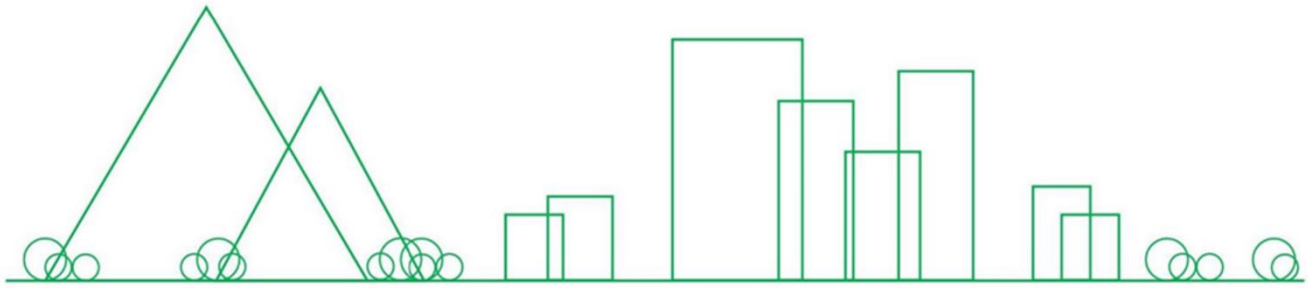
CASBEE ISKANDAR

Comprehensive Assessment System for Built Environment Efficiency

for

JOHOR BAHRU CITY COUNCIL (MBJB)

Building
(New Construction)



CASBEE ISKANDAR for Building

Technical Manual 2024

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CASBEE (Comprehensive Assessment System for Built Environment Efficiency) Iskandar is a method for the evaluation and rating the environmental performance of buildings in Iskandar Malaysia. It is a comprehensive assessment of the quality of a building, evaluating features such as interior comfort and scenic aesthetics, in consideration of good environmental practices which include using materials and equipment that save energy or achieve smaller environmental loads.

CASBEE Iskandar includes different assessment tools depending on the scale of the built environment subject to the assessment, such as housing, buildings, urban areas and cities, all of which are collectively called the CASBEE Iskandar Family as shown in Figure 1. However, to scope down the context of the assessment tool, the discussion will be based on CASBEE Iskandar Building entirely.

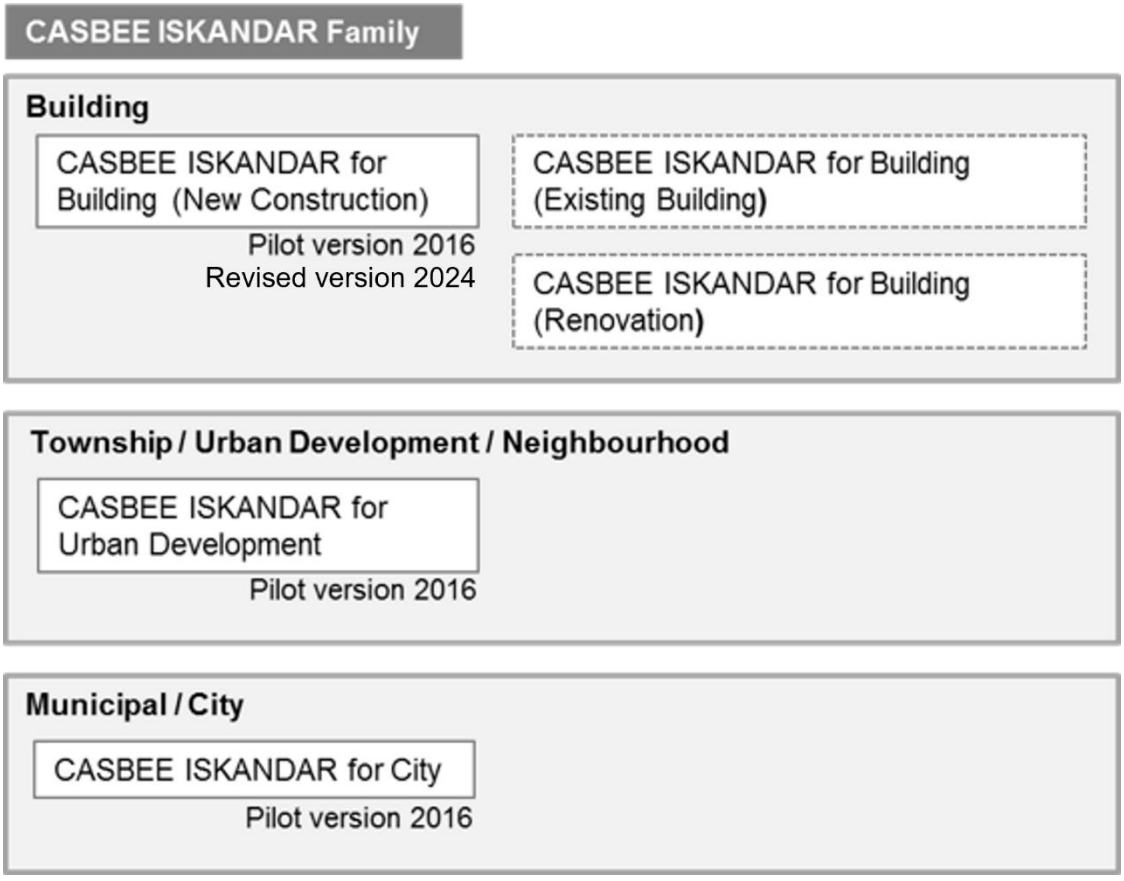


Figure 1: CASBEE ISKANDAR Family Chart

The CASBEE Iskandar assessment tools were developed on the basis of the following three principles:

i. Comprehensive assessment throughout the life cycle of the building,

ii. Assessment of the "environmental quality of building (Q)" and "environmental load of building (L)" and

iii. Assessment based on the newly-revised Built Environment Efficiency (BEE) indicators, which are further refined based on the talent institutional contents, policies, guidelines and Malaysian standards.

Chapter 2.0 Introduction

Typical Green Building assessment tools established in Malaysia are based on scoring systems or checklists, where the total scores are based on a singular numbering system, hence the higher the number achieved, the better the building's rating is.

Entirely different from what has been established in Malaysia, Comprehensive Assessment System for Built Environment Efficiency (CASBEE) Iskandar is an assessment based on a formula which can be verse as 'Quality of building over Load of Building'.

$$BEE = \frac{\text{Q: Environmental Quality of Building}}{\text{L: Environmental Load of Building}} = \frac{25\times(SQ - 1)}{25\times(5 - SLR)} \quad (1)$$

CASBEE Iskandar is a tool for assessing and rating the environmental performance of buildings and built environment. The assessment tools for buildings provided have been categorised as follows:

i. CASBEE for Building (New Construction)
ii. CASBEE for Building (Existing Building)
iii. CASBEE for Building (Renovation)
iv. CASBEE for Home (Detached House)

However, the most reliable or usable tool for Malaysia is CASBEE Iskandar for Building (New Construction). Therefore, the system is able to make assessments at each stage of a building's design and construction (preliminary design, execution design and construction completion), on the basis of target performance, design specification and forecast performance, enabling consideration of improvements at each stage. Figure 2 explains the stages of the CASBEE Iskandar Building Assessment.

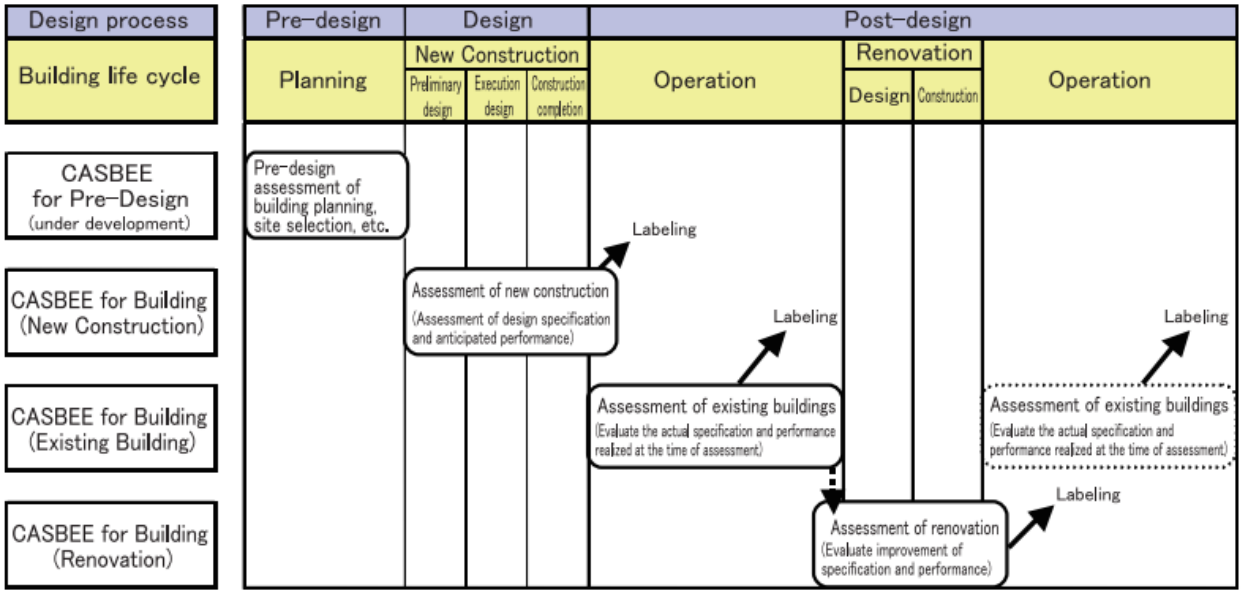


Figure 2: CASBEE Iskandar Building Assessment Stages

This tool could also be used for rebuilding, in which the existing structure is reutilized. As CASBEE Iskandar for Building (New Construction) produces predictive assessments based on design specifications, the assessments results remain valid for three years past the completion of construction. After that period, if necessary, the building should be evaluated at that stage using the latest edition of CASBEE Iskandar for Building (Existing Building).

Chapter 3.0 Scoring and Assessment Method

CASBEE Iskandar for Building (New Construction) is applicable to all building types except for detached houses. The building classification consists of 8 purposes adopted in the energy conservation standards (including factories) and apartments, excluding detached houses. For factories, assessments under "Q1 Indoor Environment" and "Q2.1 Serviceability" mainly address occupied areas (e.g. office space), and exclude production areas. The energy consumption in production areas of factories, which is excluded from the calculation based on the energy conservation standards, is also excluded from the assessment of "LR1 Energy".

The building types covered are broadly divided into "non-residential" and "residential". In particular, hospitals, hotels and apartments that fall in the residential category are buildings that include living or accommodation spaces for users (refer to Table 1). Assessment of these buildings with residential building types is divided between residential sections and other common sections.

Table 1: CASBEE Iskandar Building Classification and Types

Classification	Building Type	Types included
Non-residential	Offices	Offices, government buildings, libraries, museums, post offices, etc.
	Schools	Primary schools, secondary schools, universities, technical colleges and other school types
	Retailers	Department stores, supermarkets, etc.
	Restaurants	Restaurants, canteens, cafes, etc.
	Halls	Auditoriums, halls, bowling lanes, gymnasiums, theatres, movie theatres, pachinko parlours exhibition facilities, etc.
	Factories	Factories, garages, warehouses, spectator stands, wholesale markets, computer rooms, etc.
Residential	Hospitals	Hospitals, homes for elderly, welfare homes for the handicapped, etc.
	Hotels	Hotels, inn, etc.
	Apartments	Apartments (not applicable to detached houses)

3.1 Outline of the assessment system

One characteristic of CASBEE Iskandar is that it assigns separate scores for Quality: Environmental quality of building (Q) and Load: Environmental load of building (L) and ultimately gives an assessment of Built Environment Efficiency (BEE) as an indicator based on the results for Q and L. L is first evaluated as LR (Environmental load reduction of building).

The scoring criteria were examined with a view to applicability to each building type of subject buildings through keeping the criteria as simple as possible. The scoring criteria for each assessment score are based on the approaches below.

1) Assessment on a five-level scale, Level 1 to 5, with Level 3 as the standard score.
2) As a general rule, Level 1 is earned for satisfying the minimum conditions required by laws, regulations and other standards of Malaysia, such as the Uniform Building By-Laws 1984, and a building at what is judged to be a general, ordinary level earns 3.
3) The ordinary level (Level 3) is a level corresponding to ordinary technical and social practices at the time of assessment.

The assessment items included in Q and L should be according to the scoring criteria set for each level (Level 1-5). For apartments, hotels and hospitals (classified as "Residential"), the assessment is subdivided between residential sections and all other sections. Different scoring criteria are applied to Residential and Non-residential classifications, depending on the assessment items. In obtaining assessment results for the building as a whole, the score for each item is weighted according to the share of floor area occupied by each part, to obtain the whole-building result. Figure 3 shows the CASBEE Iskandar Building Assessment Diagram.

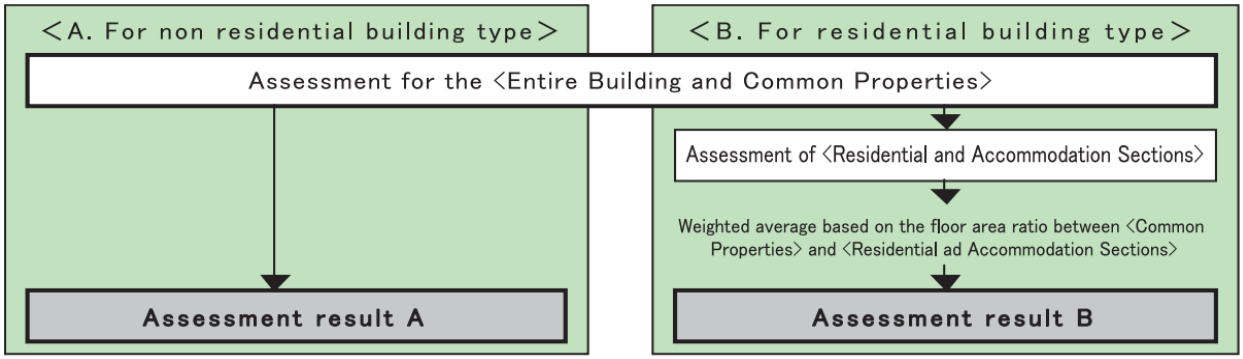


Figure 3: CASBEE Iskandar Building Assessment Diagram

1) Construction stage - Under "LR2 Resources & Materials," "Continuing use of existing structural frame, etc." and "Use of recycled materials" are evaluated. For these items, CO_2 emissions related to the manufacture of construction materials (embodied CO_2) are approximated based on the usage rates of existing structural frames and blast furnace cement.
2) Operation stage - CO_2 emissions in the operational phase are estimated in a simple manner by using values such as the primary energy consumption ratio BEI evaluated in "LR1 Energy" and the reduction ratio corresponding to individual efforts in efficient operations.
3) Assessment result - Assessment results are collated in two forms, the Score Sheet and the Assessment Results Sheet. First, the scoring results for each assessment item are tabulated on the Score Sheet. These are weighted using a weighting coefficient for each assessment

item to produce overall scores SQ1-SQ3 and SLR1-SLR3, specific to major categories Q1-Q3 and LR1-LR3. SQ and SLR are also calculated as scores for Q and LR (refer to Figure 4).

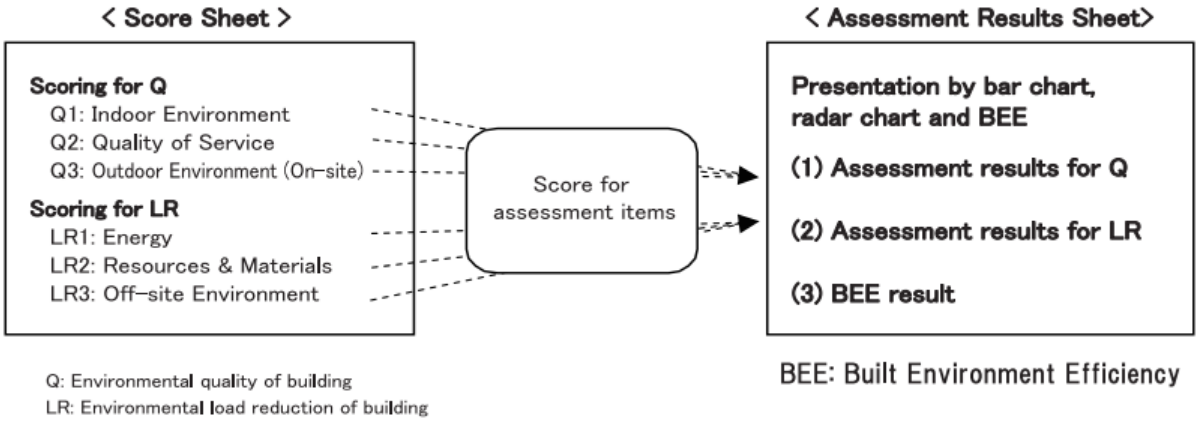


Figure 4: CASBEE Iskandar Building Score Sheet and Assessment Result Sheet

The Assessment Results Sheet presents assessment results for each category as radar charts, bar charts and numerical data for Q (environmental quality of building) and LR (environmental load reduction of building) (refer to Figure 5). The BEE (Built Environment Efficiency) result is also presented numerically and graphically, giving a multi-faceted and comprehensive grasp of the environmental characteristics of the evaluated building. BEE is calculated from SQ and SLR, the scores for Q and LR, according to the formula below.

$$BEE = \frac{\text{Q: Environmental Quality of Building}}{\text{L: Environmental Load of Building}} = \frac{25\times(SQ - 1)}{25\times(5 - SLR)} \quad (1)$$

The graph points are plotted with Q values on the Y axis and L values on the X axis to determine the Built Environment Efficiency position, which enables Built Environment Efficiency ranking on five levels from S down to C and each rank corresponds to the assessment expressions used in CASBEE Iskandar Building (New Construction) in Malaysia (refer to Figure 6).

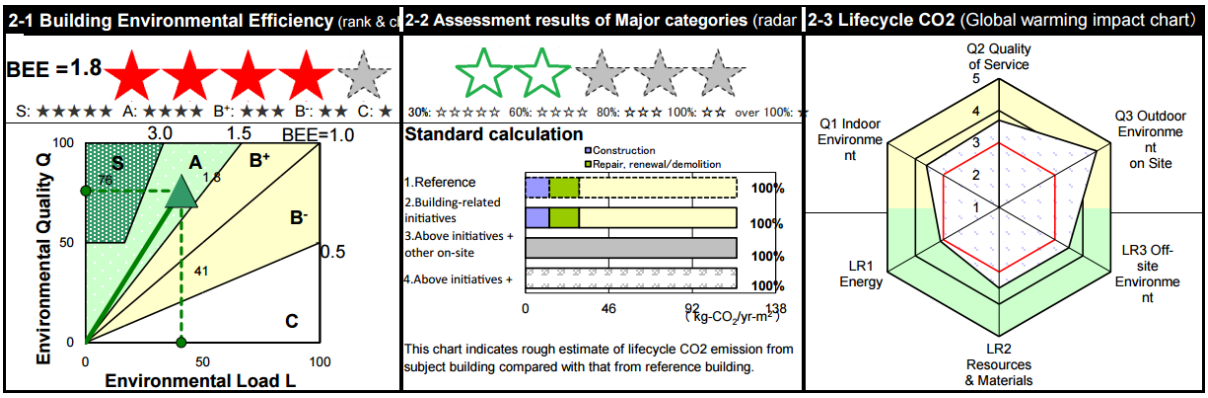


Figure 5: CASBEE Iskandar Building Assessment Result Diagrams

Ranks	Assessment	BEE value, etc.	Expression
S	Excellent	BEE = 3.0 or more and Q = 50 or more	★★★★★
A	Very Good	BEE = 1.5-3.0 BEE = 3.0 or more and Q is less than 50	★★★★
B+	Good	BEE = 1.0-1.5	★★★
B-	Fairy Poor	BEE = 0.5-1.0	★★
C	Poor	BEE = less than 0.5	★

Figure 6: CASBEE Iskandar Building Assessment Ranking

Environmental Quality of Building (Q) and Environmental Load of Building (L) are directly related in the formula; however the descriptive explanation shows that Q can be described as 'sum of Q minus 1' as the maximum ratio value for Q is 1, but the SQ maximum value itself is 5, referring to maximum level that can be obtained from each criterion provided.

$$\text{Building Environment Effeciency: } BEE = \frac{25 \times (\text{Sum of Q Value (SQ)} - \text{Ratio of Q (1)})}{25 \times (\text{Max Value Sum of LR (5)} - \text{Sum of LR (SLR)})} \quad (1)$$

Same as value for Q, the maximum value for L is also 1 and the maximum value for SLR is 5 depending on each level received in every criterion. Therefore, the ratio is still within relative values. In a sense, the higher value obtained in SLR, the lower the coefficient or ratio divided to SQ. Likewise, the higher value of SQ, higher the coefficient or ratio divided by SLR.

3.2 Approaches to scoring criteria

The assessment for buildings which combine two or more types is calculated as a weighted average of assessment results for each type of the building, according to the ratio of floor areas for each type. The scores for the building complex are calculated using the equation below, using the ratio between floor areas for each building type.

Score for building complex
=Σ(score for each building type x corresponding floor area ratio) (2)

This equation can also be applied to building complexes for different types on a single site, similar to a single building complex (refer to Figure 7).

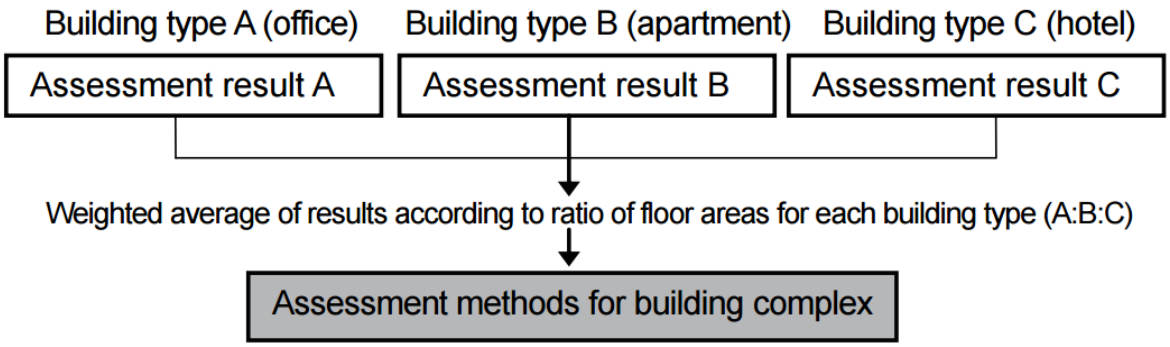


Figure 7: CASBEE Iskandar Building Assessment Method for Mixed Development

In the assessment of "LR1 Energy," the weighted average is obtained in terms of individual floor space ratios depending on the levels determined in accordance with the rating levels with respect to non-residential buildings (refer to Figure 8).

