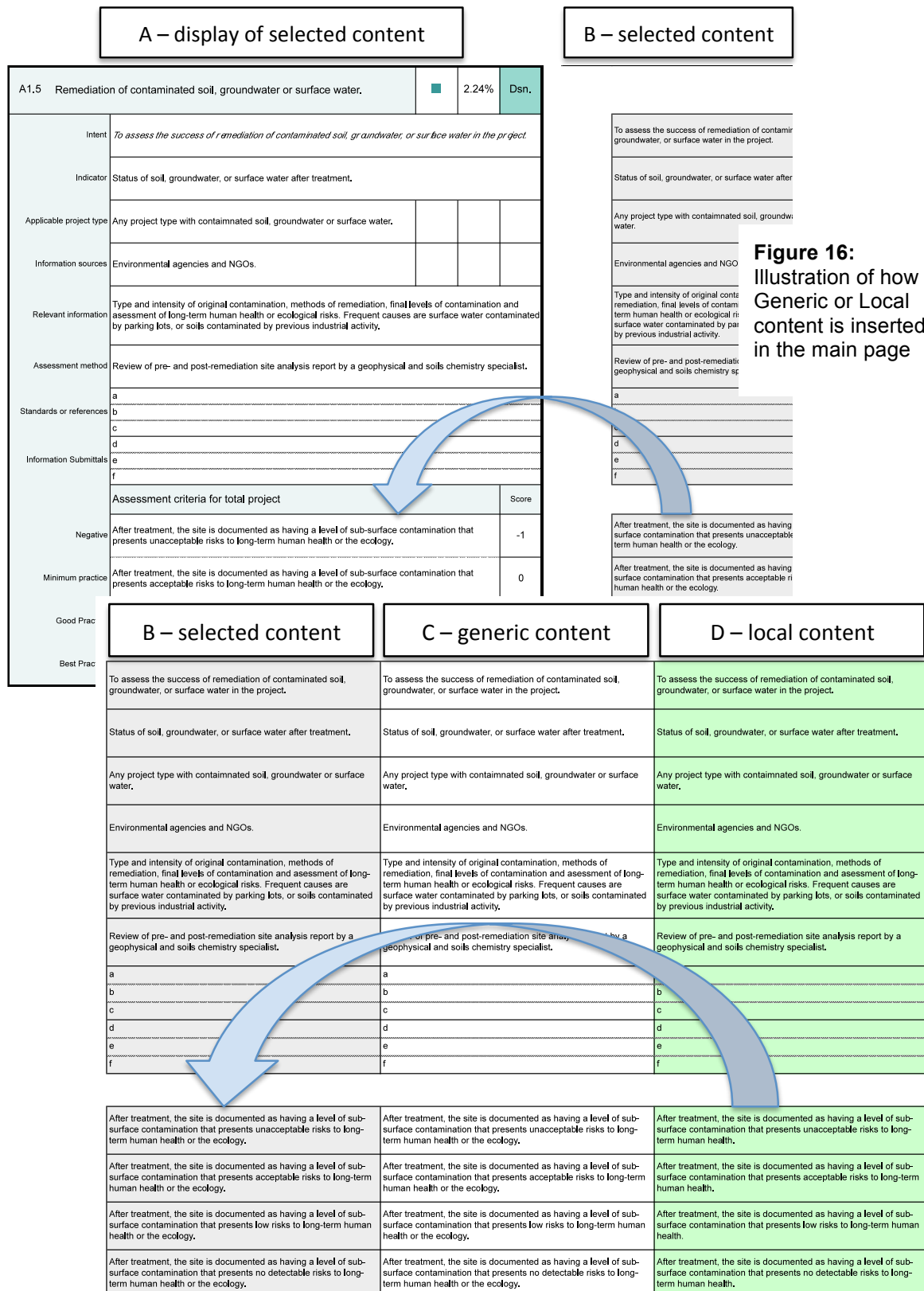| After treatment, the site is documented as having a level of sub-surface contamination that presents unacceptable risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents unacceptable risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents unacceptable risks to long-term human health.
After treatment, the site is documented as having a level of sub-surface contamination that presents acceptable risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents acceptable risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents acceptable risks to long-term human health.
After treatment, the site is documented as having a level of sub-surface contamination that presents low risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents low risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents low risks to long-term human health.
After treatment, the site is documented as having a level of sub-surface contamination that presents no detectable risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents no detectable risks to long-term human health or the ecology.	After treatment, the site is documented as having a level of sub-surface contamination that presents no detectable risks to long-term human health.

Fig. 17 shows how text benchmarks change in the system, depending on the phase selected. In this case, changes in the Design and Operations phases can be seen.

A1.5	Remediation of contaminated soil, groundwater or surface water.	🖉	2.24%	Dsn.

Intent	*To assess the success of remediation of contaminated soil, groundwater, or surface water in the project.*			
Indicator	Status of soil, groundwater, or surface water after treatment.			
Applicable project type	Any project type with contaimnated soil, groundwater or surface water.			
Information sources	Environmental agencies and NGOs.			
Relevant information	Type and intensity of original contamination, methods of remediation, final levels of contamination and asessment of long-term human health or ecological risks. Frequent causes are surface water contaminated by parking lots, or soils contaminated by previous industrial activity.			
Assessment method	Review of pre- and post-remediation [...] sical and soils chemistry specialist.			
Standards or references	a			
	b			
	c			
	d			
Information Submittals	e			
	f			

Figure 17: Same criterion, but different phases

		2.51%	Ops.

Assessment criteria for total project		Score
Negative	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present unacceptable risks to long-term human health or the ecology.	-1
Minimum practice	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present acceptable risks to long-term human health or the ecology.	0
Good Practice	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present low risks to long-term human health or the ecology.	3
Best Practice	Documentation indicates that the site will still have a level of sub-surface contamination after treatment that will present no detectable risks to long-term human health or the ecology.	5

Note different text for different phases of the same criterion

	f	
Assessment criteria for total project		Score
Negative	After treatment, the site is documented as having a level of sub-surface contamination that presents unacceptable risks to long-term human health or the ecology.	-1
Minimum practice	After treatment, the site is documented as having a level of sub-surface contamination that presents acceptable risks to long-term human health or the ecology.	0
Good Practice	After treatment, the site is documented as having a level of sub-surface contamination that presents low risks to long-term human health or the ecology.	3
Best Practice	After treatment, the site is documented as having a level of sub-surface contamination that presents no detectable risks to long-term human health or the ecology.	5