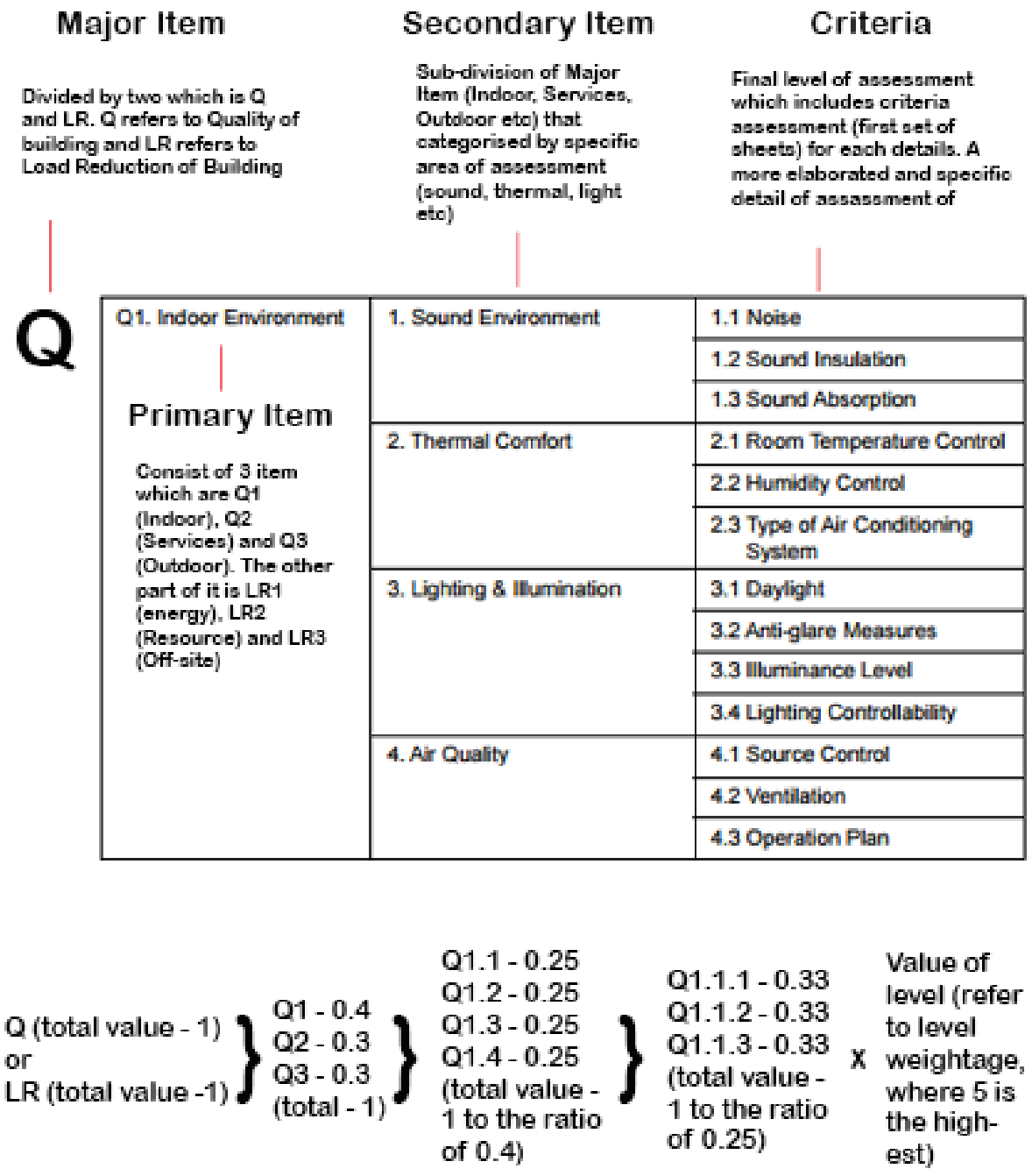


Figure 8: CASBEE Iskandar Building Weightage Distribution

The weighting coefficients between assessment categories should not be determined solely on scientific knowledge. They should also take into account the value and perceptions of various interested parties, such as designers, building owners and managers and related officials. Different weighting coefficients for detailed assessment levels are set for individual buildings, as appropriate for their types. Table 2 shows the CASBEE Iskandar Building Assessment Categories.

Table 2: CASBEE Iskandar Building Assessment Categories

Assessment Categories		
Q1 Indoor Environment	Non-factory	Factory
	0.40	0.30
Q2 Quality of Service	0.30	0.30
Q3 Outdoor Environment (On-site)	0.30	0.40
LR1 Energy	0.40	
LR2 Resources & Materials	0.30	
LR3 Off-site Environment	0.30	

Chapter 4.0 Assessment Procedure

CASBEE Iskandar for Building (New Construction) has been developed to allow simple data entry from general-purpose spreadsheet software for various usage of assessment result. Figure 9 shows the CASBEE Iskandar Building Input and Output Items.

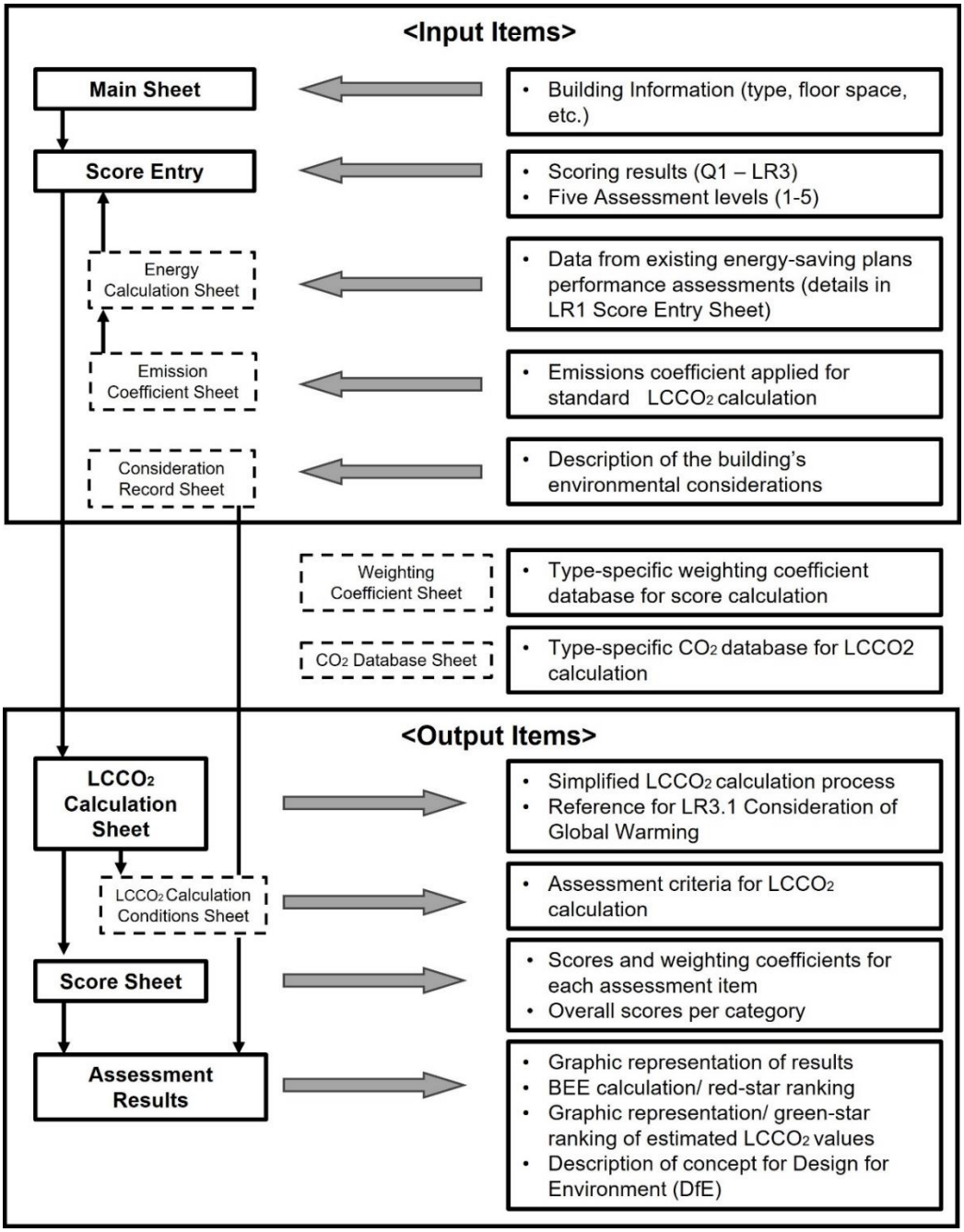


Figure 9: CASBEE Iskandar Building Input and Output Items

Figure 10 below shows the Main sheet. The Main sheet is the sheet where the assessor makes the first input. Enter the information necessary for the assessment, such as basic information on the subject building (name, type, size, etc.). From the assessment of buildings with residential type buildings, enter the floor area ratio between Entire Building and Common Properties section and Residential and Accommodation section.

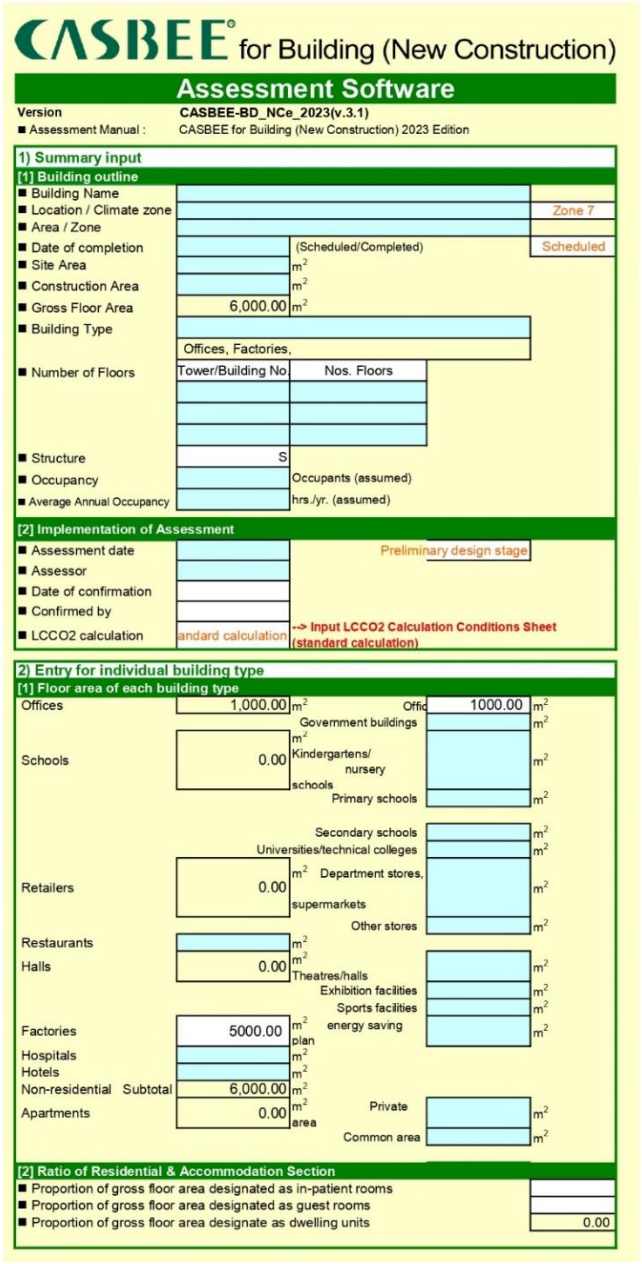


Figure 10: The Main Sheet in the CASBEE Scoring Template

4.1 Summary Input

1) Building outline - Enter the basic information necessary for the assessment (name, type, scale, etc.). This information will be transferred to the Assessment Results Sheet. Enter the average occupancy and the annual occupancy time where possible. These are for reference only and do not directly affect the CASBEE assessment.
2) Assessment Implementation - Input the date of the assessment and the name of the assessor. If the contents of the assessment are checked by a different person, enter the date of the check and name of the checker in this column.
    i. Entry for individual building type
        a. Building types. Select the most applicable building type name from the list. Enter the gross floor area for each building type. Use 1) Summary input to enter a more specific type for the building concerned. With respect to buildings whose purposes are offices, schools, stores and meeting places, the floor space is provided in terms of individual detailed purposes.
        b. Ratio of residential and accommodation sections. Enter the floor area ratio of Entire Building and Common Properties and Residential and Accommodation Sections when evaluating residential-type buildings. (Input the value, in the range 0-1.0, for the proportion of wards in hospitals, guest rooms in hotels and residential portions in apartments. Make no input for buildings of non-residential use.)
    ii. Display of each sheet. The Assessment Results Sheet, Score Sheet and $LCCO_2$. Sheets can be selected in the output results column to display the sheet on the screen.

4.2 Score Entry Sheet

The Score Entry Sheet indicates an assessment standard list for individual purposes, in which a five-level assessment standard on a scale of Level 1 to Level 5 is described. The assessor marks in accordance with the list.

1) Scoring criteria

As shown in Figure 11 below, Score Entry Sheet displays a list of scoring criteria for each building type, and the assessor should assign points accordingly. "Entire Building and Common Properties" should be scored for all types in common. However, for residential buildings, the Score Entry Sheets for Q1 and Q2 have scoring criteria and assessment columns for "Residential and Accommodation Sections," and those should be used for scoring.

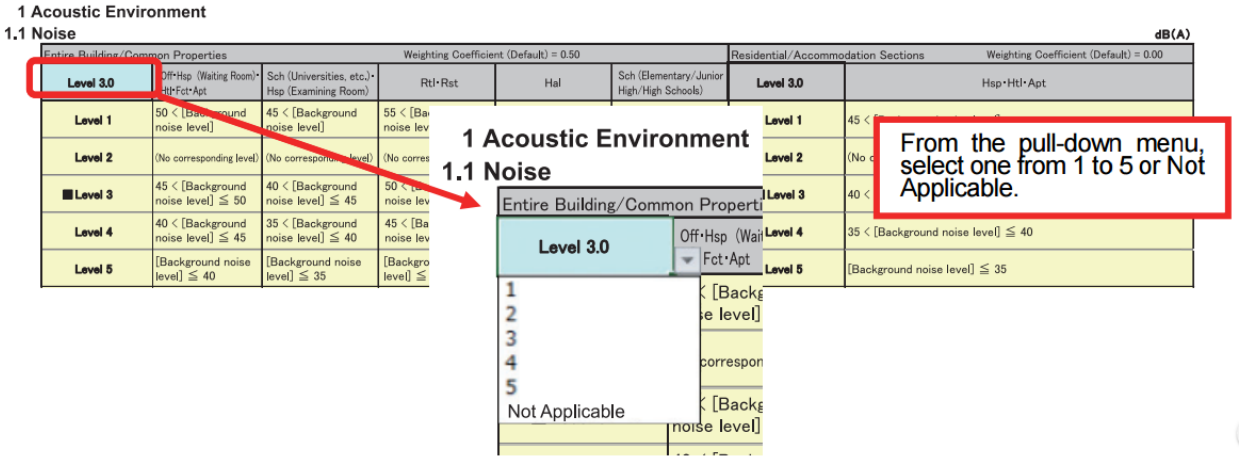


Figure 11: Score Entry Sheet Display

2) Efforts to be evaluated

For some scoring items (particularly "Q3 Outdoor Environment (On-site)" and "LR3 Off-site Environment"), the score is determined by checking the levels of efforts indicated in the table of the efforts to be evaluated attached to the scoring criteria table. This information is listed under "Efforts to be evaluated," as a checklist of points to be considered in Design for Environment (DfE), or as a list of methods. Evaluate whether each of the listed efforts has been made, and score the item concerned according to the total number of points awarded (or the number of items). (Refer to Figure 12)

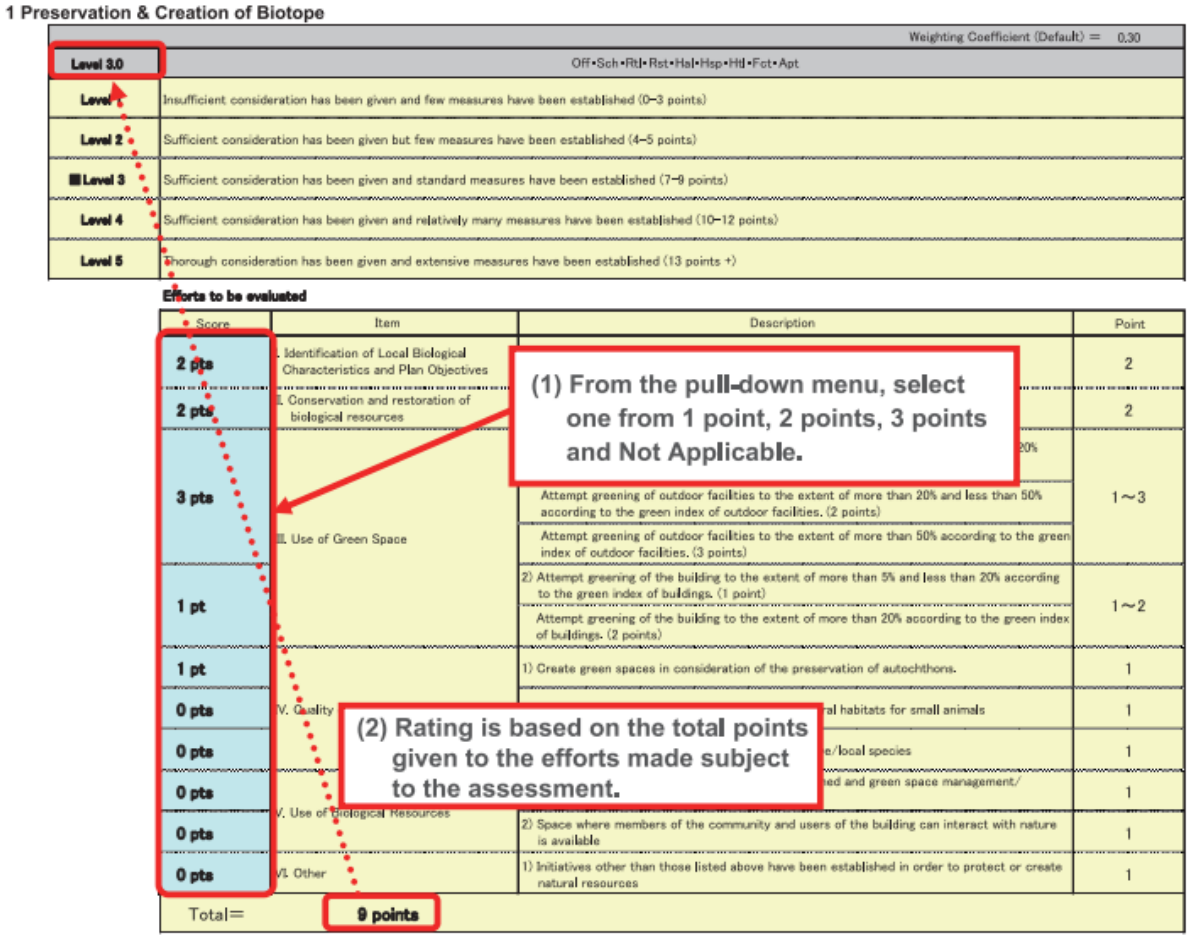


Figure 12: Score Entry Sheet with method using "efforts to be evaluated"

3) Scoring method for LR1 Energy

In LR1, criterion "3 Efficiency in Building Service System," the assessment is carried out according to the primary energy consumption ratio, utilising the BEI method. Use the Energy Calculation Sheet ("ENCalc" sheet) shown to enter data for these two categories. Specifically, in terms of individual items such as the outer surface performance, the standard primary energy consumption and the designed primary energy consumption, the corresponding values are entered in accordance with the energy conservation standards. When an energy-saving plan has been developed, transfer the corresponding figures in the documents for the evaluations under "1 Control of Heat Load on the Outer Surface of Buildings" and "3 Efficiency in Building Service System." (Refer to Figure 13).

■ LR1 Data from "energy-saving plan" ■Building Name 0

3 Primary energy consumption of the building (Efficiency in Building Service System)

	Bldgs. except Apt.	
■ Standard building energy consumption*		GJ/yr
Other energy consumption (for home appliances and cooking) included therein		
■ Designed building energy consumption (1)**		
■ Designed building energy consumption (2)***	0	
■ Total energy generated ([3] On-site measures)		GJ/yr
BEI(1)	-	
BEI(2)	-	

*The standard building energy consumption for the building type(s) evaluated, assuming a "business-as-usual" scenario
**The amount of energy the building is designed to consume from the national grid
***The designed amount of energy required by the building, including sources of energy from on-site generation (including solar power generation and the like)

Primary energy consumption (standard calculation) used for calculating $LCCO_2$ during operation stage

Reduction by natural er	Reduction rate by effici	Subject GJ/yr	Ref. bldg. GJ/yr
0.00 GJ/yr	0.975	46,240.97	########

			floor area m^2	Primly energy consumption Statistic value MJ/m^2-yr	conversion factor kg-CO2/MJ
Office	Office		0	0	0.05645
	Government buildings		41,592	1,380	0.05674
School	Kindergartens/ nursery		0	0	0.05689
	Sch (Primary/ Secondary	Malaysia	0	0	0.05782
		Other area	0	0	0.05674
	High schools		0	0	0.05821
	Sch(Tertiary,etc)		0	0	0.05666
Retailers	Department, supermarl		0	0	0.05664
	Other stores		0	0	0.05658
Restaurants			0	0	0.05533
Halls	Theatres/halls		0	0	0.05628
	Exhibition facilities		0	0	0.05698
	Sports facilities		0	0	0.05620
Factories			0	0	0.05635
Hospitals			0	0	0.05781
Hotels			0	0	0.05728
Other than apartment	Total		41,592	57,397 (GJ/yr)	0.05674

■ Direct use of natural energy
LR1/2. Natural Energy Utilisation

	floor area m^2
Sch(Primary/Secondary)/Apt*	0
Other than above	41,592

*Entire Building & Common Property only

Level 3	Level 4	Level 5	Score	Reduction	
0.0	1.0	15.0	2.0	0.0	
0.0	1.0	0.0	3.0	0.0	MJ/m^2-yr

■ Efficient operation
LR1/4. Efficient Operation

Level 3	Level 4	Level 5	Score	Reduction
1.00	0.975	0.95	4.5	0.975

Figure 13: Energy Calculation Sheet ("ENCalc" sheet)

4) Scoring for building complex

When evaluating a building complex, enter the average of the levels (points) for all applicable building types, weighted for relative floor areas of each complex. Obtain the area-weighted average for each assessment item, and select the corresponding values from the pull-down list in the Score Entry Sheet of CASBEE for Building (New Construction). The averaged results are rounded to the nearest whole integer. In cases when a detailed assessment is conducted such as when

applying for a certification system, values including weight-averaged fractional values may be entered directly in the rating field.

4.3 Consideration record sheet

State points that are considered in Design for Environment (DfE), so that it is easy for a third party to gain an overview of environmental considerations in the evaluated building. The contents of such statements are indicated in "3 Design Considerations" in the Assessment Results Sheet ("Result" sheet). Include statements in each space for General, Q1-LR3 and Other in the Consideration Record Sheet ("Consider" sheet) (refer to Table 3). State the concept of the building as a whole in the General space, and make any statements related to assessment items in the relevant columns Q1-LR3. Use the Other column to describe other environment-oriented efforts not evaluated under Q1-LR3.

Table 3: Consideration Record Sheet ("Consider" sheet)

Consideration in design	
General	Describe briefly comprehensive concept of environment design of the building.
Q1 Indoor Environment	Describe briefly considerations for Q1 Indoor Environment of the building.
Q2 Quality of Service	Describe briefly considerations for Q2 Quality of Service of the building.
Q3 Outdoor Environment on Site	Describe briefly considerations for Q3 Outdoor Environment on Site of the building.
LR1 Energy	Describe briefly considerations for LR1 Energy of the building.
LR2 Resources & Materials	Describe briefly considerations for LR2 Resources & Materials of the building.
LR3 Off-site Environment	Describe briefly considerations for LR3 Off-site Environment of the building.

4.4 Emissions coefficient sheet

The default CO_2 emissions coefficient for electricity use specific to the assessment objective has been preset (refer to Figure 14).

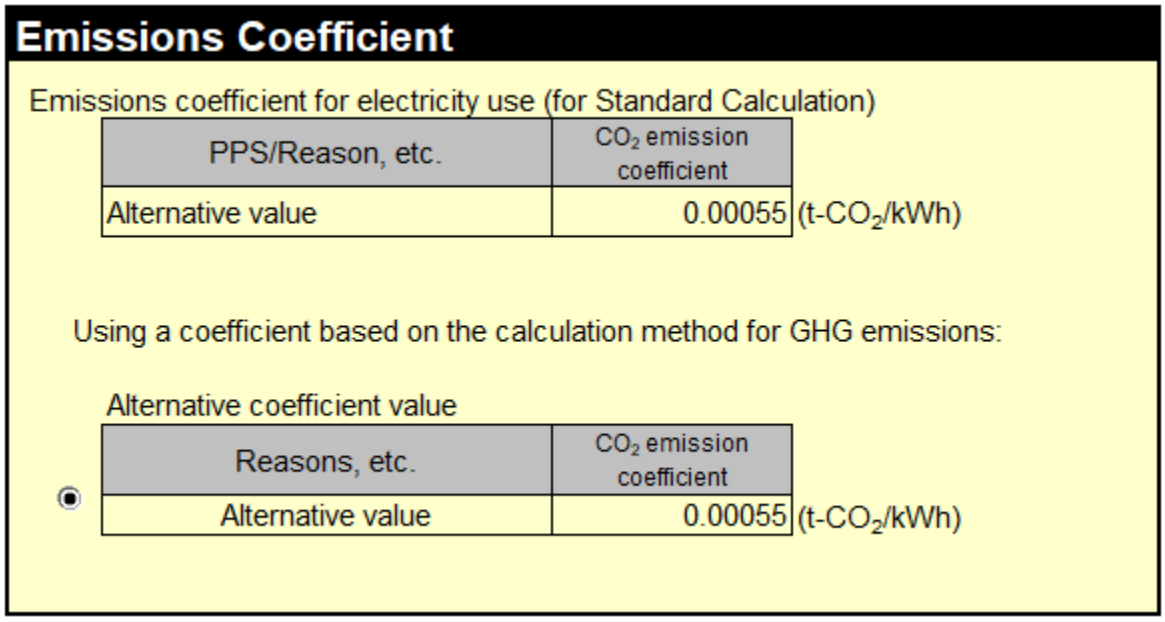
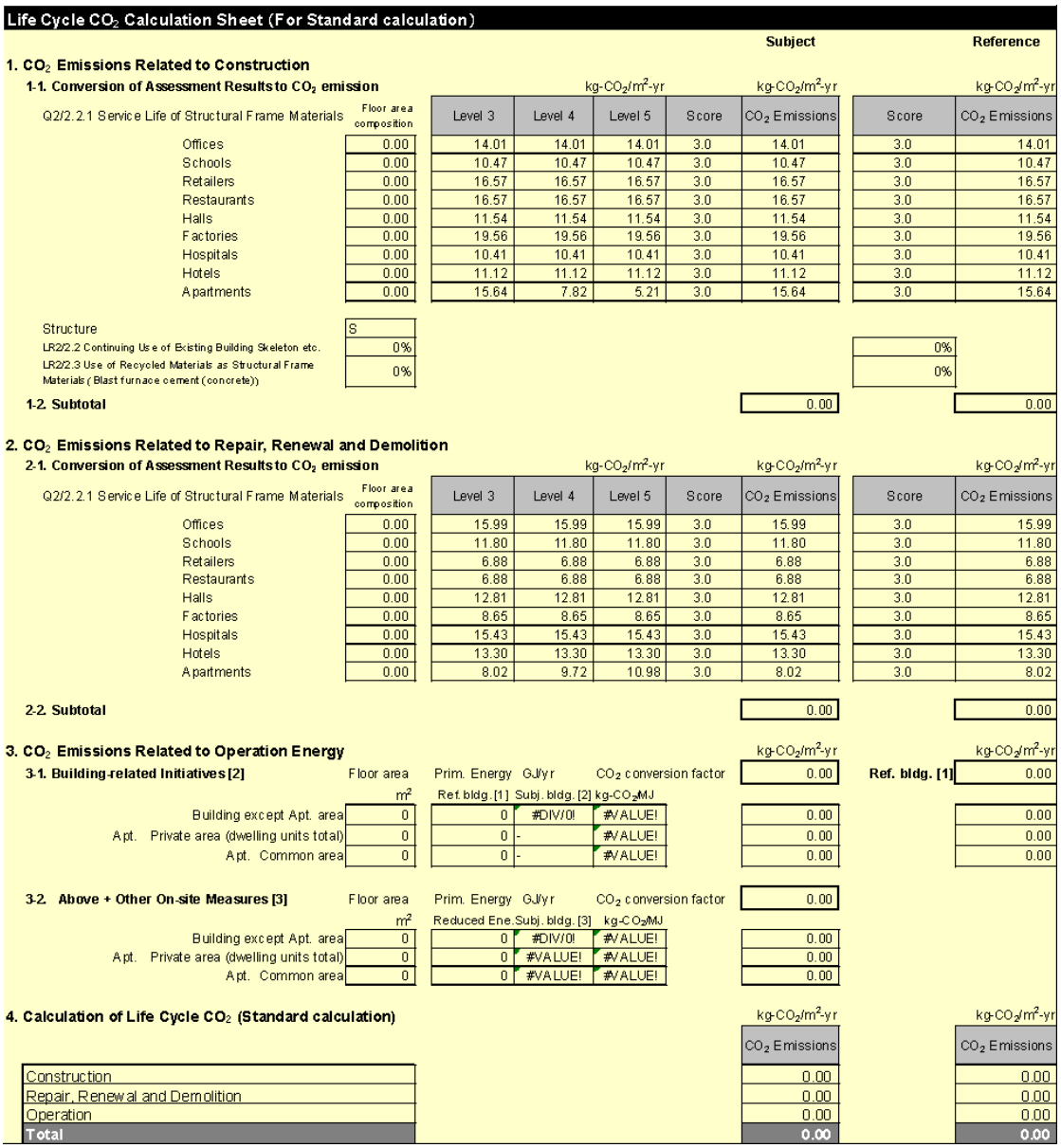


Figure 14: Emissions Coefficient Sheet ("Coefficient" sheet)

4.5 Life cycle CO_2 calculation sheet

Figure 15 shows the Life Cycle CO_2 ($LCCO_2$) calculation sheet that displays the automatic calculation process for $LCCO_2$ (standard calculation) based on data entered in the Score Entry Sheet ("Score" sheet) and the Energy Calculation Sheet ("ENCalc" sheet). Under each category of the building's life cycle stages (i.e.: construction, maintenance/upgrade/demolition and operation), the reference value (Standard building = Level 3 equivalent in all assessment items) and CO_2 emissions of a building subject to the assessment are indicated in kg- CO_2/year-m^2.



Life Cycle CO_2 Calculation Sheet (For Standard calculation)

						Subject		Reference
1. CO_2 Emissions Related to Construction								
1-1. Conversion of Assessment Results to CO_2 emission					kg-CO_2/m^2-yr	kg-CO_2/m^2-yr		kg-CO_2/m^2-yr
Q2/2.2.1 Service Life of Structural Frame Materials	Floor area composition	Level 3	Level 4	Level 5	Score	CO_2 Emissions	Score	CO_2 Emissions
Offices	0.00	14.01	14.01	14.01	3.0	14.01	3.0	14.01
Schools	0.00	10.47	10.47	10.47	3.0	10.47	3.0	10.47
Retailers	0.00	16.57	16.57	16.57	3.0	16.57	3.0	16.57
Restaurants	0.00	16.57	16.57	16.57	3.0	16.57	3.0	16.57
Halls	0.00	11.54	11.54	11.54	3.0	11.54	3.0	11.54
Factories	0.00	19.56	19.56	19.56	3.0	19.56	3.0	19.56
Hospitals	0.00	10.41	10.41	10.41	3.0	10.41	3.0	10.41
Hotels	0.00	11.12	11.12	11.12	3.0	11.12	3.0	11.12
Apartments	0.00	15.64	7.82	5.21	3.0	15.64	3.0	15.64
Structure	S							
LR2/2.2 Continuing Use of Existing Building Skeleton etc.	0%						0%	
LR2/2.3 Use of Recycled Materials as Structural Frame Materials (Blast furnace cement (concrete))	0%						0%	
1-2. Subtotal						0.00		0.00
2. CO_2 Emissions Related to Repair, Renewal and Demolition								
2-1. Conversion of Assessment Results to CO_2 emission					kg-CO_2/m^2-yr	kg-CO_2/m^2-yr		kg-CO_2/m^2-yr
Q2/2.2.1 Service Life of Structural Frame Materials	Floor area composition	Level 3	Level 4	Level 5	Score	CO_2 Emissions	Score	CO_2 Emissions
Offices	0.00	15.99	15.99	15.99	3.0	15.99	3.0	15.99
Schools	0.00	11.80	11.80	11.80	3.0	11.80	3.0	11.80
Retailers	0.00	6.88	6.88	6.88	3.0	6.88	3.0	6.88
Restaurants	0.00	6.88	6.88	6.88	3.0	6.88	3.0	6.88
Halls	0.00	12.81	12.81	12.81	3.0	12.81	3.0	12.81
Factories	0.00	8.65	8.65	8.65	3.0	8.65	3.0	8.65
Hospitals	0.00	15.43	15.43	15.43	3.0	15.43	3.0	15.43
Hotels	0.00	13.30	13.30	13.30	3.0	13.30	3.0	13.30
Apartments	0.00	8.02	9.72	10.98	3.0	8.02	3.0	8.02
2-2. Subtotal						0.00		0.00
3. CO_2 Emissions Related to Operation Energy						kg-CO_2/m^2-yr		kg-CO_2/m^2-yr
3-1. Building-related Initiatives [2]	Floor area m^2	Prim. Energy Ref. bldg. [1]	GJ/yr Subj. bldg. [2]	CO_2 conversion factor kg-CO_2/MJ		0.00	**Ref. bldg. [1]**	0.00
Building except Apt. area	0	0	#DIV/0!	#VALUE!		0.00		0.00
Apt. Private area (dwelling units total)	0	0	-	#VALUE!		0.00		0.00
Apt. Common area	0	0	-	#VALUE!		0.00		0.00
3-2. Above + Other On-site Measures [3]	Floor area m^2	Prim. Energy Reduced Ene.	GJ/yr Subj. bldg. [3]	CO_2 conversion factor kg-CO_2/MJ		0.00		
Building except Apt. area	0	0	#DIV/0!	#VALUE!		0.00		
Apt. Private area (dwelling units total)	0	0	#VALUE!	#VALUE!		0.00		
Apt. Common area	0	0	#VALUE!	#VALUE!		0.00		
4. Calculation of Life Cycle CO_2 (Standard calculation)						kg-CO_2/m^2-yr		kg-CO_2/m^2-yr
						CO_2 Emissions		CO_2 Emissions
Construction						0.00		0.00
Repair, Renewal and Demolition						0.00		0.00
Operation						0.00		0.00
Total						**0.00**		**0.00**

Figure 15: $LCCO_2$ Calculation Sheet

For assessments based on the standard calculation, $LCCO_2$ Calculation Conditions Sheet displays the assessment conditions applied in the $LCCO_2$ calculation, such as the amount of key materials, environmental load units, CO_2 emissions coefficient for energy, and other source data. When the existing structural frame or blast furnace cement is used, enter the percentage utilisation for each item. These values are reflected in the calculation of the CO_2 emissions under the construction stage category of the $LCCO_2$ Calculation Sheet.

4.6 Entry into the score sheet

Rating results entered into individual Score Entry Sheets are indicated in the rating fields in the Score Sheet. The standard for the final rating is 3 points. With respect to assessment items to which more than 3 points are given, specific grounds of such assessment results must be provided in the "Summary for Design for Environment (DfE)" column located in the middle of the Score Sheet. (Refer to Figure 16).

Score Sheet							
Concerned categories	Summary of environmentally conscious efforts in design	Entire Building and Common Properties		Residential and Accomodation sections		Total
		Score	weight	Score	weight	
Q Environmental Quality of the building						####
Q1 Indoor Environment			#DIV/0!		-	#####
1 Noise & Acoustics		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.1 Noise	Indicate specific measures taken (Mandatory for assessments items that obtained more than 3 points)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
1.2 Sound Insulation		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
1 Sound Insulation of Openings		3.0	#DIV/0!	3.0	#DIV/0!	
2 Sound Insulation of Partition Walls		3.0	#DIV/0!	3.0	#DIV/0!	
3 Sound Insulation Performance of Floor Slabs (light-weight impact source)		3.0	#DIV/0!	3.0	#DIV/0!	
4 Sound Insulation Performance of Floor Slabs (heavy-weight impact source)		3.0	#DIV/0!	3.0	#DIV/0!	
1.3 Sound Absorption		3.0	#DIV/0!	3.0	#DIV/0!	

Figure 16: How to enter data into the Score Sheet

4.7 Assessment results sheet

The Assessment Results Sheet ("Result" sheet) is shown in Figure 17 below. The assessment results of Q (Environmental quality of building), LR (Environmental load reduction of building), BEE (Built Environment Efficiency) and $LCCO_2$ emission rates are shown in graph and numerical formats. (Refer to Figure 17).

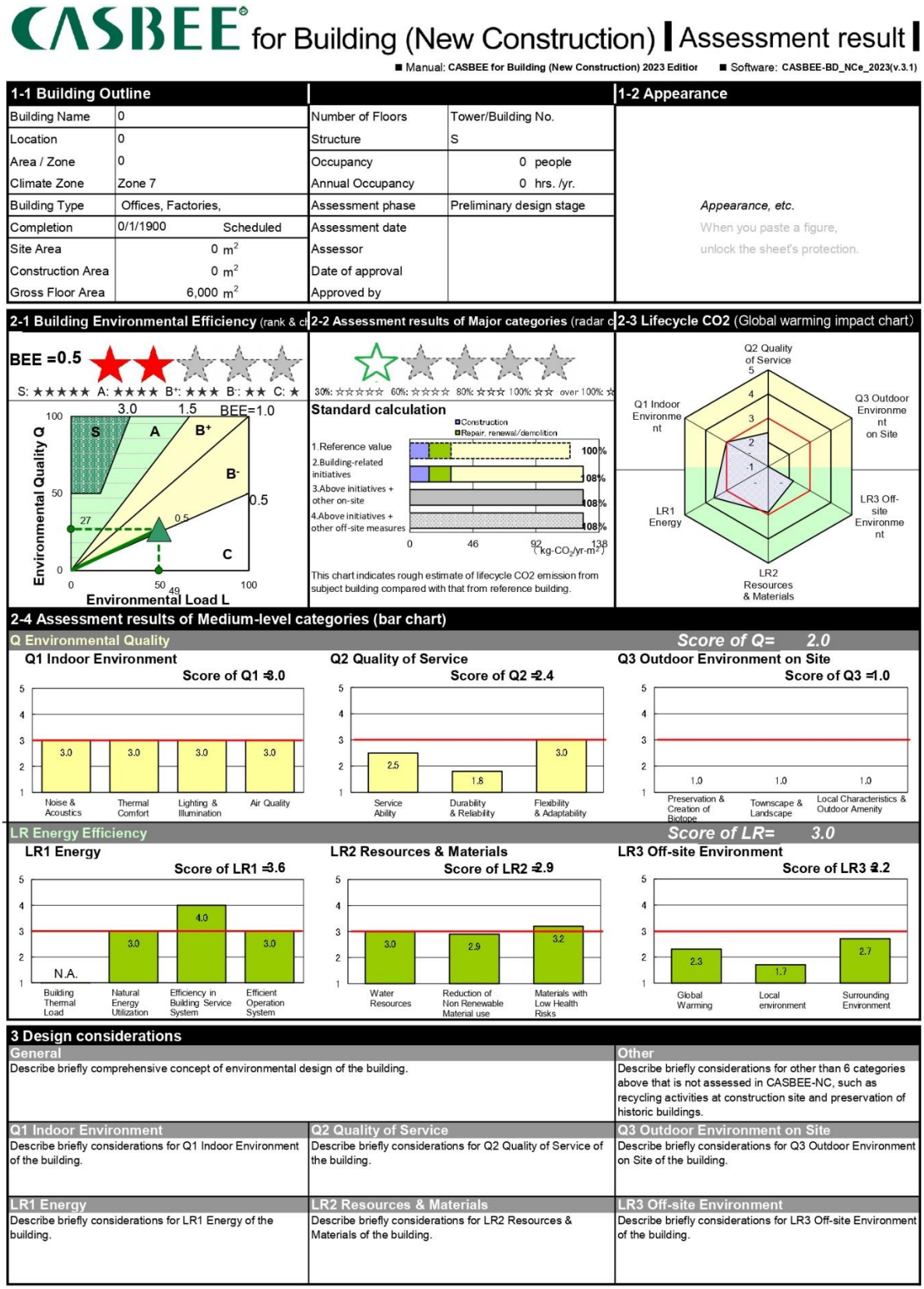


Figure 17: Assessment Results Sheet for CASBEE Iskandar for Building (New Construction)

1. Building outline - Shows the project summary information from the 1. Building outline entry of the Main Sheet 1), including building name and type, location, scale and structure.
2. Assessment results of CASBEE - The assessment results for environmental performance assessment items on the building itself are presented in this column. It shows graphs of the input results for the scoring items collated on the Score Sheet. The indicated score for each assessment item is the value rounded to two decimal places. Unrounded values are used for calculating the score for each item.
3. 2-1. BEE: Built Environment Efficiency - Built Environment Efficiency (BEE), which is calculated from the assessment results of Q (Environmental quality of building) and L (Environmental load of building), is shown here. The values for Q and L are derived from SQ (the total score for the Q categories) and SLR (the total score for the LR categories). First the numerator Q is defined as Q = 25(SQ-1) to convert the SQ (from 1 to 5) for the environmental quality of building into the Q scale of 0 to 100. Then the denominator L is defined as L = 25(5-SLR) to convert the SLR (from 1 to 5) for load reduction into the L scale of 0 to 100. BEE is presented as a graph on the left of the table, with Q on the Y axis and L on the X axis, so that BEE is the gradient of the line joining the point with coordinates equal to the Q and L values to the origin (Q = 0, L = 0). The higher the Q value and the lower the L value, the steeper the gradient and the more sustainable the building is. CASBEE labels buildings with an overall environmental performance assessment rating ranging from C (Poor) through B-, B+, A and S (Excellent), corresponding to regions divided according to the line gradient. The ranks correspond to the assessment expressions shown in Figure 6, using a number of red stars for clarity.
4. 2-2 Lifecycle CO_2 (Global warming impact chart) - The reference values and $LCCO_2$ for the evaluated building are indicated on a bar chart. The emission rate (%) for the assessment subject is displayed, relative to the reference value of $LCCO_2$ emission as 100%
    a. Reference value ($LCCO_2$ emissions of a standard building that satisfies the standard for building owners)
    b. $LCCO_2$ emissions of subject building: assessment of building-related initiatives (e.g. energy efficiency improvement, use of ecological materials and extended building lifespan.
    c. Assessment of above initiatives + other on-site measures (e.g. on-site solar power generation)
    d. Assessment of above initiatives + off-site measures (e.g. procurement of renewable energy certificates and carbon credits)

5. 2-3 Radar Chart - The points for the six major categories from Q1 to LR3 are shown together in a radar chart on the upper right of the second column, to give an immediate clear presentation of the characteristics of environmental considerations in the target building.
6. 2-4 Bar Chart - Assessment results for Q (environmental quality of building) is presented as a bar chart per middle item on the upper column for each major category, "Q1 Indoor Environment," "Q2 Quality of Service" and "Q3 Outdoor Environment (On-site)." The assessment results for LR (environmental load reduction of building) are presented likewise, for "LR1 Energy," "LR2 Resources & Materials" and "LR3 Off-site Environment."
7. Design Considerations - Indicate items that are considered in the Design for Environment (DfE), so that it is easy for a third party to gain an overview of environmental considerations in the evaluated building. The statements made in each space for General, Q1-LR3 and Other in the Consideration Record Sheet are displayed as they were input.

Chapter 5.0 Case Study

Various samples of buildings in Iskandar region have been taken as a benchmark for the result for CASBEE Iskandar. The buildings chosen for the assessment case study are based on their typology, which consist of residential, commercial and industrial buildings. The buildings are:

1) Industrial building A - JST Connectors Factory
2) Industrial building B - Heng Hiap Industry
3) Commercial building A - JLand Office Tower
4) Residential building A - Molek Pine 4
5) Office building A – Menara MBJB

The initial pilot assessments for CASBEE Iskandar are based on these five buildings that serve as a benchmark or guidelines for other buildings in the Iskandar region. The results are based on information provided by the owners of the buildings.

5.1 Industrial building A – JST connectors factory

Industrial buildings, especially large factories, have succumbed to the fact that their functions as a production-based activity have been identified to also use more energy, thus producing more carbon emissions. To receive a higher rating in CASBEE Iskandar, the factory should emphasise its design on other factors, such as Q3 - Outdoor Environment (On-site) and LR3 - Off-site Environment.

Case study industrial building A, JST Connectors Factory is a good example of an industrial building that has taken Q3 and LR3 as the main approach of the design.

Figure 18: Aerial view of the factory.

Source: (https://greenroofsaustralasia.com.au/news/factory-earth-%EF%BD%9C-jst-malaysia)

JST Connectors Factory is owned by a Japanese company that has established its factory in Pelabuhan Tanjung Pelepas. The building consists of two main components, which are the office area and the production area. Producing electrical connectors requires a lot of mechanical machinery that produce a lot of environmental load. Therefore, the design of the building approaches towards implementing a more load reduction design that includes green roofing and green walling.

The total site area is approximately 46,490 m^2 and the total built-up area is 22,800 m^2. The structure of the building consists of steel and concrete. The roof itself is specially designed as a green roof. The details and constructions of the roof itself is not a typical design in Malaysia.

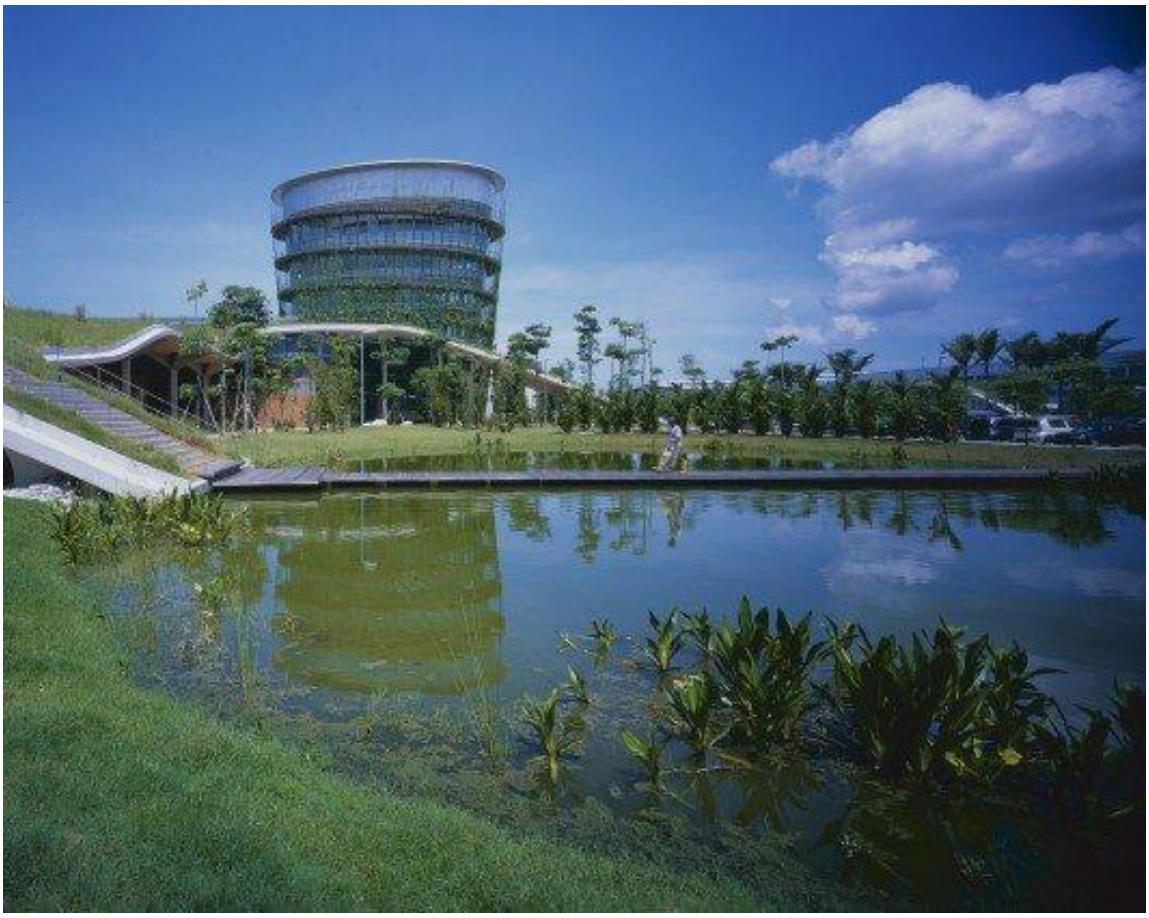


Figure 19: Biotope preservation onsite.

Source: (http://design.fr/architecture/factory-on-the-earth-ryuichi-ashizawa-architect-associates/)

The strong element for the building is the implementation of "Q3 Outdoor Environment (On-Site)" where the design of the building itself promotes local landscape integration and preservation. The roof of the newly-built factory is entirely covered by local shrubs and plants that were taken directly from site. It also provides and preserves the biotope of the environment.

Figure 20: Air well inside the factory.

Source: (http://www.archdaily.com/586653/factory-on-the-earth-ryuichi-ashizawa-architect-and-associates)

Another feature that allows the building to be efficient in its electrical consumption is the usage of light wells in every production area. Natural daylighting is welcomed in the environment of the factory, but at the same time sunlight is entirely considered as a hazard to human comfort within the building, especially in the production area.

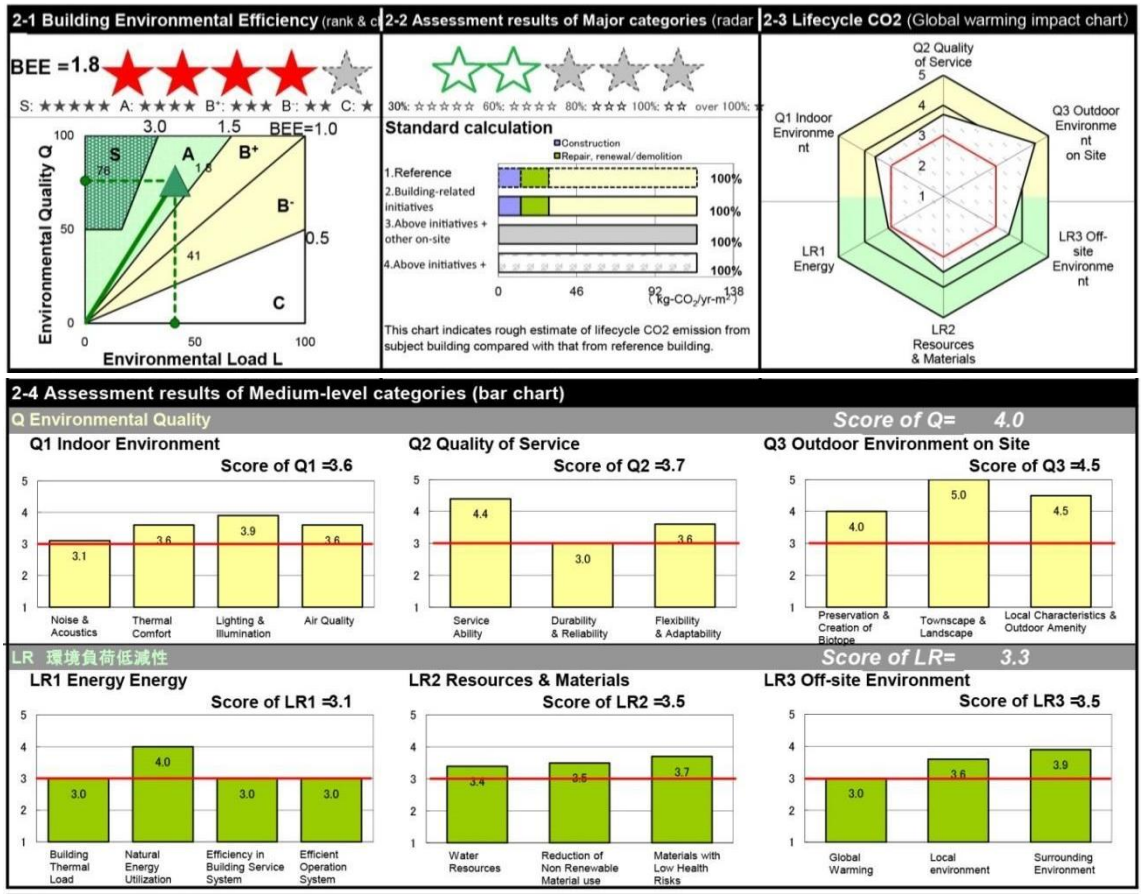


Figure 21: JST Connectors Factory Assessment Results

Referring to Graph 2-1 in Figure 21, it shows that the factory received a high score of 4 stars. The factory was able to retrieve such a high score due to its implementation of green areas within the site and the building itself. Referring as well to Spider Chart 2-3 in Figure 21, it can be seen that the factory's design emphasises its investment entirely on "Q3 Outdoor Environment (On-Site)".

The bar charts in 2-4 shows the results for each Secondary Item. From here the building owner can identify which item(s) they should focus on improving. As seen in the bar chart for Q3, Townscape and Landscape items obtained a full score of 5, and the other two items receive at least a minimum of 4, which is higher than the average of 3.

5.2 Industrial building B – Heng Hiap Industry Factory

Heng Hiap Industries Recycle Factory is a newly built factory building that is focused on recycling plastics into a few new fuels such as coal and oil, as well as new biodegradable plastics. The building has two sections, which are the office and production areas. The production area is designed to suit the site's sun orientation and wind flow. Due to heavy machinery and heat production within the space, the wind flow helps the building to be more comfortable in the sense of thermal comfort.

Equipped with various energy saving and environmental-friendly technology, this building with a 7,591 m^2 built-up area is located on a site area that is approximately 15,410 m^2. It still has more planning and implementation towards passive green approach, such as a green tropical fruit garden around the perimeter of the site.

Figure 22: Exterior view of the factory

Source: (http://www.laubros.com/devportal/index.php/component/k2/item/110-commercial-project)

This 3-storey high office building with its triple-volume the factory is built using a steel and concrete structure. The cladding of the office is reflective towards heat penetration. The factory itself is covered with metal cladding and has its own natural daylighting intake from the side of the factory that actually was evaluated beforehand to meet appropriate illuminance level.

The building program is mixed between office activities, factory or recycling activities as well as community awareness programs. The building compound is opened up to the public for any 'green technology' conference or events.

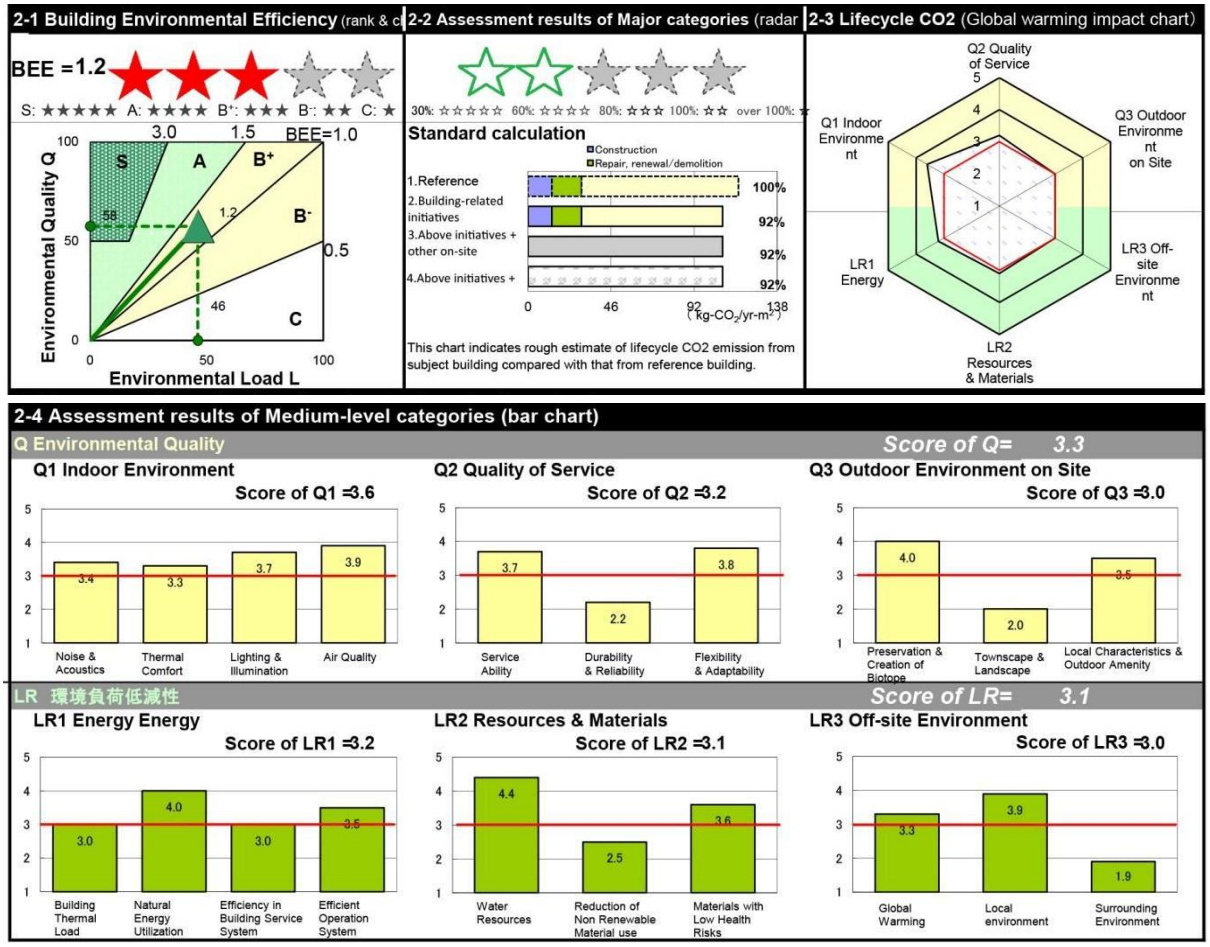


Figure 23: Heng Hiap Factory Assessment Results

Typically for an industrial building it is normal to obtain B- to B+ marks due to its function as a production-based building. However, this factory utilises a lot of efforts to increase the indoor quality environment by implementing new mechanical technology to keep the interior of the office area to receive high quality air intake.

The result shown in the bar charts in 2-4 in Figure 23 reflects the score currently obtained by the building. Most of the lower scores obtained are from Q3 and LR3, which is 3 points each. Even though the building retrieves a lower score compared to a non-industrial building, there are still opportunities for the building to receive a higher score if the owner of the building increases the Q or LR of the establishment.

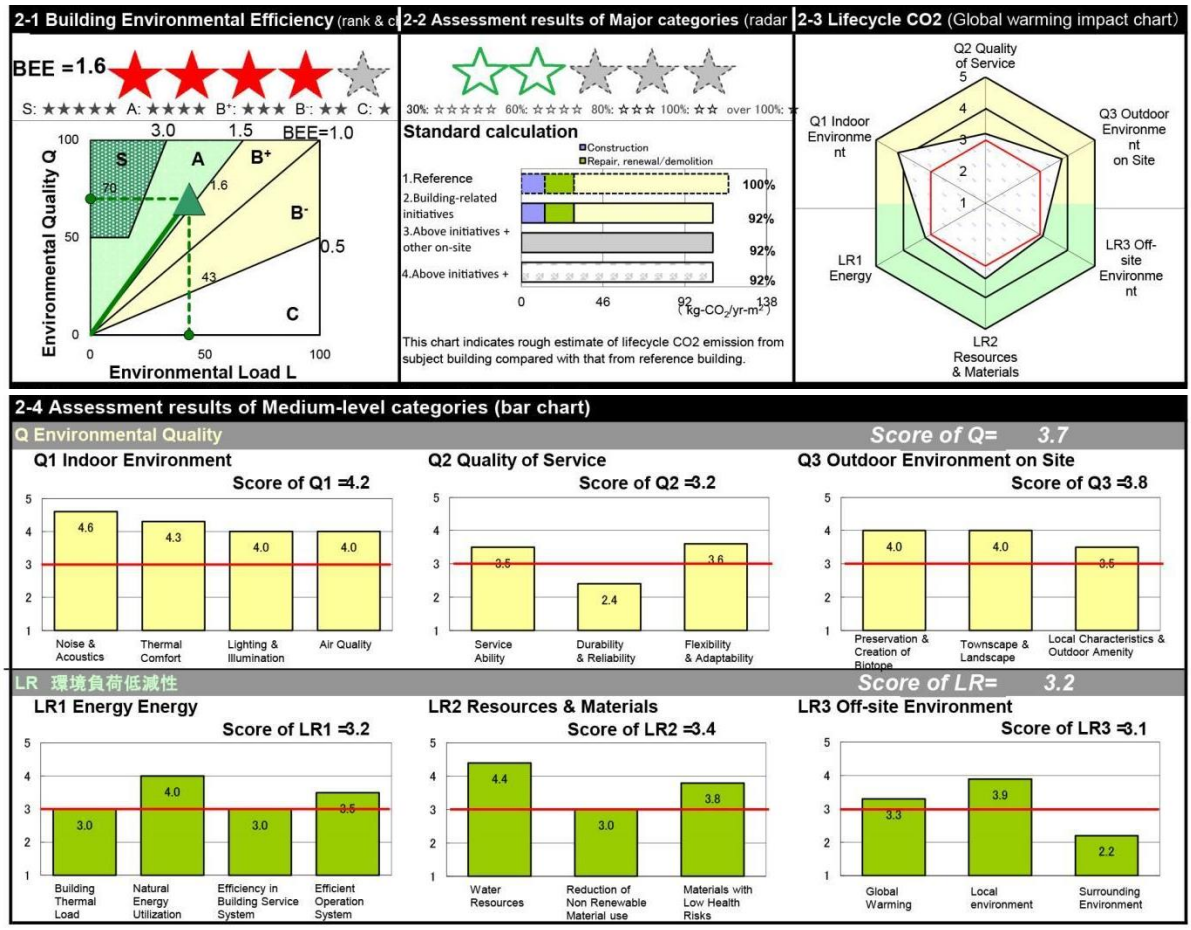


Figure 24: Heng Hiap Factory Assessment Results - Future Planning

The new graph 2-1 in Figure 24 shows an increment in Q and an A score for the proposed future implementation. This was made possible by increasing the Q factor of "Q1 Indoor Environment" and "Q3 Outdoor Environment (On-Site)" in future planning and implementation.

The building also has a few upcoming green strategies such as the implementation of an interior green wall within the multi-purpose hall in the office. Aside from the interior, there are also plans to develop the perimeter of the vicinity to become a green area or green park with its own biotope integration, where the main focus is to invite natural elements within the compound. At the same time, there are also a few new green technologies implemented for exhibition purposes.

Regarding the above bar charts in sections 2-4, it shows an increment in Q3 which previously only obtained a score of 3. Specifically targeting Townscape and Landscape, the building achieved a 0.8-point increase in scores. Q1 achieved an increment of 0.6 points.

5.3 Commercial Building A - JLand Office Tower

Developed by Johor Land Berhad, the building is a 30-storey office building. The building starts from Level 8 KOMTAR JBCC Podium, Jalan Wong Ah Fook, Johor Bahru. Well known as Menara JLand, the building was assessed and obtained good results under the Green Building Index assessment tool. This tower building is a newly-built office tower that has implemented energy saving precautions and technology.

Figure 25: Artist impression of the building

Source: (http://www.skyscrapercity.com/showthread.php?t=553962&page=18)

As a newly constructed tower on top of an existing building that serves as a podium for parking, and is directly connected to the shopping complex below, this tower is constructed using concrete structures and a metal exterior structure that supports the glass curtain wall.

This 193,415 m^2 tower is part of a mixed-use development within a 21,438 m^2 site in the heart of the city. The façade of the building continues the language of the existing tower on the side of the podium, which is the existing KOMTAR Tower.

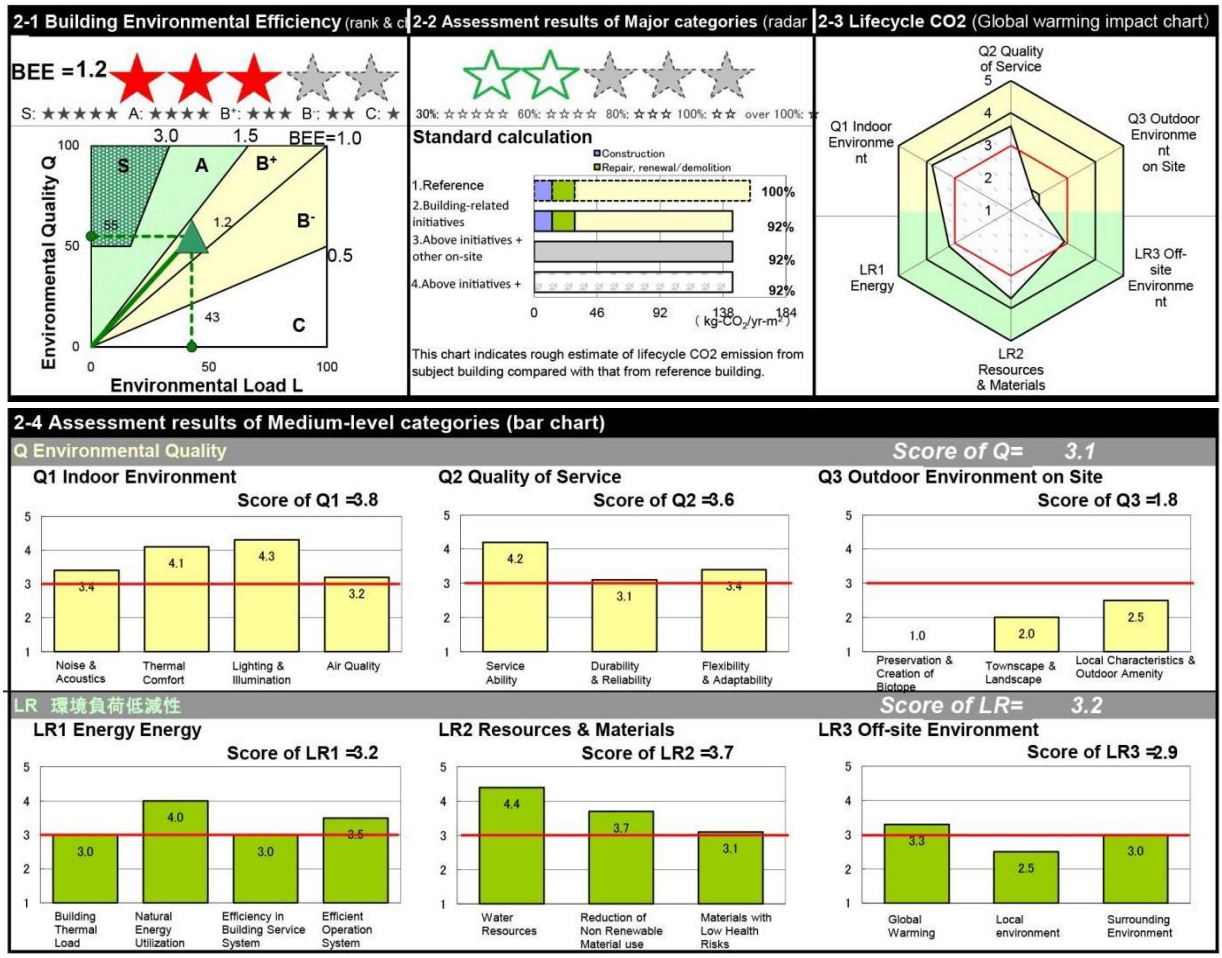


Figure 26: JLand Tower Assessment Results

Figure 26 illustrates the assessment results of the JLand Office Tower only. The whole assessment should include the neighbouring tower and the podium with the shopping complex; however, the above result is still relevant as one part of the whole assessment.

In order for the tower to receive a higher score, the development should consider the environmental effect or impact from the building. Q3 and LR3 scores are below the acceptable level, which is less than 3. However, the tower compensates the lack of those scores by achieving higher scores in other criteria and items.

The main advantage this building has in the assessment is its usage of new and innovative technology. Fire system test water is recycled for toilet flushing. Regenerative lifts and electronic air filters are new technologies that were employed in the building, both for energy efficiency and human indoor environment comfort.

5.4 Residential Building A - Molek Pine 4

The proposed development, also known as Molek Pine 4, is situated along Jalan Molek Pine 1 /27, Taman Molek, Johor Bahru. The proposed development consists of a block of 37-storey condominiums (260 units), a 3-storey clubhouse, a 1-storey multi-purpose hall, and a sub-basement car park. It sits on a land of 6.24 acres and has a total gross floor area (excluding car park area) of 58,399.01 m^2 (628,610 ft^2).

The 37-storey condominium is sited on a lush tropical landscaped podium with a naturally-ventilated sub-basement car park. The green strategies adopted in its overall site planning aim to minimise the heat island effect while achieving the lush green ambience effect.

Figure 27: Molek Pine 4 Advertisement image.

Source: Completion and Verification Assessment Report by GBI Innovation

All 260 units in the 37-storey condominium tower are oriented along the North-South axis. This is deliberate designed to minimise heat gain. The window glazing on the North and South elevations have been carefully studied to reduce the Overall Thermal Transfer Value (OTTV) without compromising on the panoramic views of the units.

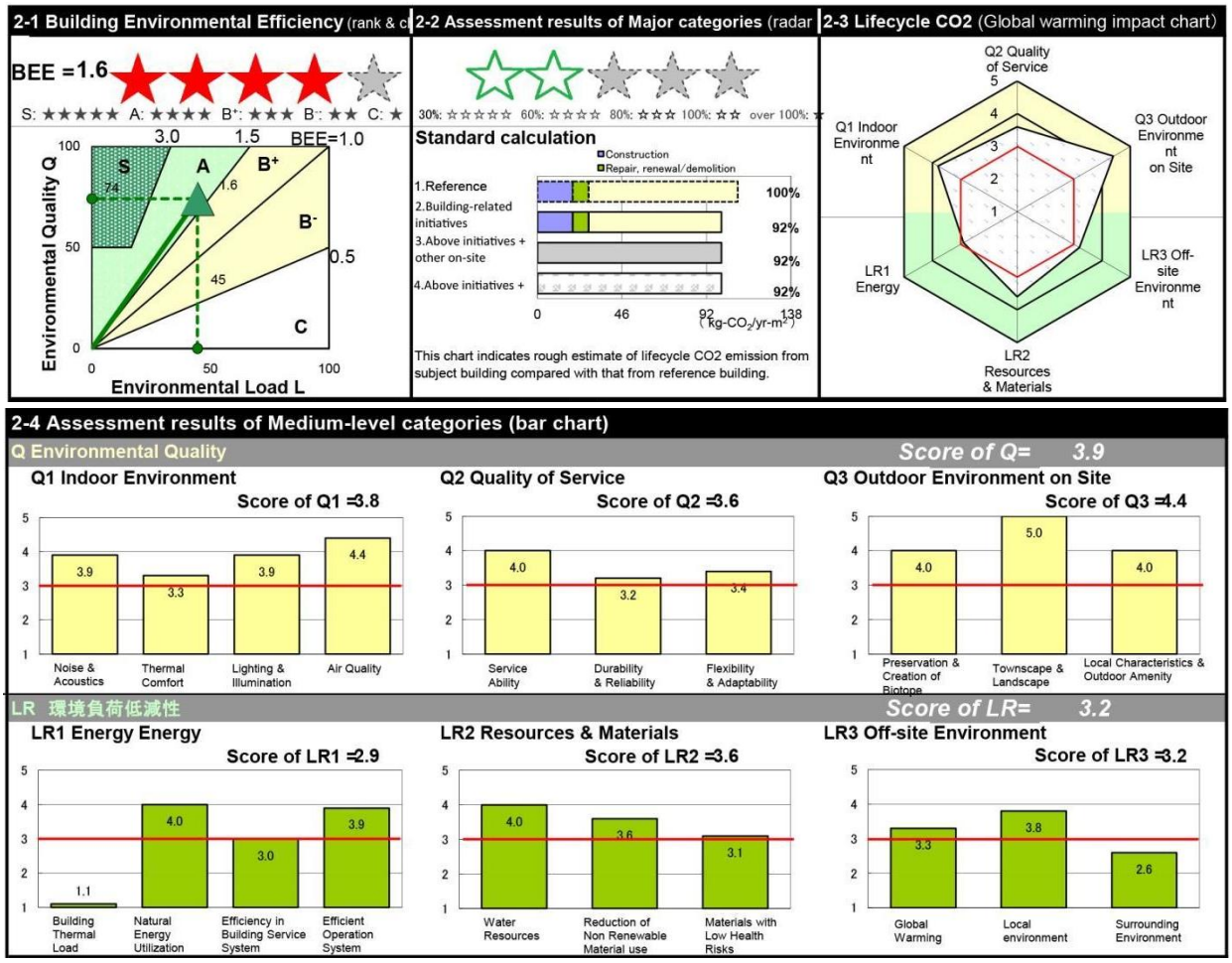


Figure 28: Molek Pine 4 Assessment Results

This apartment building received a high score due to its concept of being a 'Green Building'. The multi-purpose hall within the development has been built with a green roof feature that can help the site to decrease the heat island effect. Therefore, the score for "Q3 Outdoor Environment (On-Site)" as referred to spider web in Radar Chart 2-3 in Figure 28 has the highest score for the entire assessment. Balconies, egg-crate facades and sun shading elements are introduced as a passive design feature to reduce heat gain while allowing good daylighting to all the units. Horizontal/vertical cross ventilation has been introduced at the central void to improve air quality and daylighting performance while reducing trapped heat. The only item with a low score is "LR1 Energy". Most of the criteria obtained a higher-than-average score, which compensates for the lack of scores for item "Building Thermal Load".

5.5 Office Building A – Menara MBJB

The MBJB Tower, also known as Menara MBJB, has served as the new headquarters for the Johor Bahru City Council (MBJB) since 2019. Strategically situated at the heart of the Johor Bahru City Centre (JBCC) in Bukit Senyum, it is conveniently located less than 1 km from the Johor Bahru Customs and Immigration Quarantine Complex (CIQ).

Figure 29: Exterior view of Menara MBJB.

Source: (https://utracon.com/ucplwp/index.php/mbjb-tower-malaysia/)

Menara MBJB is a 15-storey Grade-A office tower with a 7-storey basement, offering ample parking space on a 1.37 acre site, developed by Astaka Padu Sdn Bhd. The structure comprises 14 floors of office space, with 15th level designed as a rooftop garden and event room. Menara

MBJB obtained its Green Building Index (GBI) certification with a Certified rating in November 2021, positioning it as an iconic building leading MBJB in the state's green transformation.

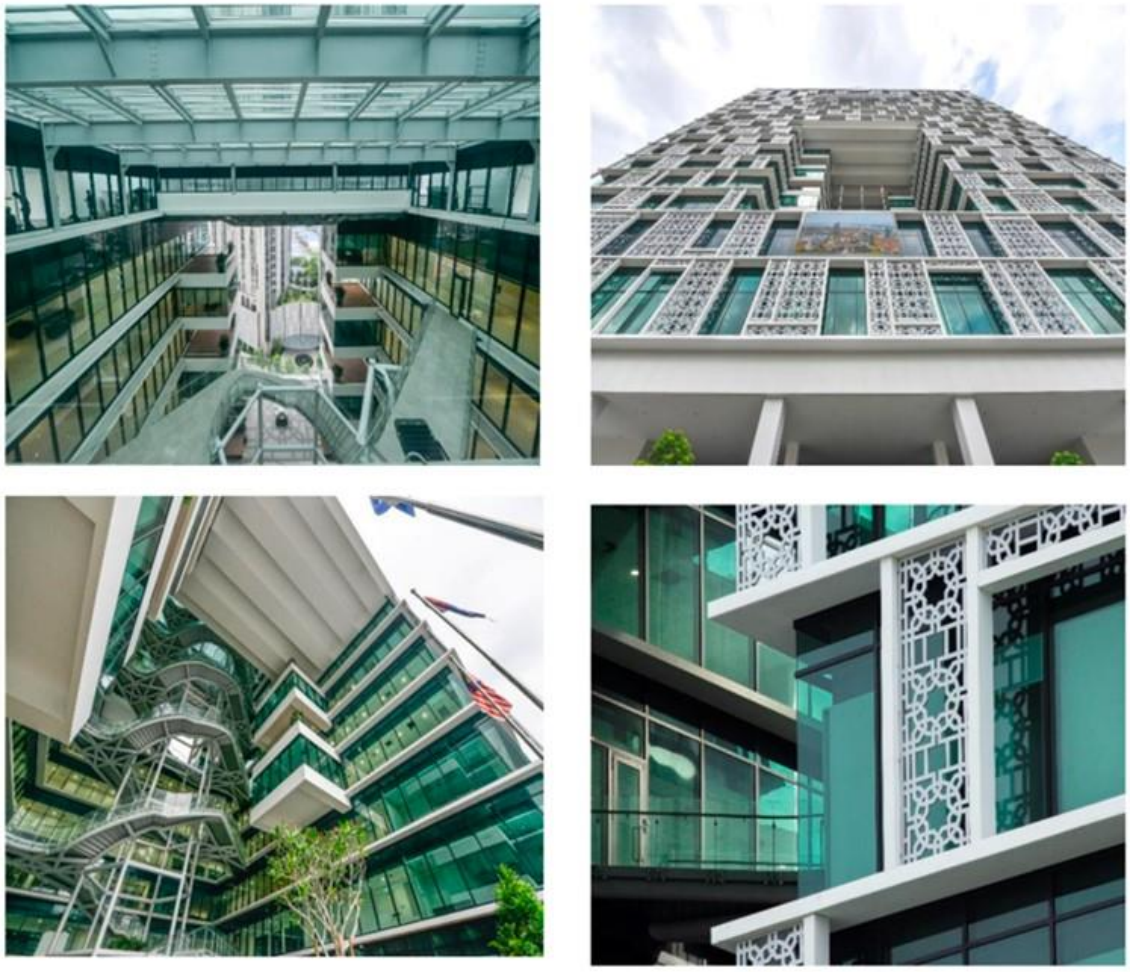


Figure 30: Sunscreens and covered courtyards provide effective shading for the building.

Source: (https://www.mbjb.gov.my/ms/MBJBTower)

Featuring traditional Islamic architectural motifs on its façade lattice, Menara MBJB enhances shading and contributes to the building's energy efficiency. High-performance glass on the façade further mitigates heat gain. The cube-shaped building incorporates open courtyard gardens in cut-out spaces, providing sky gardens, daylight, and elevated views. The cube design is oriented at a 19-degrees north, south, east, and west to optimize natural ventilation in various space.

Additionally, the Menara MBJB office layout prioritizes the use of natural light. Translucent blinds installed along the facade reduce glare while preserving panoramic views and ensuring an abundance of diffused daylight.

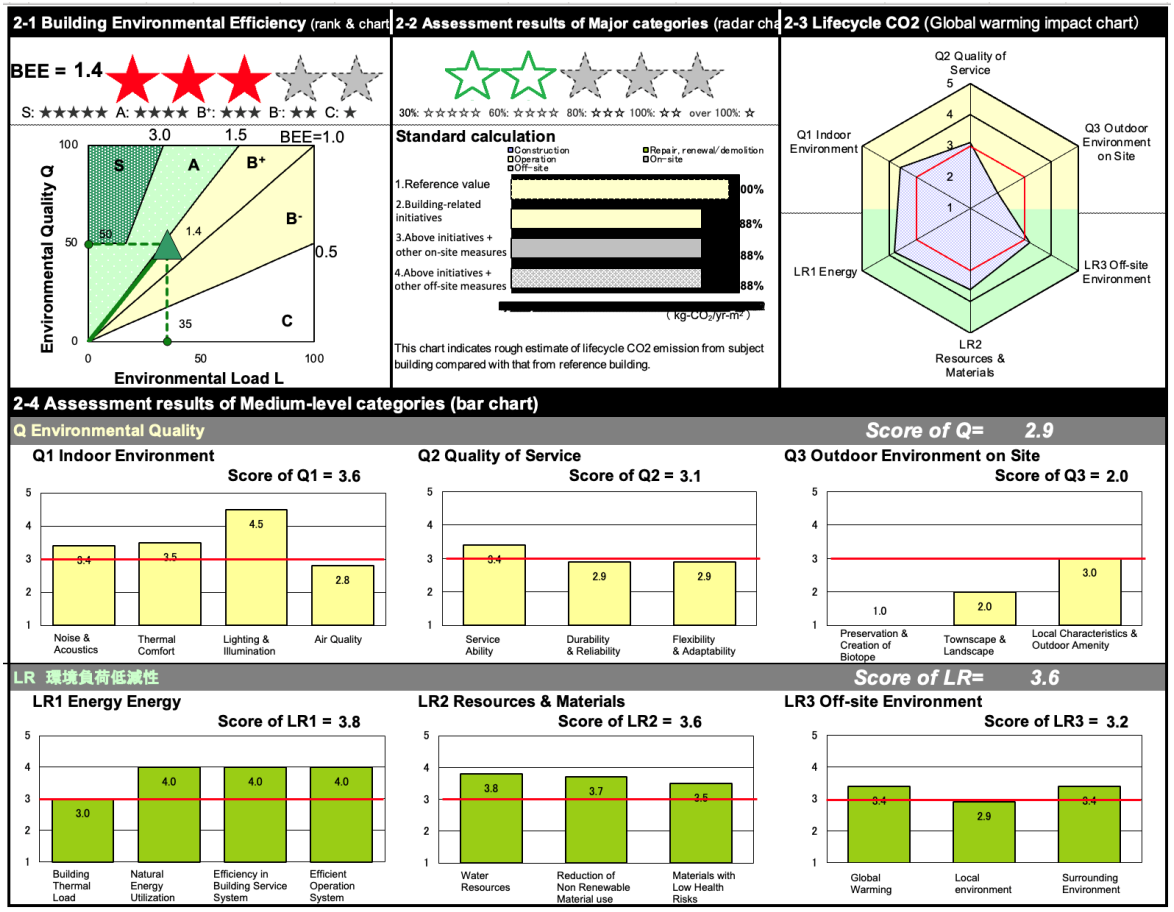


Figure 31: Menara MBJB Assessment Results for CASBEE Design Assessment (DA) stage.

Referring to Graph 2-1, Menara MBJB received a BEE score of 1.4, equivalent to a 3-star rating. Upon analyzing the spider chart 2-3, it is evident that the design of Menara MBJB prioritises energy efficiency. Nevertheless, there is room for improvement in enhancing the Q3 Outdoor Environment on Site.

The bar charts in 2-4 depict the results for each secondary item. In the bar chart for Q1 Indoor Environment, Menara MBJB received a high rating for lighting and illumination. However, in the bar chart for Q3 Outdoor Environment, the preservation and creation of biotope received only a

1.0 score, and townscape and landscape received only 2.0 score, indicating a need for improvement in these aspects. Worth mentioning, the three items under LR1- Energy received a high score of 4.0, surpassing the average of 3.0.

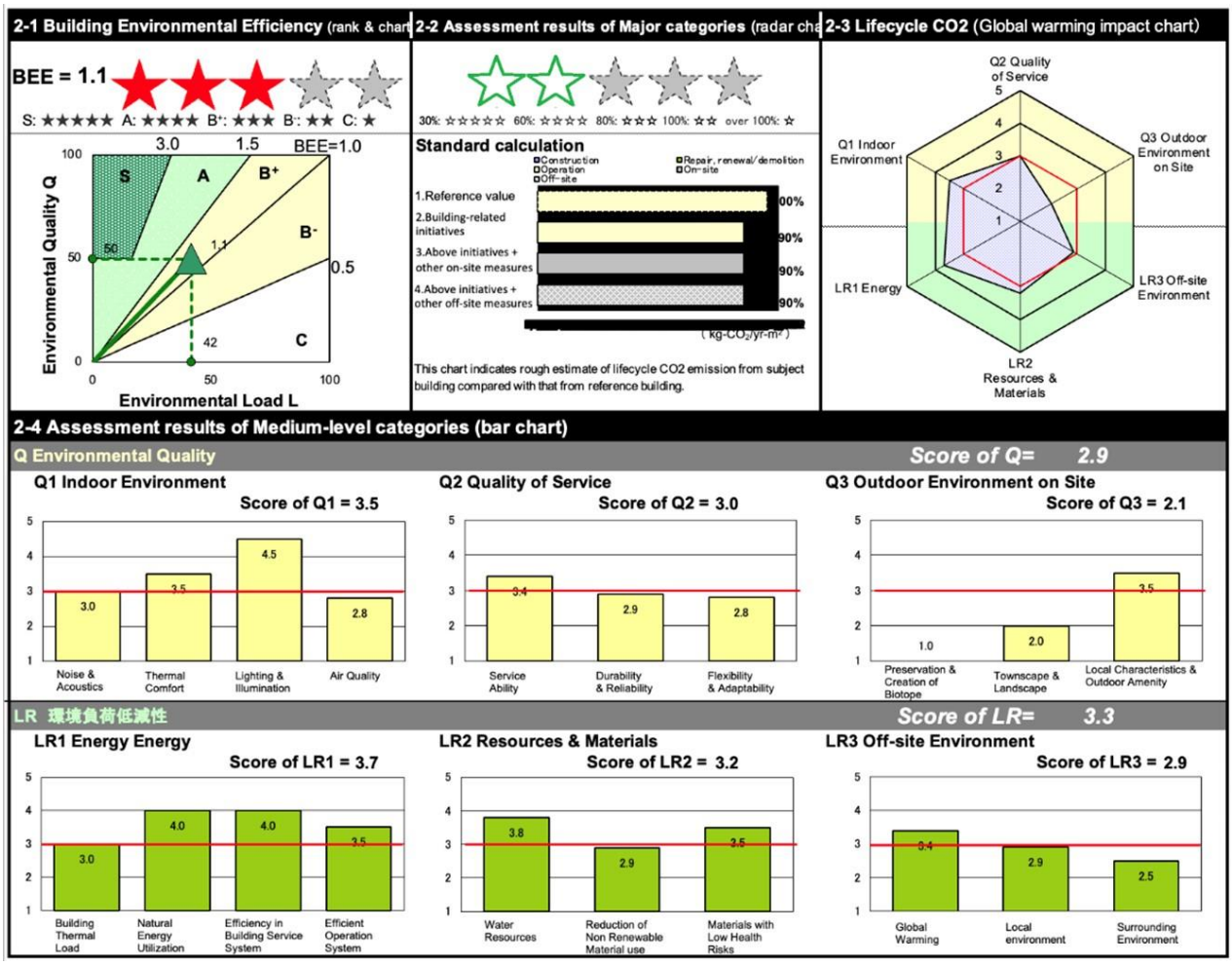


Figure 32: Menara MBJB Assessment Results for Completion & Verification Assessment (CVA) stage.

In comparison to the assessment result of DA, the assessment of CASBEE's CVA received a BEE score of 1.1, slightly lower than that of DA but still maintaining a 3-star rank. This is in contrast with its achievement under GBI's CVA stage. The decrease in the score compared to CASBEE's DA can be attributed to several factors. Firstly, it did not meet the DA target noise level, resulting in a downgrade of one CASBEE level. Additionally, there was a significant reduction in the percentage of recycled content materials, primarily relying on steel, impacting several CASBEE criteria. Furthermore, the water efficiency of CVA was below the DA target. These factors collectively contributed to the lower BEE score in the CVA assessment compared to DA.

Chapter 6.0 Criteria

The components for the criteria are divided by two which are Environmental Quality of Building (Q) and Environmental Load of Building (L). The Q and L are two sets of different formulas. However, these later on will be derived into a new formula (refer to Assessment Method).

6.1 Q: Environment Quality of Building

In a relevant building, CASBEE Iskandar for Building (New Construction) takes the environmental quality of building as quality related to improving everyday amenities for users, and evaluates each item (refer to Table 4)

Table 4: CASBEE Iskandar Building Quality (Q) Table of Items

Major Item	Primary Item	Secondary Item	Criterion
Q	Q1 - Indoor Environment	Q1.1 Sound Environment	Q1.1.1 Noise
			Q1.1.2 Sound Insulation
			Q1.1.3 Sound Absorption
		Q1.2 Thermal Comfort	Q1.2.1 Room Temperature Control
			Q1.2.2 Humidity Control
			Q1.2.3 Type of Air Conditioning System
		Q1.3 Lighting & Illumination	Q1.3.1 Daylight
			Q1.3.2 Anti-glare Measures
			Q1.3.3 Illuminance Level

Major Item	Primary Item	Secondary Item	Criterion
			Q1.3.4 Lighting Controllability
		Q1.4 Air Quality	Q1.4.1 Source Control
			Q1.4.2 Ventilation
			Q1.4.3 Operation Plan
	Q2 – Quality of Services	Q2.1 Serviceability	Q2.1.1 Functionality & Useability
			Q2.1.2 Amenities
			Q2.1.3 Maintenance
		Q2.2 Durability & Reliability	Q2.2.1 Natural Catastrophe Resistance
			Q2.2.2 Service Life of Components
			Q2.2.3 Appropriate Renewal *(not applicable for New Construction)*
			Q2.2.4 Reliability
		Q2.3 Flexibility & Adaptability	Q2.3.1 Spatial Margin
			Q2.3.2 Floor Load Margin
			Q2.3.3 System Renewability
	Q3 - Outdoor Environment (On-Site)	Q3.1 Preservation & Creation of Biotope	
		Q3.2 Townscape & Landscape	

Major Item	Primary Item	Secondary Item	Criterion
		Q3.3 Local Characteristics & Outdoor Amenities	Q3.3.1 Local Character & Improvement of Comfort
			Q3.3.2 Improvement of the Thermal Environment on Site

Q1 - Indoor Environment

Evaluate the indoor environment, which has a major impact on the health, comfort and intellectual productivity of occupants, as a basic performance of the building. Research into the performance of indoor environments began before global environmental problems rose to prominence, and it already has a strong record and body of knowledge.

However, those typical evaluation methods were aimed to evaluate performance after completion of the building, or during its operation life. In contrast, this "CASBEE Iskandar for Building (New Construction)" has developed the indoor environment assessment methods previously used in the construction and environmental engineering fields. Table 5 explains the CASBEE Iskandar Building Q1 indoor environment item explanations.

Table 5: CASBEE Iskandar Building Q1 Indoor Environment Item Explanations

Primary Item	Secondary Item
Q1 - Indoor Environment	Q1.1 Sound Environment
The aim is to make it as easy as possible to evaluate target values for performance (heat, illuminance, noise values, etc.) at design and construction stages. In that	The assessment is carried out regarding the level of background noise, which is closely related to the level of comfort and ease of operation, the level of sound insulation in order to prevent noises from entering the living space, and the level of sound absorption in order to prevent noises generated indoors or coming in from outside from echoing.
	Q1.2 Thermal Comfort

Primary Item	Secondary Item
process, aspects such as systems for operation, management, monitoring and control are evaluated as efforts to improve environmental performance.	Evaluate the setting, control, and maintenance systems for interior temperature, humidity and air conditioning, and the related equipment.
	Q1.3 Lighting & Illumination
	The assessment is carried out regarding the efficient utilization of natural light (daylight use), measures against the glare of direct sunlight during the day (anti-glare measures), the balance and level of brightness (illuminance level) and the control of brightness and positions of lights (lighting controllability)
	Q1.4 Air Quality
	Evaluate the level of consideration given to selection of materials to maintain safe interior indoor air quality (IAQ), ventilation methods, construction methods and other aspects. This assessment item comprises three elements: Source Control, mainly avoidance of pollution-generating materials; Ventilation, with the aim of expelling released contaminants; and Operation Plan.

Q1.1 – Sound Environment

Q1.1.1 – Noise

For building types classified as Hall, evaluate building types that particularly require anti-noise measures, such as town hall, auditorium, theatres and movie theatres, excluding the other building types. For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital. Note that the assessment criteria differ between outpatient waiting rooms and medical examining rooms. For School (primary / secondary), evaluate classrooms only. (Refer to Table 6).

Table 6: CASBEE Iskandar Building Q1.1.1 Noise Scoring Level – Common Properties

Entire Building and Common Properties					
Score	Off, Hsp (Waiting Room), Htl, Fct, Apt	Sch (Tertiary, etc), Hsp (Examining Room)	Rtl, Rst	Hal	Sch (Primary / Secondary)
Level 1	50 < [Background noise level]	45 < [Background noise level]	55 < [Background noise level]	40 < [Background noise level]	60 < [Background noise level]
Level 2	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)	50 < [Background noise level] ≦ 60
Level 3	45 < [Background noise level] ≦ 50	40 < [Background noise level] ≦ 45	50 < [Background noise level] ≦ 55	35 < [Background noise level] ≦ 40	45 < [Background noise level] ≦ 50
Level 4	40 < [Background noise level] ≦ 45	35 < [Background noise level] ≦ 40	45 < [Background noise level] ≦ 50	30 < [Background noise level] ≦ 35	35 < [Background noise level] ≦ 45
Level 5	[Background noise level] ≦ 40	[Background noise level] ≦ 35	[Background noise level] ≦ 45	[Background noise level] ≦ 30	[Background noise level] ≦ 35

Generally, indoor background noise is affected by the noise from service equipment for the building and external noise such as traffic. Evaluate the noise level based on these noise factors. Noise levels and corresponding intrusiveness and impact on conversation (in person and over the telephone) are shown next page in Table 8 for reference. For noise assessment of the building,

measure noise levels while service equipment is in operation after-hours. A standard sound level meter can be used for steady noise. For fluctuating noise, use an integrating sound level meter to determine equivalent noise levels (refer to Table 7).

Table 7: CASBEE Iskandar Building Q1.1.1 Noise Scoring Level - Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	45 < [Background noise level]
Level 2	(No corresponding level)
Level 3	40 < [Background noise level] ≦ 45
Level 4	35 < [Background noise level] ≦ 40
Level 5	[Background noise level] ≦ 35

For an apartment building, measure noise levels with one measurement point per unit. Noise measurement is conducted in the room with the largest opening. Measure noise levels with no sound generated from TV sets or voices. If the building is equipped with a 24-hour ventilation system, measure noise levels with the system in operation.

Table 8: Acceptable Noise Level

Noise: Allowable indoor noise levels

dB (A)	20	25	30	35	40	45	50	55	60
NC-NR	10～15	15～20	20～25	25～30	30～35	35～40	40～45	45～50	50～55
Intrusiveness	Silent———	————————Very Quiet————————			—Not significantly noticeable————		Perceived noise—	————Noise cannot be ignored	
Impact on conversation			A whispering voice is audible from 5m away		Possible from 10m apart Telephone use (normal)	————	Possible from 3m apart Telephone use (bearable)	————	Loud conversation (3m) Telephone use (unbearable)
Studios	Silent room	Announcement	Radio studio	Television studios	Mixing room	General offices			
Venues and halls		studio							
Hospitals		Music hall	Theater (medium)	Stage theaters	Movie theater		Hotel lobbies		
Hotels and residentials		Hearing test room	Special sickrooms	Operating rooms and	and planetarium Examining room	Laboratories	Waiting rooms		
General offices				Reading rooms	Bedrooms	Banquet halls	Lobbies		
Public buildings				Executive rooms and large meeting rooms	Reception rooms	Meeting rooms			Typing and accounting rooms
Schools and churches									
Commercial buildings									

Q1.1.2 – Sound Insulation

Q1.1.2.1 - Sound Insulation of Openings

Evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Exclude if the evaluated room has absolutely no openings. Table 9 shows CASBEE Iskandar Building Q1.1.2.1 Sound Insulation of Openings Scoring Level for Common Properties and Table 10 CASBEE Iskandar Building Q1.1.2.1 Sound Insulation of Openings Scoring Level for Residential.

Table 9: CASBEE Iskandar Building Q1.1.2.1 Sound Insulation of Openings Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Reduction of noise up until comfort level of 40 - 45 dB
Level 2	(No corresponding level)
Level 3	Reduction of noise up until comfort level of 35 - 40 dB
Level 4	(No corresponding level)
Level 5	Reduction of noise up until comfort level of 30 - 35 dB

Table 10: CASBEE Iskandar Building Q1.1.2.1 Sound Insulation of Openings Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Reduction of noise up until comfort level of 40 - 45 dB
Level 2	(No corresponding level)
Level 3	Reduction of noise up until comfort level of 35 - 40 dB
Level 4	(No corresponding level)
Level 5	Reduction of noise up until comfort level of 30 - 35 dB

Evaluate sound insulation of building openings based on the performance levels of sash windows and other fixtures. The higher the performance, the more effective it is in preventing propagation of external noise (e.g. sound of traffic). In cases where multiple openings exist, evaluate based on the lowest performance level. Table 11 shows the maximum permissible sound levels by land use category for day time and night time.

Table 11: Maximum Permissible Sound Level

Receiving Land Use Category	Day Time 7.00 am - 10.00 pm	Night Time 10.00 pm - 7.00 am
Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital), Worship Areas.	50 dBA	40 dBA
Suburban Residential (Medium Density) Areas, Public Spaces, Parks, Recreational Areas.	55dBA	45 dBA
Urban Residential (High Density) Areas, Designated Mixed Development Areas (Residential - Commercial).	60 dBA	50 dBA
Commercial Business Zones	65 dBA	55 dBA
Designated Industrial Zones	70 dBA	60 dBA

Source: Planning Guidelines for Environmental Noise and Control

Q1.1.2.2 Sound Insulation of Partition Walls

Evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Exclude if the evaluated room has absolutely no openings. Table 12 shows the CASBEE Iskandar Building Q1.1.2.2 Sound Insulation of Partition Walls Scoring Level for Common Properties and

Table 13 shows the CASBEE Iskandar Building Q1.1.2.2 Sound Insulation of Partition Walls Scoring Level for Residential.

Table 12: CASBEE Iskandar Building Q1.1.2.2 Sound Insulation of Partition Walls Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Sch, Rst, Fct	Hsp（Examining Room）
Level 1	Less than Dr-30	Less than Dr-35
Level 2	Dr-30	Dr-35
Level 3	Dr-35	Dr-40
Level 4	Dr-40	Dr-45
Level 5	Dr-45 or more	Dr-50 or more

Table 13: CASBEE Iskandar Building Q1.1.2.2 Sound Insulation of Partition Walls Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Less than Dr-40
Level 2	Dr-40
Level 3	Dr-45
Level 4	Dr-50
Level 5	Dr-55 or more

In assessing the sound insulation performance of partition walls, evaluate levels of sound insulation between rooms. Retail stores generally do not have partitions between sales areas. As such, this assessment is not applicable. A higher sound insulation performance is required for partition walls in the meeting hall building typology than in other general-use buildings.

Q1.1.2.3 Sound Insulation Performance of Floor Slabs (light-weight impact source)

Table 14: CASBEE Iskandar Building Q1.1.2.3 Sound Insulation Performance of Floor Slabs (light-weight impact source) Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Sch
Level 1	Worse than Lr-65
Level 2	Lr-65
Level 3	Lr-60
Level 4	Lr-55
Level 5	Lr-50 or better

Table 15: CASBEE Iskandar Building Q1.1.2.3 Sound Insulation Performance of Floor Slabs (light-weight impact source) Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Worse than Lr-55
Level 2	Lr-55
Level 3	Lr-50
Level 4	Lr-45
Level 5	Lr-40 or better

Examples of light-weight impact sounds include chairs being dragged over the floor or hard light-weight objects (e.g.: spoons, forks) being dropped on the floor. Basic characteristics of light-

weight impact sound insulation depend on the floor structure, but elasticity of the flooring materials significantly affects performance level.

Q1.1.2.4 Sound Insulation Performance of Floor Slabs (heavy-weight impact source)

Table 16: CASBEE Iskandar Building Q1.1.2.4 Sound Insulation Performance of Floor Slabs (heavy-weight impact source) Scoring Level – Common Properties

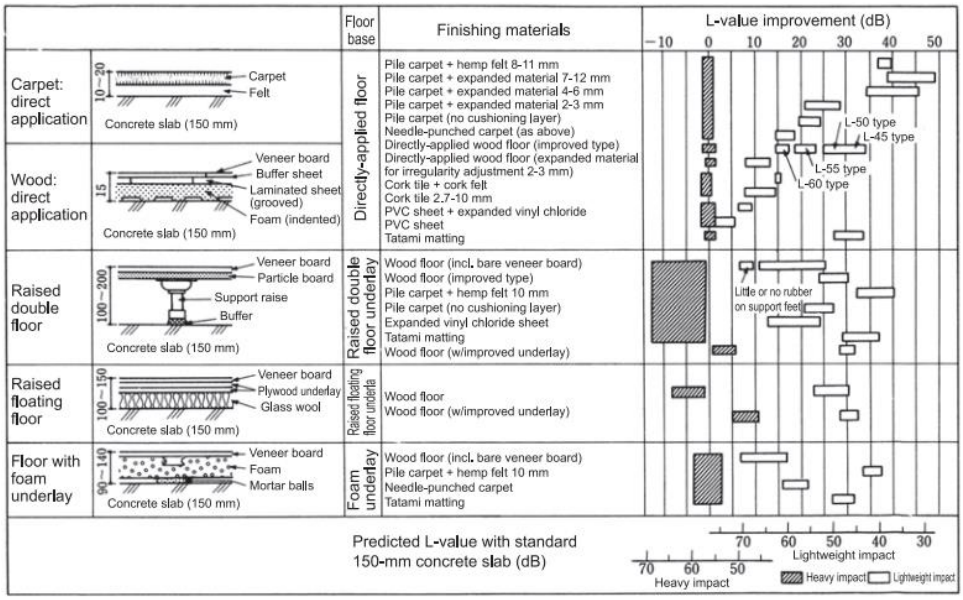
Entire Building and Common Properties	
Score	Sch
Level 1	Worse than Lr-65
Level 2	Lr-65
Level 3	Lr-60
Level 4	Lr-55
Level 5	Lr-50 or better

Table 17: CASBEE Iskandar Building Q1.1.2.4 Sound Insulation Performance of Floor Slabs (heavy-weight impact source) Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Worse than Lr-60
Level 2	Lr-55
Level 3	Lr-50
Level 4	Lr-45
Level 5	Lr-40 or better

Examples of heavy-weight impact sounds include noise generated in the room(s) by vibration from the floor above, due to a heavy but soft impact (e.g. a child jumping). The basic characteristics of heavy-weight impact sound insulation depend on the floor structure. Therefore, performance improvement using flooring materials is often difficult to achieve. Table 18 shows the Lr-value improvement per floor finish.

Table 18: Lr-value improvement per floor finish



Q1.1.3 Sound Absorption

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). For building types classified as Hal, evaluate building types which especially require acoustic absorption measures, such as concert halls, meeting halls, and performance and movie theatres, excluding the other building types. Table 19 shows the CASBEE Iskandar Building Q1.1.3 Sound Absorption Scoring Level for Common Properties and

Table 20 shows the CASBEE Iskandar Building Q1.1.3 Sound Absorption Scoring Level for Residential.

Table 19: CASBEE Iskandar Building Q1.1.3 Sound Absorption Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct
Level 1	Sound-absorbing materials are not used
Level 2	(No corresponding level)
Level 3	Sound-absorbing materials are used in one of the following areas : walls, floor or ceiling
Level 4	(No corresponding level)
Level 5	Sound-absorbing materials are used in two of the following areas : walls, floor or ceiling

Table 20: CASBEE Iskandar Building Q1.1.3 Sound Absorption Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl
Level 1	Sound-absorbing materials are not used
Level 2	(No corresponding level)
Level 3	Sound-absorbing materials are used in one of the following areas : walls, floor or ceiling
Level 4	(No corresponding level)
Level 5	Sound-absorbing materials are used in two of the following areas : walls, floor or ceiling

In assessing the sound absorption performance, evaluate the levels of sound absorption of a room which includes the interior finish materials. The higher the level of in-room sound absorption, the more effective reverberation control is, so that a conversation can be easily carried out without voices being raised. Furthermore, noise propagated into or generated within the room is also attenuated, thereby improving the acoustic environment.

An average rate of in-room sound absorption can be obtained based on the absorption rate of finishing materials. In this assessment, however, simply evaluate whether sound-absorbing materials are used in walls, floor or ceiling. The assessment criteria for the use of sound-absorbing materials are as follows:

- Ceiling and floor: at least 70% of the area is covered with sound-absorbing materials
- Walls: the total area which is covered with sound absorbing materials of all four walls account for more than 70% of the area of the largest wall.

Q1.2 Thermal Comfort

Q1.2.1 Room Temperature Control

Q1.2.1.1 Room Temperature

In the Residential and Accommodation Sections of Apartment, air-conditioning equipment is excluded from assessment if it is installed by occupants. For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital. Table 21 shows the CASBBEE Iskandar Building Q1.2.1.1 Room Temperature Scoring Level for Common Properties.

Table 21: CASBEE Iskandar Building Q1.2.1.1 Room Temperature Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Hsp (Waiting Room, Examining Room), Htl, Fct, Apt, Sch, Rtl, Rst, Hal
Level 1	Minimum equipment capacity is provided to achieve room temperatures at 30°C and above or 16°C and below with some occupant discomfort
Level 2	(No corresponding level)
Level 3	Minimum equipment capacity is provided to achieve room temperatures at 28°C and above or 18°C and below with some occupant discomfort
Level 4	Minimum equipment capacity is provided to achieve room temperatures at 26°C and above or 21°C and below with some occupant discomfort
Level 5	Sufficient equipment capacity to achieve constant room temperatures of 24°C via the use of sensors to automatically adjust temperatures

Room temperature is one of the most representative indicators for an indoor thermal environment. As such, characteristics of an indoor thermal environment are determined largely by temperature settings for the room. In this assessment, evaluate the capacity of the air-conditioning equipment to maintain comfortable room temperature levels under peak load conditions.

At the Design Assessment stage, the target performance is subject to the assessment. Table 22 shows the CASBEE Iskandar Building Q1.2.1.1 Room Temperature Scoring Level for Residential.

Table 22: CASBEE Iskandar Building Q1.2.1.1 Room Temperature Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Minimum equipment capacity to achieve room temperatures of higher than 30˚C and lower than 16˚C with some occupant discomfort
Level 2	(No corresponding level)
Level 3	Minimum equipment capacity is provided to achieve room temperatures at 28°C and above or 18°C and below with some occupant discomfort
Level 4	Minimum equipment capacity is provided to achieve room temperatures at 26°C and above or 21°C and below with some occupant discomfort
Level 5	Sufficient equipment capacity to achieve constant room temperatures of 24°C via the use of sensors to automatically adjust temperatures

Q1.2.1.2 Perimeter Performance

The Perimeter Performance refers to the performance of the building envelope, or the elements that form the façade of the building, namely the walls, roof, windows, and floors.

Table 23 shows the CASBEE Iskandar Building Q1.2.1.2 Building Envelope Scoring Level for Common properties and

Table 24 shows the CASBEE Iskandar Building Q1.2.1.2 Building Envelope Scoring Level for Residential.

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both).

Table 23: CASBEE Iskandar Building Q1.2.1.2 Building Envelope Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No attention has been paid to the infiltration of heat through window systems, outside walls, roof, and floor (particularly where piloti are used) and insulation performance is poor. (Window system SC: => 0.7, U => 6.0 W/m^{2}K, roof: => 0.4 W/m^{2}K (light-weight) or => 0.6 W/m^{2}K (heavy-weight), outer walls and others: U => 3.0 W/m^{2}K
Level 2	(No corresponding level)
Level 3	Attention has been paid to the infiltration of heat through window systems, outside walls, roof, and floor (particularly where piloti are used) and there is no practical problem with insulation blocking and insulation performance. (Window system SC: => 0.2 and =< 0.7, U => 3.0 and =< 6.0 W/m^{2}K, roof: =>0.2 and =< 0.4 W/m^{2}K (light-weight) or => 0.4 and =< 0.6 W/m^{2}K (heavy-weight), outer walls and others: U => 1.0 and =< 3.0 W/m^{2}K)*[1]
Level 4	(No corresponding level)
Level 5	Close attention has been paid to the infiltration of heat through window systems, outside walls, roof, and floor (particularly where piloti are used) and the building has the highest level of insulation blocking and insulation performance. (Window system SC: =< 0.2, U =< 3.0 W/m^{2}K, roof: =< 0.2 W/m^{2}K (lightweight) or =< 0.4 W/m^{2}K (heavyweight), outer walls and others: U =< 1.0 W/m^{2}K)*[1]

*[1] If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

SC represents the Shading Coefficient; U represents Thermal Transmittance.

Table 24: CASBEE Iskandar Building Q1.2.1.2 Building Envelope Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	No attention has been paid to the infiltration of heat through window systems, outside walls, roof and floor (particularly where piloti are used), and insulation performance is poor. (Window system SC: => 0.7, U => 6.0 W/m2k, roof: => 0.4 W/m^{2}K (lightweight) or => 0.6 W/m^{2}K (heavy-weight), outer walls and others: U => 3.0 W/m^{2}K
Level 2	(No corresponding level)
Level 3	Attention has been paid to the infiltration of heat to the interior through windows, outside walls, roof and floor (particularly where piloti are used), and there is no practical problem with insulation blocking and insulation performance. (Window system SC: => 0.2 and =< 0.7, U => 3.0 and =< 6.0 W/m^{2}K, roof: =>0.2 and =< 0.4 W/m^{2}K (light-weight) or => 0.4 and =< 0.6 W/m^{2}K (heavy-weight), outer walls and others: U => 1.0 and =< 3.0 W/m^{2}K)*[1]
Level 4	(No corresponding level)
Level 5	Close attention has been paid to the infiltration of heat to the interior through windows systems, outside walls, roof and floor (particularly where piloti are used), and the building has the highest level of insulation blocking and insulation performance. (Window system SC: around 0.2, U = < 3.0 W/m^{2}K, roof: =< 0.2 W/m^{2}K (light-weight) or =< 0.4 W/m^{2}K (heavy-weight), outer walls and others: U =< 1.0 W/m^{2}K)*[1]

*[1] If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

SC represents Shading Coefficient; U represents Thermal Transmittance.

Evaluate ability to block thermal infiltration from the surroundings. Evaluate whether window systems and exterior walls have been selected to exclude outside disturbances as far as possible, in order to maintain room temperature. Even with inferior perimeter performance, it is possible to meet the temperature setting at the thermostat position, provided the temperature setting is not unreasonable and the equipment has sufficient capacity, but if there are windows and walls that have extremely low or high surface temperatures there will be inconsistencies in temperature within the room.

Vertical temperature difference and radiation from exterior walls and windows will cause localised discomfort to occupants. Also, the use of internal blinds, air barriers, airflow windows, double skins and other window systems should not be evaluated for their individual performance, but rather for the combined shading coefficient and heat transfer coefficient of the systems they form.

This criterion directly refers to the latest Malaysian Standard MS1525, Clause 5: Building Envelope.

Q1.2.1.3 Zoned Control

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 25 shows the CABEE Iskandar Building Q1.2.1.3 Zoned Control Scoring Level for Common Properties and Table 26 shows the example of HVAC Systems Corresponding to each level.

Table 25: CASBEE Iskandar Building Q1.2.1.3 Zoned Control Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Hsp, Htl, Fct	Rtl, Rst, Hal
Level 1	No distinction is made between orientation directions, or between perimeter and interior	There is no zoning of heating and cooling within a single floor, and a single-circuit air conditioning system is planned. Switching between heating and cooling is required for the selection of air conditioning modes.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	There are air-conditioning zonings*1 that differentiate between orientation directions, between perimeter and interior, and between internal load distributions.	Each floor is divided into multiple zones according to their thermal loads, and the air conditioning system is planned to allow either heating or cooling in each zone.
Level 4	There is air conditioning zoning at around the standard of Level 3*1	There is air conditioning zoning at around the standard of Level 3, and the planned system also allows selection between cooling and heating for each zone.
Level 5	There are separate air conditioning systems for each orientation direction, and for perimeter and interior*1, allowing more detailed zoning (broadly, zones of 40 m^2 or less).	Each floor is divided into many small zones for individual sales areas or tenants, and the air conditioning system is planned to allow either heating or cooling in zone units.

NOTE: If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

*1 In cases where the space is not immediately next to the external perimeter wall, or in small offices with shallow depths, the first half of the description, concerning the distinction between perimeter and interior, may be ignored.

Table 26: CASBEE Iskandar Building Q1.2.1.3 Zoned Control – examples of HVAC systems

Example of HVAC Systems Corresponding to Each Level
Level 1 : Single-duct system, two-pipe FCU system (no zoning, switching between heating and cooling).
Level 3 : Single-duct system, two-pipe FCU system (zoning grade assessment, switching between heating and cooling).
Level 4 : Double-duct system (4 pipes for AHU), four-pipe FCU system, task/ambient air conditioning system (evaluate both the zoning grade and simultaneous heating and cooling).
Level 5 : Multi-unit heat pump system (simultaneous heating and cooling), double duct system (4 pipes for AHU), and four-pipe FCU system level with more detailed zoning than levels 3 and 4 (zones of around 40 m^2).

Evaluate whether a finely-zoned air-conditioning system is used to eliminate temperature variations and create a comfortable environment in the interior. Furthermore, even if the applicable system is not adequate, a high level can be evaluated if operation is managed manually, or receives planned consideration, and the internal environment is maintained with an adequate degree of success.

Q1.2.2 Humidity Control

In the Residential and Accommodation Sections of Apartment, air-conditioning equipment is excluded from assessment if it is installed by occupants. For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 27 shows the CASBEE Iskandar Building Q1.2.2 Humidity Control Scoring Level for Common Properties and Table 28 shows the CASBEE Iskandar Building Q1.2.2 Humidity Control Scoring Level for Residential.

Evaluate according to the set target value for humidity.

Table 27: CASBEE Iskandar Building Q1.2.2 Humidity Control Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt, Sch
Level 1	No humidity control and humidity is below 30% or above 70%
Level 2	(No corresponding level)
Level 3	Humidification equipment is available, and equipment capacity is generally sufficient to keep humidity to 60% or about 40%

Level 4	(No corresponding level)
Level 5	Humidification equipment is available, and equipment capacity is generally sufficient to keep humidity to about 55%

NOTE: If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

Table 28: CASBEE Iskandar Building Q1.2.2 Humidity Control Scoring Level – Residential

Residential and Accommodation Sections		
Score	Hsp, Htl	Apt
Level 1	Not adequate for Level 3.	No consideration given.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	Humidification equipment is available, and equipment capacity is generally sufficient to keep humidity to 60% or about 40%*[1]	
Level 4	(No corresponding level)	(No corresponding level)
Level 5	Humidification and dehumidification equipment is available, and equipment capacity is sufficient to keep humidity to about 55%.	

NOTE: If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

*[1] In Residential and Accommodation Sections of Apt, air-conditioning equipment is excluded from assessment if it is installed by occupants.

Q1.2.3 Type of Air-Conditioning System

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital. Note that the assessment criteria differ between outpatient waiting rooms and medical examining rooms. Table 29 shows the CASBEE Iskandar Building Q1.2.3 Type of Air-Conditioning System Scoring Level for Common Properties.

Table 29: CASBEE Iskandar Building Q1.2.3 Type of Air-Conditioning System Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Sch, Rtl, Rst, Hal, Hsp (Waiting Room), Htl, Fct, Apt	Hsp (Examining Room)
Level 1	The air-conditioning system was planned with no particular consideration for the vertical temperature distribution and air-flow speed in the occupancy zone.	The air-conditioning system was designed without specific consideration of vertical temperature variation and air flow in occupied areas.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	The air-conditioning system is normal, but the air supply and extraction plan considered the vertical temperature distribution and airflow speed in the occupancy zone.	The air-conditioning system is normal, but the air supply and extraction plan considered the vertical temperature distribution and airflow speed in the occupancy zone, and the partitions in the medical examining rooms.
Level 4	(No corresponding level)	(No corresponding level)
Level 5	The air-conditioning system*[1] was chosen to mitigate the vertical temperature distribution and airflow speed in the room.	The air-conditioning system was chosen to mitigate the vertical temperature distribution and airflow speed in the occupancy zone, and to consider the partitions of the medical examining rooms.

NOTE: If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

*[1] This refers to, for example, ceiling and floor radiant heating and cooling systems, or floor-vented systems, etc.

In the Residential and Accommodation Sections of Apartment, air conditioning-equipment is excluded from assessment if it is installed by occupants. Table 30 shows the CASBEE Iskandar Building Q1.2.3 Type of Air-Conditioning System Scoring Level for Residential.

Table 30: CASBEE Iskandar Building Q1.2.3 Type of Air-Conditioning System Scoring Level – Residential

Residential and Accommodation Sections		
Score	Hsp, Htl	Apt
Level 1	The air-conditioning system was planned with no particular consideration for the vertical temperature distribution and air-flow speed in the occupancy zone.	The air-conditioning system was designed without specific consideration of vertical temperature variation and air-flow in air-conditioned occupied areas, or of temperature difference between air-conditioned and non-air-conditioned areas.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	The air-conditioning system is normal, but the air supply and extraction plan considered the vertical temperature distribution and air-flow speed in the occupancy zone.	The air-conditioning system was designed in consideration of vertical temperature variation and air-flow in air-conditioned occupied areas, or of temperature difference between air-conditioned and non-air-conditioned areas.
Level 4	(No corresponding level)	(No corresponding level)
Level 5	The air conditioning system*[1] was chosen to mitigate the vertical temperature distribution and airflow speed in the occupancy zone.	The air-conditioning system was designed in consideration of minimising vertical temperature variation and air-flow in air-conditioned occupied areas, or of temperature difference between air-conditioned and non-air-conditioned areas.

NOTE: If it is difficult to decide, choose an intermediate level (Level 2 or Level 4).

*[1] This refers to, for example, ceiling and floor radiant heating and cooling systems, or floor-vented systems, etc.

Evaluate whether the air-conditioning was chosen to mitigate the vertical temperature distribution and airflow speed (residual wind speed) in the room. The design stage of air-conditioning equipment involves consideration of various air conditioning methods to choose a system that will best avoid causing localised discomfort to room occupants.

Therefore, it is not possible to name an air-conditioning system that will always create a comfortable environment, but the air-conditioning system should be evaluated on the basis of past results, existing experience, and design policies. The space for which vertical temperature distribution and air-flow speed are evaluated should be the occupancy zone, and the evaluated

points should be the vertical temperature distribution and air-flow speed in the space occupied by humans.

The temperature difference evaluated should be between heights of 0.1 m and maximum 2.0 m with a zone of uniform temperature as the target standard. In the Design Assessment stage, the target performance is subject to the assessment.

Examples of air-conditioning systems:

The system types below are not categorised by air-conditioning types, such as single-duct, but by the venting methods.

Level 1	:	Methods which do not allow free design of airflow forms in the interior, such as cassette-type interior units, extensive use of dampers with poor diffusion, such as line diffusers, etc.
Level 3	:	Diffusion methods which employ dampers with good diffusion, such as anemostat or pan types.
Level 5	:	Cooling/heating system equipped with floor diffusers or radiant ceiling panels to minimise vertical temperature variation and air flow that cause occupant discomfort, or an air conditioning system with appropriate diffusers and layout to achieve performance of vertical temperature variation of approximately 2˚C or less and an air flow rate of 0.15 m/s.

Q1.3 Lighting & Illumination

Q1.3.1 Daylight

Q1.3.1.1 Daylight Factor

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 31 shows the CASBEE Iskandar Building Q1. 3.1.1 Daylight Factor Scoring Level for Common Properties and

Table 32 shows the CASBEE Iskandar Building Q1. 3.1.1 Daylight Factor Scoring Level for Residential.

Table 31: CASBEE Iskandar Building Q1. 3.1.1 Daylight Factor Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Hsp, Htl, Fct, Apt
Level 1	<30% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 2	30% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 3	50% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 4	70% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 5	>70% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%

Table 32: CASBEE Iskandar Building Q1.3.1.1 Daylight Factor Scoring Level – Residential

Residential and Accommodation Sections		
Score	Hsp, Htl	Apt
Level 1	<30% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%	<30% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 2	30% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%	30% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 3	50% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%	50% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 4	70% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%	70% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%
Level 5	>70% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%	>70% of the habitable spaces achieve an average Daylight Factor between 1.0%-3.5%

Daylight factor is the ratio of outdoor illuminance (overcast-sky illuminance) to the illuminance of a measurement point in the room, excluding direct daylight. It is an indicator of the potential for use of daylight (refer to Figure 33). Daylight is always variable, but a stable value can be obtained for daylight factor, because it is a ratio.

Utilising the height of the central desktop surface in the room concerned as the calculation point. The types of rooms for evaluation are expected to be standard administrative Office, classrooms in School, and lobbies and other common areas in Apartment, Hospital and Hotel. In order to simplify the procedure as much as possible, the calculation of the daylight factor in this section utilises the direct daylight factor and adopts a method that treats the configuration factor as the daylight factor equivalent. The transmittance of windows and the reflectance of the ceiling are not taken into consideration. This assessment refers to MS 1525:2019.

Table 1. Daylight factors and impact

DF (%)	Lighting	Glare	Thermal comfort	Appearance and energy implication
> 6.0	Intolerable	Intolerable	Uncomfortable	Room appears strongly day lit. At daytime artificial lighting is rarely needed, but thermal problems due to solar heat gain and glare may occur.
3.5 - 6.0	Tolerable	Uncomfortable	Tolerable	
1.0 - 3.5	Acceptable	Acceptable	Acceptable	Room appears moderately day lit. Good balance between lighting and thermal aspects. Supplementary artificial lighting is needed at dark areas due to effect of layout or furniture arrangement
< 1.0	Perceptible	Imperceptible	Acceptable	Room looks gloomy, artificial lighting is needed most of the time.
NOTE. In Malaysia, DF between 1.0 and 3.5 is recommended.				

Figure 33: MS 1525:2019 Daylight Factors and Impact.

Q1.3.1.2 Openings by Orientation

This criterion is only applicable to Residential assessment. Table 33 shows the CASBEE Iskandar Building Q1.3.1.2 Openings by Orientation Scoring Level for Residential.

Table 33: CASBEE Iskandar Building Q1.3.1.2 Openings by Orientation Scoring Level – Residential

Residential and Accommodation Sections			
Score	Apt	Hsp	Sch
Level 1	>50% of windows face east or west OR >50% of the habitable spaces do not comply with Level 3 requirements	>50% of windows face east or west OR >50% of the habitable spaces do not comply with Level 3 requirements	>50% of windows face east or west OR >50% of the habitable spaces do not comply with Level 3 requirements
Level 2	(No corresponding level)	(No corresponding level)	(No corresponding level)
Level 3	Every habitable space shall have windows with a total opening area of >10% of the clear floor area	Every habitable space shall have windows with a total opening area of >15% of the clear floor area	Every habitable space shall have windows with a total opening area of >20% of the clear floor area
Level 4	Every habitable space shall have windows with a total opening area of >10% of the clear floor area AND >50% of windows face north or south	Every habitable space shall have windows with a total opening area of >15% of the clear floor area AND >50% of windows face north or south	Every habitable space shall have windows with a total opening area of >20% of the clear floor area AND >50% of windows face north or south
Level 5	Every habitable space shall have windows with a total opening area of >10% of the clear floor area AND >50% of windows face north or south AND no windows facing west except for toilet windows	Every habitable space shall have windows with a total opening area of >15% of the clear floor area AND >50% of windows face north or south AND no windows facing west except for toilet windows	Every habitable space shall have windows with a total opening area of >20% of the clear floor area AND >50% of windows face north or south AND no windows facing west except for toilet windows

Key considerations for assessment are as follows:

- Each habitable space shall achieve the minimum total opening areas required, in line with the Uniform Building By-Laws 1984
- Percentage of openings that are oriented towards the north and south, compared to those oriented towards the east and west

Evaluate whether the positions (orientations) of openings make efficient use of daylight. For a dwelling with the most common room layout on the standard floor, make a total assessment of one unit of each dwelling's typical unit layout.

In Malaysia, the ideal orientations for openings are towards the north and south, avoiding the direct, harsh daylight from the east and west. Where it is unfeasible or impractical to orientate all openings along the north or south, at a minimum, each habitable space shall have openings in the form of windows, low walls, or other means, with a cumulative opening area as a percentage of the room's floor area as recommended by Level 3.

Q1.3.1.3 Daylight Devices

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 34 shows the CASBEE Iskandar Building Q1.3.1.3 Daylight Devices Scoring Level for Common Properties and Table 35 shows the CASBEE Iskandar Building Q1.3.1.3 Daylight Devices Scoring Level for Residential.

Table 34: CASBEE Iskandar Building Q1.3.1.3 Daylight Devices Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Fct, Rtl, Rst, Hsp, Htl, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	There are no daylight devices.
Level 4	There is one type of daylight device.
Level 5	There are two or more types of daylight devices, or they have advanced functions.

Table 35: CASBEE Iskandar Building Q1.3.1.3 Daylight Devices Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	There are no daylight devices.
Level 4	(No corresponding level)
Level 5	There are some daylight devices.

Key considerations for assessment are as follows:

- Buildings in which daylight devices are widely used are highly rated
- Rooms that have a low daylight factor, and therefore a low initial feasibility of sufficient daylighting, should be given more consideration in the provision of daylight devices, as the effects of such devices will be more profound

Evaluate the openings according to the planned installation of daylight devices. Daylight devices optimally utilise daylight in addition to windows installed in the exterior walls. Specifically, such devices include light harvesting or guiding devices which carry light deeper into the interior of the room. Examples include:

- light shelves
- light ducts
- light condensers
- optical fibres

Devices with advanced functions, for example, may be devices which serve dual functions of collecting light and guiding it to the interior of a room, such as those which combine light condensers and optical fibres.

Skylights or atriums can be considered to be daylight devices if they were provided with the deliberate intention of using daylight. However, in tropical countries like Malaysia, it would not enhance human comfort due to direct sunlight penetration.

Q1.3.2 Anti-glare Measures

Q1.3.2.1 Daylight Control

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 36 shows the CASBEE Iskandar Building Q1.3.2.1 Daylight Control Scoring Level for Common Properties and Table 37 shows the CASBEE Iskandar Building Q1.3.2.1 Daylight Control Scoring Level for Residential.

Table 36: CASBEE Iskandar Building Q1.3.2.1 Daylight Control Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Sch (Tertiary, etc, Hsp, Htl, Fct, Apt	Sch (Primary / Secondary)
Level 1	Nothing.	Nothing.
Level 2	Glare is controlled using tinted glass with a minimum VLT of 30, or by the use of screens, awnings, or eaves.	Glare is controlled using tinted glass with a minimum VLT of 30, or by the use of screens, awnings, or eaves.
Level 3	Glare is controlled with blinds, or by a combination of any two among screens, awnings and eaves.	Glare is controlled using screens, awnings and eaves.
Level 4	Glare is controlled with blinds, together with any one among screens, awnings and eaves.	Glare is controlled using blinds or any combination of two or more fixtures including curtains, screens, awnings and eaves.
Level 5	Glare is controlled by automatically-controlled blinds.	Glare is controlled using blinds and at least one other fixture, including curtains, screens, awnings and eaves.

Table 37: CASBEE Iskandar Building Q1.3.2.1 Daylight Control Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Nothing.
Level 2	(No corresponding level)
Level 3	Glare is controlled using curtains, screens, awnings and eaves.
Level 4	Glare is controlled with blinds, or a combination of any two among curtains, screens, awnings and eaves.
Level 5	Glare is controlled with blinds, together with any one among curtains, screens, awnings and eaves.

Key considerations for assessment are as follows:

- Spaces that have a high daylight factor should have better or more efficient means to control incoming daylight
- The use of fewer different types of daylight control measures is preferred
- Users should have a high degree of control over direct sunlight according to the position of the sun (sunshine control performance) or brightness control performance

Automated daylight control measures are also desirable as they reduce the need for manual adjustment. Examples include:

1. Automated blinds that automatically adjust the tilt angle of blades according to the sun angle
2. Colour-changing smart windows that adjust the transmittance of daylight according to temperature, etc

The assessment is carried out regarding glare counter-measures at portions of windows that are exposed to direct daylight or high brightness from outside. Examples of counter-measures include the use of eaves around the opening, awnings (shading tents and window shades), screens, curtains, sun blinds, and/or shading devices. Moreover, daylight devices that also have daylight control effects such as light shelves may be evaluated with respect to both aspects.

In order to take advantage of daylight harvesting capabilities, the visible light transmission (VLT) of the glass shall be at least 30%, in accordance with recommendations set out in MS 1525:2019.

For evaluating the Residential and Accommodation Sections of Apartment, most curtains, screens, awnings, blinds, shades and similar elements are installed by the residents, but curtains should be included in assessment if there are installed curtain rails (boxes). Eaves (including balconies) may only be included in the assessment if they are present on every floor.

Q1.3.3 Illuminance Level

In the Residential and Accommodation Sections of the Apartment, lighting equipment is excluded from the assessment if it is installed by occupants.

For the Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital. Table 38 shows the CASBEE Iskandar Building Q1.3.3 Illuminance Level Scoring Level for Entire Building and Common Properties.

Table 38: CASBEE Iskandar Building Q1.3.3 Illuminance Level Scoring Level – Entire Building and Common Properties

Entire Building and Common Properties	
Score	Off, Hsp (Examining Room & Waiting Room),Fct,Sch,Htl,Apt
Level 1	<50% of all habitable areas comply with lux recommendations described in the latest version of MS1525.
Level 2	50%-75% of all habitable areas comply with lux recommendations described in the latest version of MS1525.
Level 3	76%-100% of all habitable areas comply with lux recommendations described in the latest version of MS1525.
Level 4	76%-90% of all habitable areas and 50%-90% of all other areas with lux recommendations comply with lux recommendations described in the latest version of MS1525.
Level 5	>90% of all habitable areas and all other areas with lux recommendations comply with lux recommendations described in the latest version of MS1525.

For the Entire Building and Common Properties of Apartment, evaluate based on the most principal room of the unit. Furthermore, when using an overall lighting system, illuminance exceeding 1,000 lx for Office and 750 lx for School is considered too high, and not appropriate. For a task/ambient lighting system where illuminance does not correspond to Level 4 and 5, award Level 3 with respect to illuminance balance. Table 39 shows the CASBEE Iskandar Building Q1.3.3 Illuminance Level Scoring Level for Residential and Accommodation Sections.

Table 39: CASBEE Iskandar Building Q1.3.3 Illuminance Level Scoring Level – Residential and Accommodation Sections

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	<50% of all habitable areas comply with lux recommendations described in the latest version of MS1525.
Level 2	50%-75% of all habitable areas comply with lux recommendations described in the latest version of MS1525.
Level 3	76%-100% of all habitable areas comply with lux recommendations described in the latest version of MS1525.
Level 4	76%-90% of all habitable areas and 50%-90% of all other areas with lux recommendations comply with lux recommendations described in the latest version of MS1525.
Level 5	>90% of all habitable areas and all other areas with lux recommendations comply with lux recommendations described in the latest version of MS1525.

Key consideration(s) for assessment are as follows:

- As many habitable areas as possible shall comply with the lux recommendations described in the latest version of MS 1525

In this assessment, task illuminance level is the horizontal illuminance on desk surfaces and ambient illuminance level is the horizontal illuminance of non-task areas surrounding task zones (approximately 80 cm above the floor).

The assessment focuses on the indoor brightness on desktop surfaces (approximately 80 cm above the floor), according to the illuminance of horizontal surfaces (lux). In cases where facility use is limited to daytime hours, such as a School, apply lux values based on minimum daylight levels. Level 3 and Level 4 given to Office, Hospital (examination rooms) and Factory are evaluated

based on, in cases of general lighting, the illuminance of horizontal surfaces on the desktop surface inside the room. Table 40 shows the recommended average illuminance levels based on task and applications.

Table 40: Recommended Average Illuminance Levels, MS 1525:2019

Table 13. Recommended average illuminance levels

Task and applications	Illuminance (Lux)
a) Lighting for infrequently used area:	
- Minimum service illuminance	20
- Interior walkway and car-park	100
- Hotel bedroom	100
- Lift interior	100
- Corridor, passageways, stairs	100
- Escalator, travellator	150
- Entrance and exit	100
- Staff changing room, locker and cleaner room, cloak room, lavatories, stores.	100
- Entrance hall, lobbies, waiting room	100
- Inquiry desk	300
- Gate house	200
b) Lighting for working interiors	
- Infrequent reading and writing	200
- General offices, shops and stores, reading and writing	300 - 400
- Drawing office	300 - 400
- Restroom	150
- Restaurant, canteen, cafeteria	200
- Kitchen	150 - 300
- Lounge	150
- Bathroom	150
- Toilet	100
- Bedroom	100
- Class room, library	300 - 500
- Shop/supermarket/department store	200 - 750
- Museum and gallery	300
c) Localised lighting for exacting task	
- Proof reading	500
- Exacting drawing	1 000
- Detailed and precise work	2 000

Q1.3.4 Lighting Controllability

In the Residential and Accommodation Sections of Apartment, lighting equipment is excluded from assessment if it is installed by occupants. For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of Hospital (assessment criteria are common to both). Table 41 shows the CASBEE Iskandar Building Q1.3.4 Lighting Controllability Scoring Level for Common Properties.

Table 41: CASBEE Iskandar Building Q1.3.4 Lighting Controllability Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Sch (Tertiary, etc), Rtl, Hsp, Htl, Fct, Apt	Sch (Primary / Secondary)
Level 1	Lighting control is not zoned and no control panel/devices are available for adjustment.	Lighting control is not zoned in accordance with illuminance levels and learning methods.
Level 2	Each space enclosed by walls or ceiling-height partitions should have at least 1 operable ON/OFF switch.	Each space enclosed by walls or ceiling-height partitions should have at least 1 operable ON/OFF switch.
Level 3	Lighting control per four-task unit OR per 30m^2 task area is available or control panel/devices are available for adjustment.	Lighting control is zoned in accordance with illuminance levels and learning methods, and on/off control by the occupants is available.
Level 4	(No corresponding level)	(No corresponding level)
Level 5	Lighting control per task unit is available and adjustment via computer terminal/remote control or automatic control is available. External lighting not intended for 24-hour continuous use should be automatically switched by timer and/or photocell.	Level 3 is satisfied and automatic lighting adjustment is partially available.

A higher assessment level is awarded for detailed lighting control or automatic control systems. In Office, a task unit refers to an area consisting of connected desks for a single task, or a single span where the task boundary is difficult to determine based on desk layout. In the Apartment, a multi-zone unit is used for an area where partial lighting is available in accordance with the location and movements of occupants.

For School (Tertiary, etc.), assessment criteria equivalent to Office are applied, assuming large-capacity classrooms. Schools (Primary / Secondary) have smaller classrooms. As such, evaluate lighting control systems based mainly on daylight control. In the Design Assessment stage, the target performance is subject to assessment. Table 42 shows CASBEE Iskandar Building Q1.3.4 Lighting Controllability Scoring Level for Residential.

Table 42: CASBEE Iskandar Building Q1.3.4 Lighting Controllability Scoring Level – Residential

Residential and Accommodation Sections		
Score	Hsp	Htl, Apt
Level 1	No lighting control is available.	No lighting control is available.
Level 2	(No corresponding level)	
Level 3	Lighting control per multi-bed unit is available or control panel/devices for adjustment are available.	Control panel/devices are available for broad lighting adjustment for the entire room.
Level 4	(No corresponding level)	
Level 5	Detailed lighting control per bed is available.	Detailed lighting control per multi-zone unit is available via For Htl: computer terminal/remote control OR automatic control system For Apt: switches/control devices per lighting zone in each room.

Lighting controllability refers to the level of control over brightness, colour, temperatures and lighting positions in a room by ON/OFF switching and light adjustment. In this assessment, evaluation is based on the minimum area in a room for which lighting control is available and on methods of control (manual/automatic). For Hospital, Level 1 is awarded where lighting can only be turned on/off or adjusted for the whole area despite the need for partial lighting control.

Q1.4 Air Quality

It is clearly important to maintain healthy indoor air in rooms, but achieving that aim requires careful consideration of aspects such as materials selection, ventilation and construction methods. The level of such consideration is evaluated here. The basic approach to maintaining healthy indoor air in rooms is simple in itself, namely to first avoid the emission of pollutants as far as possible, and then to use ventilation to expel pollutants which have been emitted. This approach is combined with operation and management aspects and divided into three items (source control, ventilation and operation plan) for assessment.

Q1.4.1 Source Control

Cutting off pollutants at source is a sure and effective way of maintaining healthy indoor air quality. Thus, the first consideration is to minimise the emission of pollutants from the building and its equipment. In that sense, source control is more important than ventilation and operation plan.

Q1.4.1.1 Chemical Pollutants

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 43 shows the CASBEE Iskandar Building Q1.4.1.1 Chemical Pollutants Scoring Level for Common Properties and

Table 44 shows the CASBEE Iskandar Building Q1.4.1.1 Chemical Pollutants Scoring Level for Residential.

Table 43: CASBEE Iskandar Building Q1.4.1.1 Chemical Pollutants Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Does not comply with indoor air quality acceptable limits set by DOSH.
Level 2	(No corresponding level)
Level 3	Complies with the indoor air quality acceptable limits set by DOSH.
Level 4	Complies with the indoor air quality acceptable limits set by DOSH. Most materials used have a low level of formaldehyde and other VOC emissions.
Level 5	Complies with the indoor air quality acceptable limits set by DOSH. Most materials used have a low level of formaldehyde and other VOC emissions, AND technologies have been introduced to purify indoor air.

Table 44: CASBEE Iskandar Building Q1.4.1.1 Chemical Pollutants Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Complies with the indoor air quality acceptable limits set by DOSH.
Level 4	Complies with the indoor air quality acceptable limits set by DOSH. Most materials used have a low level of formaldehyde and other VOC emissions.
Level 5	Complies with the indoor air quality acceptable limits set by DOSH. Most materials used have a low level of formaldehyde and other VOC emissions, AND technologies have been introduced to purify indoor air.

Evaluate whether adequate measures have been taken to avoid air pollution by chemical pollutants. Since the 1980s, Sick Building Syndrome has become a major problem in Europe and North America. It was triggered by changes in the materials used in buildings and a rapid reduction in the volume of air ventilation, which was intended to save energy in offices.

Sick Building Syndrome has become a major problem in houses which rely on mechanical ventilation, and the problem has even emerged in "sick schools".

For this assessment, an ordinary level of design that satisfy the Uniform Building By-Laws 1984, Amendment 2021 (UBBL) and Malaysian Standard (MS), which is mainly derived from consideration of chemical pollutants, receives a Level 3 score. More rigorous efforts will be awarded higher scores.

Q1.4.2 Ventilation

The most effective method for maintaining healthy indoor air is to totally minimise the emission of pollutants from the building and its equipment, but in many cases that ideal must be balanced against cost and design considerations to permit some level of emission. In such cases, adequate ventilation can be planned to improve the air quality.

Rather than conveniently relying on operation and management or automatic control, it is important to give careful consideration to the baseline quality of the outside air, the volume of outside air, zoning and other issues. It is also important to give the occupants some degree of scope for controlling their own ventilation.

Q1.4.2.1 Ventilation Rate

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 45 shows the CASBEE Iskandar Building Q1.4.2.1 Ventilation Rate Scoring Level for Common Properties and

Table 46 shows the CASBEE Iskandar Building Q1.4.2.1 Ventilation Rate Scoring Level for Residential.

Table 45: CASBEE Iskandar Building Q1.4.2.1 Ventilation Rate Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Hsp	Off, Sch, Apt, Htl, Rst, Rtl, Htl, Fct
Level 1	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	Ventilation rate achieves the minimum recommended rate for each specific hospital facility covered under the latest ASHRAE Standard 170, or the latest ASHRAE Standard 62.1 for spaces that are not covered under ASHRAE Standard 170.	Ventilation rate achieves the minimum recommended rate under the 3rd Schedule of the Uniform Building By-Laws 1984 and ASHRAE Standard 62-73.
Level 4	For rooms equipped with a centrally-controlled air mixing system, a ventilation rate of 30 m^3/h per person or higher; or if not centrally controlled, a ventilation rate 20% higher than requirements of the latest ASHRAE Standard 170, or the latest ASHRAE Standard 62.1 for spaces that are not covered under ASHRAE Standard 170.	Ventilation rate is 20% higher than the minimum recommended rate under the 3rd Schedule of the Uniform Building By-Laws 1984 and ASHRAE Standard 62-73.

Level 5	For rooms equipped with a centrally-controlled air mixing system, a ventilation rate of 35 m^3/h per person or higher; or if not centrally controlled, a ventilation rate 40% higher than requirements of the latest ASHRAE Standard 170, or the latest ASHRAE Standard 62.1 for spaces that are not covered under ASHRAE Standard 170.	Ventilation rate is 40% higher than the minimum recommended rate under the 3rd Schedule of the Uniform Building By-Laws 1984 and ASHRAE Standard 62-73.

Table 46: CASBEE Iskandar Building Q1.4.2.1 Ventilation Rate Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Not adequate for Level 3.
Level 2	(No corresponding level)
Level 3	Ventilation rate achieves the minimum recommended rate under the 3rd Schedule of the Uniform Building By-Laws 1984 and ASHRAE Standard 62-73.
Level 4	Ventilation rate is 20% higher than the minimum recommended rate under the 3rd Schedule of the Uniform Building By-Laws 1984 and ASHRAE Standard 62-73.
Level 5	Ventilation rate is 40% higher than the minimum recommended rate under the 3rd Schedule of the Uniform Building By-Laws 1984 and ASHRAE Standard 62-73.

Evaluate according to whether there is an adequate volume of ventilation. The Uniform Building By-Laws 1984 and its latest amendment, Uniform Building By-Laws 1984 (Amendment 2021) both have minimum recommendations for fresh air ventilation rates, which shall also comply with the requirements of ASHRAE Standard 62-73. The Uniform Building By-Laws 1984 has two distinct recommendations for the following scenarios:

i. fresh air ventilation in conjunction with recirculated, filtered, and conditioned air; and

ii. fresh air ventilation in conjunction with mechanical ventilation systems

A higher level is awarded when air quality improvement measures are actively undertaken. While this assessment is based on ventilation rates, a localised air exhaust system at pollution sources is also important in practice. In an Office, for example, zones which generate pollutants (e.g: cafeteria, graphic production area, and printing room) require a fully-segregated ventilation system.

Q1.4.2.2 Natural Ventilation Performance

Evaluate only if the building is an Office, School, or Factory (for Entire Building and Common Properties section) (refer to Table 47), or a Hospital, Hotel, or Apartment (for Residential and Accommodation section) (refer to Table 48).

For the Residential and Accommodation section evaluation, evaluate individual rooms in the unit and award the appropriate level based on the room with the lowest performance. For other building types, evaluate the entire standard floor or another representative floor.

Table 47: CASBEE Iskandar Building Q1.4.2.2 Natural Ventilation Performance Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Sch (Tertiary, etc), Fct	Sch (Primary/ Secondary)
Level 1	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	Fixed windows and no valid opening for natural ventilation; or fixed windows and valid opening area for natural ventilation of less than 25 cm^2/m^2; or one or more windows having a total area of not less than 10% of clear floor area of such room and not less than half out of this 10% floor area shall have opening capable of	Valid opening area for natural ventilation of at least 5% of the total floor space of an occupied room, and every room used for the purpose of conducting classes in a school shall be provided with natural ventilation by means of one or more windows having a total area of not less than 20% of clear floor area of such room and not less than half out of this 20% floor

	allowing a free uninterrupted passage of air.	area shall have opening capable of allowing a free uninterrupted passage of air.
Level 4	Fixed windows and valid opening area for natural ventilation of at least 25 cm^2/m^2; or one or more windows having a total area of not less than 15% of clear floor area of such room and not less than half out of this 15% floor area shall have opening capable of allowing a free uninterrupted passage of air.	Valid opening area for natural ventilation of at least 7% of the total floor space of an occupied room, and every room used for the purpose of conducting classes in a school shall be provided with natural ventilation by means of one or more windows having a total area of at least 25% of clear floor area of such room and at least half out of this 25% floor area shall have opening capable of allowing a free uninterrupted passage of air.
Level 5	Fixed windows and valid opening area for natural ventilation of at least 50 cm^2/m^2; or openable windows and valid opening area for natural ventilation of at least 15% of the total floor space of an occupied room; or valid opening area for natural ventilation is equivalent to Level 4, and in-room air quality improvement is expected with use of outdoor air-cooling system(s) that can use more than double the required outdoor air volume.	Valid opening area for natural ventilation of at least 10% of the total floor space of an occupied room / or valid opening area for natural ventilation is equivalent to Level 4, and in-room air quality improvement is expected with use of outdoor air-cooling system that can use more than double the required outdoor air volume.

Table 48: CASBEE Iskandar Building Q1.4.2.2 Natural Ventilation Performance Scoring Level –Residential and Accommodation Sections

Residential and Accommodation Sections

Score	Hsp, Htl	Apt
Level 1	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	Fixed windows and no valid opening for natural ventilation; or fixed windows and valid opening area for natural ventilation of less than 50 cm^2/m^2; or openable windows and valid opening area for natural ventilation of at least 5% of the total floor space of an occupied room.	Area of openable windows at least 10% of floor space of occupied rooms.
Level 4	Fixed windows and valid opening area for natural ventilation of at least 50 cm^2/m^2; or one or more windows having a total area of not less than 15% of clear floor area of such room and not less than 2/3 out of this 15% floor area shall have opening capable of allowing a free uninterrupted passage of air for an occupied room; or where in-room air quality improvement is expected with use of outdoor air-cooling system which can use more than double the required outdoor air volume.	Area of openable windows at least 12.5% of floor space of occupied rooms.
Level 5	Fixed windows and valid opening area for natural ventilation of at least 100 cm^2/m^2; or openable windows and valid opening area for natural ventilation of at least 20% of the total floor space of an occupied room; or	Area of openable windows at least 15% of floor space of occupied rooms.

	valid opening area for natural ventilation is equivalent to Level 4, and in-room air quality improvement is expected with use of outdoor air-cooling system that can use more than double the required outdoor air volume.	

Evaluate whether enough openable windows are provided. It is basically a pre-condition that air-conditioning and ventilation equipment should provide the necessary volume of outside air. Nevertheless, there are still cases where the usage of a room causes pollutant emission to temporarily exceed expectations. In other instances, the occupants' physical condition or other factors make them want to temporarily improve air quality by bringing in outside air even in the absence of excessive pollutant concentration.

Opening windows to bring in natural ventilation is important, as it gives occupants the power to control ventilation for their own needs at will. Smoke vents are designed to operate on natural ventilation, so if they can be opened and shut easily and the occupants can use that at will at any time, they can be regarded as natural ventilation openings for this purpose. Furthermore, an outdoor air-cooling system is mainly intended for energy efficiency.

However, Level 4 is awarded when the system can also be used to improve in-room air quality. In assessing openable windows referred to in the Residential and Accommodation section, evaluate the area of non-fixed windows. The area of sliding windows does not need to be halved. The assessment of an Apartment building is based on a representative dwelling unit.

Q1.4.2.3 Consideration for Outside Air Intake

Exclude from assessment if there is no ventilation equipment in the building (fully ventilated through windows). For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both). Table 49 shows the CASBEE Iskandar Building Q1.4.2.3 Consideration for Outside Air Intake Scoring Level for Common Properties and

Table 50 shows the CASBEE Iskandar Building Q1.4.2.3 Consideration for Outside Air Intake Scoring Level for Residential.

Table 49: CASBEE Iskandar Building Q1.4.2.3 Consideration for Outside Air Intake Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct	Apt
Level 1	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also oriented away from extraction vents or positioned at least 3 m away.	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site.
Level 4	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also positioned at least 6 m away from extraction vents.	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also positioned at least 3 m away from extraction vents.
Level 5	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also oriented away from extraction vents and positioned at least 6 m away.	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also oriented away from extraction vents and positioned at least 3 m away.

Table 50: CASBEE Iskandar Building Q1.4.2.3 Consideration for Outside Air Intake Scoring Level – Residential

Residential and Accommodation Sections		
Score	Hsp, Htl	Apt
Level 1	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)
Level 3	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also oriented away from extraction vents or positioned at least 3 m away.	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site.
Level 4	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also positioned at least 6 m away from extraction vents.	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also positioned at least 3 m away from extraction vents.
Level 5	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also oriented away from extraction vents and positioned at least 6 m away.	The air intakes are oriented away from pollution sources, considering conditions in areas surrounding the site. They are also oriented away from extraction vents and positioned at least 3 m away.

Outside air intakes should be designed to take in the best outside air available. Pollution sources should be taken to mean cars, factories, waste heat and air collected from adjacent buildings or the subject building, cooling towers, garbage collection areas, and other sources based on other circumstances specific to the site concerned.

Consider also the positional relationships between waste air vents and outside air intakes on each floor and in each dwelling of the subject building.

Q1.4.3 Operation Plan

Q1.4.3.1 CO_2 Monitoring

CO_2 monitoring is only applicable to the Entire Building and Common Properties section of an Office, School, Retail, Restaurant, Hall, or Factory. Table 51 shows the CASBEE Iskandar Building Q1.4.3.1 CO_2 Monitoring Scoring Level for Common Properties.

Table 51: CASBEE Iskandar Building Q1.4.3.1 CO_2 Monitoring Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Fct
Level 1	Not adequate for Level 3.
Level 2	(No corresponding level)
Level 3	The system is based on manual measurement, with the minimum necessary level of recording.
Level 4	The system is based on manual measurement, a management manual, etc. has been provided for properly maintaining air quality, and it functions effectively.
Level 5	The system has constant central monitoring of CO_2 . Also, a management manual, etc. has been provided for properly maintaining air quality, and it functions effectively.

Evaluate whether a system has been instituted for properly maintaining air quality, and whether the system functions effectively. Monitoring shall consist of regular manual monitoring, but that should be regarded as minimum management. There are variations over time and between seasons in the quality of indoor and outside air, and temporary malfunctions of the equipment can also occur. Therefore, a constant monitoring system for CO_2 is desirable wherever possible.

Q1.4.3.2 Control of Smoking

For Hospital, evaluate only outpatient waiting rooms as common areas of Hospital. Table 52 shows the CASBEE Iskandar Building Q1.4.3.2 Control of Smoking Scoring Level for Residential.

Table 52: CASBEE Iskandar Building Q1.4.3.2 Control of Smoking Scoring Level – Residential

Residential and Accommodation Sections	
Score	Off, Sch, Rtl, Rst, Hal, Hsp (Waiting Room), Htl, Fct
Level 1	Not adequate for Level 3.
Level 2	(No corresponding level)
Level 3	There is a minimum level of measures, such as smoking booths, to avoid exposing non-smokers to smoke.
Level 4	(No corresponding level)
Level 5	Smoking is confirmed to be prohibited in the entire building. Alternatively, there is an adequate level of measures, such as smoking booths, to avoid exposing non-smokers to smoke.

Evaluate whether thorough measures, such as a building-wide smoking ban or the installation of smoking booths, have been taken to avoid passive smoking. Tobacco smoke contains many pollutants, including nicotine, carbon monoxide and particulates, causing the problem of passive smoking of smoke from smokers and their cigarettes. At the same time, there is the problem of the odour of tobacco smoke.

Therefore, as a minimum measure there should be smoking booths with direct extraction of smoke to the outside, with no recirculation to other indoor spaces. For Level 5, smoking must be prohibited in the entire building, or, if there are smoking booths, they must be entirely isolated from other spaces, including via ceiling voids, to prevent any smoke dispersion to other space, with a constant negative pressure maintained in them.

Q2 – Quality of Services

Assessment of service functions to the users and owners of a building covers functional aspects that impact users' activities within the building, and others that are necessary for keeping the building itself in good condition in the long term (refer to Table 53).

Table 53: CASBEE Iskandar Building Q2 Quality of Service Item Explanation

Primary Item	Secondary Item
Q2 – Quality of Services	Q2.1 Serviceability
	Evaluate ease of movement and comfort. It is not easy to express such aspects as directs quantitative indices, so this assessment uses substitute indices such as floor area per occupant, ceiling height, adaptation to IT equipment, availability of refreshment space, and consideration of maintenance. This assessment of functionality is an unprecedented characteristic, developed from the assessment of spatial elements. Unlike typical assessments which emphasise users' psychological reactions, this assessment mainly considers the physical performance of the indoor environment.
	Q2.2 Durability & Reliability
	Evaluate the ability to maintain good operational condition over a long period of time. First, potential threats to human life such as a building collapse during a disaster and compromised occupant comfort during strong winds are taken into consideration as environmental factors for the space within virtual boundaries. Interruption of building functions in the event of a disaster or an accident is taken into consideration as a functionality issue.
	Q2.3 Flexibility & Adaptability

Primary Item	Secondary Item
	Evaluate readiness for long-term use, including future renewals and changes of usage, in terms of the substitute functions allowance for land and allowance for space. Spatial Margin focuses on two aspects, allowance for story height and adaptability of floor layout evaluates consideration given to such renewal of building facilities in construction planning and equipment planning.

Q2.1 Serviceability

Evaluate the service functions of the building for the functionality and usability of its spaces and, in a more positive sense, how pleasant and comfortable it is. Also, evaluate the consideration for daily maintenance.

Q2.1.1 Functionality & Useability

Q2.1.1.1 Provision of Space & Storage

For the Entire Building and Common Properties section, evaluate only if the building is an Office or Factory (refer to Table 54). For the Residential and Accommodation section, evaluate only if the building is a Hospital or Hotel (refer to Table 55).

Table 54: CASBEE Iskandar Building Q2.1.1.1 Provision of Space & Storage Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Fct
Level 1	Not adequate for level 3.
Level 2	(No corresponding level)
Level 3	Working space per person is at least 6.25 m^2. Baseline recommendation refer to Guidelines on Occupational Safety and Health in the Office by Department of Occupational Safety and Health, Ministry of Human Resources Malaysia JKKP:GP(1)1/96
Level 4	Working space per person is at least 9 m^2
Level 5	Working space per person is at least 12 m^2

Working space refers to floor area allocated within the effective floor area of the office for ordinary workers to go about their daily duties. It does not include common spaces such as canteens, medical rooms, conference rooms, meeting rooms, private executive offices, filing rooms, space for refreshment spaces (see Q2.1.2.2) and similar spaces. Therefore, the working space includes meeting spaces (spaces for day-to-day discussions), OA equipment spaces, management spaces, circulation spaces, and any other types of related spaces.

Table 55: CASBEE Iskandar Building Q2.1.1.1 Provision of Space & Storage Scoring Level – Residential

Residential and Accommodation Sections		
Score	Hsp	Htl
Level 1	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)

Level 3	Private rooms minimum 10 m^2/bed, measuring minimum 3.0m in any direction. Multi-bed rooms to have minimum 1.5m between beds. Requirement and procedures under Act 586 (Handbook on Setting Up Private Hospitals in Malaysia) set by the Ministry of Health Malaysia (MOH).	50% of the rooms provided comply with the minimum room sizes required under the appropriate Grade (star rating) & Category of Tourist Accommodation Premises set by the Ministry of Tourism, Arts and Culture (MoTAC).
Level 4	Not adequate for Level 5.	50%-80% of the rooms provided comply with the minimum room sizes required under the appropriate Grade (star rating) & Category of Tourist Accommodation Premises set by the Ministry of Tourism, Arts and Culture (MoTAC).
Level 5	Private rooms minimum 12 m^2/bed, measuring minimum 3.0m in any direction. Multi-bed rooms to have minimum 1.5m between beds. Requirement and procedures under Act 586 (Handbook on Setting Up Private Hospitals in Malaysia) set by the Ministry of Health Malaysia (MOH).	>80% of the rooms provided comply with the minimum room sizes required under the appropriate Grade (star rating) & Category of Tourist Accommodation Premises set by the Ministry of Tourism, Arts and Culture (MoTAC).

The primary aspect of interior serviceability functionality and ease of use concerns spaciousness and storage capacity. The spaciousness used here as an assessment indicator is not necessarily directly linked to functionality and storage space, but its effects, such as giving more freedom in layout of fixtures and allowing enough space for storage, can easily be imagined.

For Hospital, Level 3 is the bare minimum currently required by related regulations in normal circumstances, while Level 5 is regarded as extremely spacious, with reference to the Handbook on Setting Up Private Hospitals in Malaysia. For Hotel, a higher score is awarded if a higher percentage of its rooms comply with the minimum room size required for its Grade and Category.

Use the effective measurements (internal dimension) to calculate the area subject to assessment.

Q2.1.1.2 Use of Advanced Information Systems

For the Entire Building and Common Properties section, evaluate only if the building is an Office or Factory (refer to Table 55). For the Residential and Accommodation section, evaluate only if the building is a Hotel or Apartment (refer to Table 57).

Table 56: CASBEE Iskandar Building Q2.1.1.2 Use of Advanced Information System Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Fct
Level 1	Not adequate for Level 2.
Level 2	Measures such as OA floors* accommodate layout changes, and electrical sockets for OA equipment have at least 30 VA/m^2 socket capacity. In addition, fibre optic is routed into the building for communications.
Level 3	Measures such as OA floors* accommodate layout changes, and electrical sockets for OA equipment have at least 30 VA/m^2 socket capacity. Also, Level 2 is satisfied for communications, and communications lines with capacity for one data communications device per 8 m^2 (one phone, one PC) is routed onto each floor.
Level 4	Measures such as OA floors* accommodate layout changes, and electrical sockets for OA equipment have at least 40 VA/m^2 socket capacity. Also, Level 3 is satisfied for communications, lines for multiple communications carriers are routed into the building, and space is provided for each communications carrier to lay cables onto each floor.
Level 5	Measures such as OA floors* accommodate layout changes, and electrical sockets for OA equipment have at least 50 VA/m^2 socket capacity. Also, Level 4 is satisfied for communications, Gigabit communications lines are routed onto each floor, and tenant EPS is ensured for communications between floors.

*OA floors refer to raised-access system floors. Structures with equivalent functions can be included in this category.

Table 57: CASBEE Iskandar Building Q2.1.1.2 Use of Advanced Information System Scoring Level – Residential

Residential and Accommodation Sections	
Score	Htl, Apt
Level 1	Not adequate for Level 2.
Level 2	Communications lines able to carry telephone and broadcasting are routed into each dwelling or guest room.
Level 3	Level 2 is satisfied, and Internet services not adequate for Level 4 are provided.
Level 4	Each dwelling or guest room is equipped with a communications environment able to use 100 Megabit-class broadband.
Level 5	Each dwelling or guest room is equipped with a communications environment able to use Gigabit-class broadband.

In a highly computerised society, the installation of IT equipment is essential for all functional space in buildings. Measures in offices should go beyond just increasing the capacity of the sockets.

As much consideration as possible should be given to the building and its services to facilitate the addition of IT equipment, and the relocation of such equipment for layout changes.

Level 3 is the level currently demanded in normal circumstances, while Level 5 requires a more active approach. For communications in Office buildings, Level 3 or better requires vertical cabling within the building, and Level 5 requires capacity for Gigabit communications. The communications media corresponding to these levels are fibre optic and LAN cables.

Q2.1.1.3 Barrier-free Planning

Only the Entire Building and Common Properties section is evaluated for this item. For Retail, Restaurant, Hall, Hospital, and Hotel, different qualifiers apply depending on the size of the building (more or less than 2,000m^2) (refer to Table 58).

Table 58: CASBEE Iskandar Building Q2.1.1.3 Barrier-free Planning Scoring Level – Common Properties

Entire Building and Common Properties			
Score	Rtl, Rst, Hal, Hsp, Htl	Off, Sch, Fct, Apt	Rtl, Rst, Hal, Hsp, Htl [<2,000m^2]
Level 1	Not adequate for Level 3.	Not adequate for Level 3.	
Level 2	(No corresponding level)	(No corresponding level)	
Level 3	The building satisfies the standard for easing building use (the minimum level) by compliance with Malaysian Standards MS 1184.	At least half of the building satisfies the standard for easing building use (the minimum level) by compliance with Malaysian Standards MS 1184.	
Level 4	The building satisfies the standard for easing building use (the preferred level) by compliance with Malaysian Standards MS 1184 and MS 1183.	The building satisfies the standard for easing building use (the minimum level) by compliance with Malaysian Standards MS 1184 and MS 1183.	
Level 5	The building exceeds the standard for easing and guiding building use (the preferred level) by compliance with Malaysian Standards MS 1184 and MS 1183, achieving the universal design level.	The building satisfies the standard for easing building use (the desirable level) by compliance with Malaysians Standard MS 1184 and MS 1183 - Universal Design and Accessibility	

Functional building must be open to all people who have the possibility of using it. At a minimum, MS 1184:2014 - Universal Design and Accessibility standards for easing and guiding building use for both abled and differently-abled people shall be utilised. A higher score can be achieved if the design also complies with the latest version of MS 1183:Part 8 – Code of Practice for Means of Escape for Disabled People, to ensure that emergency evacuation can also be conducted without significant impediment for a wider range of users.

Q2.1.2 Amenity

Q2.1.2.1 Perceived Spaciousness & Access to View

For the Entire Building and Common Properties section, evaluate only if the building is a Factory, Office, Retail, Restaurant, or School (refer to Table 59).

Table 59: CASBEE Iskandar Building Q2.1.2.1 Perceived Spaciousness & Access to View Scoring Level – Common Properties

Entire Building and Common Properties				
Score	Fct	Off, Rtl, Rst	Sch (Tertiary, etc)	Sch (Primary/ Secondary)
Level 1	Not adequate for Level 3.	Not adequate for Level 3.	Not adequate for Level 3.	Not adequate for Level 3.
Level 2	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)
Level 3	Ceiling height of at least 3.0 m in office spaces, and windows provide all occupants with sufficient awareness of the outside environment.	Ceiling height at least 2.75 m in habitable areas.	Ceiling height of at least 3.0 m in classrooms.	Ceiling height at least 3.0 m in most classrooms.
Level 4	Ceiling height of at least 3.2 m in office spaces, and windows provide all occupants with	Ceiling height at least 3.0 m in habitable areas.	Ceiling height of at least 3.2 m in classrooms.	Ceiling height of at least 3.2 m in classrooms.

	sufficient awareness of the outside environment.			
Level 5	Ceiling height of at least 3.5 m in office spaces, and windows provide all occupants with sufficient awareness of outside the environment.	Ceiling height at least 3.5 m in habitable areas.	Ceiling height of at least 3.5 m in classrooms.	Ceiling height exceeding 3.0 m in classrooms.

Table 60: CASBEE Iskandar Building Q2.1.2.1 Perceived Spaciousness & Access to View Scoring Level – Residential

Residential and Accommodation Sections			
Score	Hsp	Htl	Apt
Level 1	Not adequate for level 3.	Not adequate for level 3.	Not adequate for level 3.
Level 2	(No corresponding level)	(No corresponding level)	(No corresponding level)
Level 3	Ceiling height at least 3.0 m in residential and accommodation sections.	Ceiling height at least 3.5 m in residential and accommodation sections.	Ceiling height at least 2.5 m in residential and accommodation sections.
Level 4	Ceiling height at least 3.2 m in residential and accommodation sections.	Ceiling height at least 3.75 m in residential and accommodation sections.	Ceiling height at least 2.75 m in residential and accommodation sections.

Level 5	Ceiling height at least 3.5 m in residential and accommodation sections.	Ceiling height at least 4 m in residential and accommodation sections.	Ceiling height at least 3.0 m in residential and accommodation sections.

Buildings should be evaluated from the point of view that spaces that are perceived as spacious by their users and offer them good views are psychologically comfortable. Evaluate flat ceiling height, taking beam shape into account in the absence of a suspended ceiling system.

The ceiling height indicator used here is not necessarily directly explanatory of comfort, but it appears to be effective in imparting various benefits, such as a sense of space and openness. Level 3 is the bare minimum currently required by related regulations in normal circumstances, while level 5 is regarded as extremely high, with reference to past examples.

If an elementary school has multiple ceiling heights specific to grades, the ceiling height of the highest grade can be applied.

Q2.1.2.2 Provision of Refreshment Spaces

Only the Entire Building and Common Properties section is evaluated for this item. Evaluate only if the building is an Office, Factory, or Retail (refer to Table 61).

Table 61: CASBEE Iskandar Building Q2.1.2.2 Refreshment Spaces Scoring Level – Common Properties

Entire Building and Common Properties		
Score	Off, Fct	Rtl
Level 1	(No corresponding level)	(No corresponding level)
Level 2	No refreshment spaces are provided.	Not adequate for Level 3.
Level 3	Refreshment spaces comprise less than 1% of the working space.	Refreshment spaces comprise at least 2% of the sales floor area.
Level 4	Refreshment spaces comprise at least 1% of the working space.	Refreshment spaces comprise at least 3% of the sales floor area.

Level 5	Refreshment spaces comprise at least 1% of the working space and refreshment equipment such as a vending machine is provided.	Refreshment spaces comprise at least 4% of the sales floor area.

Office work is often highly stressful, and with the increasing use of IT there is more time spent concentrating on the computer screen. The ability to go for relaxation and refreshment is essential for comfortable office life. Spaces for refreshment in offices generate new vitality in occupants.

Many users spend extended periods in retail facilities, so a generous allowance of rest space for them would enhance their comfort. Levels of multi-tenant buildings may be determined as to whether their facility planning and other related factors are on the premise of providing refreshment spaces (including sports facilities, outdoor terrace spaces, etc.) as well as other refreshment equipment such as vending machines which provide drinks and snacks that are effective for refreshment.

Other services and systems that would provide similar functions shall also be included in the assessment.

Note: when refreshment space is divided from working space by partitions, plants or other elements, it must be excluded from the working space floor area evaluated in 2.1.1.1.

Q2.1.2.3 Décor Planning

For Hospital, evaluate the outpatient waiting rooms and the medical examining rooms as the common areas of the Hospital (assessment criteria are common to both).

Table 62: CASBEE Iskandar Building Q2.1.2.3 Décor Planning Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Not adequate for Level 3.
Level 2	(No corresponding level)
Level 3	Applicable to two of the efforts to be evaluated.
Level 4	Applicable to three of the efforts to be evaluated.
Level 5	Applicable to four of the efforts to be evaluated.

Table 63: CASBEE Iskandar Building Q2.1.2.3 Décor Planning Efforts to be evaluated – Common Properties

Entire Building and Common Properties
The concept of the building as a whole is well defined, and specific efforts to reflect the concept are made at the décor planning stage. (For example, shifting to natural and ecological materials in a building with an ecological theme).
The functions required of the building have been clarified, and specific measures to encourage those functions are indicated at the décor planning stage. (For example, in Hotels and similar facilities, the interior is perceived as living space, and natural materials such as wood and stone are introduced in deliberate efforts to produce a living room-like atmosphere).

Specific measures were taken during décor planning to integrate the lighting design (e.g. effective use of indirect lighting specific to activity type, décor planning in consideration of color temperatures of a light source, etc.).
Mockups and interior perspectives are used to verify the décor planning in advance.

Table 64: CASBEE Iskandar Building Q2.1.2.3 Décor Planning Scoring Level – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	Not adequate for Level 3.
Level 2	(No corresponding level)
Level 3	Applicable to two of the efforts to be evaluated.
Level 4	Applicable to three of the efforts to be evaluated.
Level 5	Applicable to four of the efforts to be evaluated.

Table 65: CASBEE Iskandar Building Q2.1.2.3 Décor Planning Efforts to be evaluated – Residential

Residential and Accommodation Sections
The concept of the building as a whole is well defined, and specific efforts to reflect the concept are made at the décor planning stage. (For example, shifting to natural and ecological materials in a building with an ecological theme).
The functions required of the building have been clarified, and specific measures to encourage those functions are indicated at the décor planning stage. (For example, in Hotels and similar facilities, the interior is perceived as living space, and natural materials such as wood and stone are introduced in deliberate efforts to produce a living room-like atmosphere).
Specific measures were taken during décor planning to integrate the lighting design (e.g. effective use of indirect lighting specific to activity type, décor planning in consideration of colour temperatures of a light source, etc.).
Mockups and interior perspectives are used to verify the décor planning in advance.

There is no general standard for interior planning, so it is very difficult to evaluate this item. However, it is an essential assessment item for the creation of attractive and pleasant spaces. Evaluate whether or not there are specific efforts here that consider the concept or functions of the entire building.

Q2.1.3 Maintenance

Standards require that the specified buildings include measures to maintain a healthy environment, such as air conditioning and water supply management systems. Furthermore, buildings not included in any specified building category but which have many users are also required to have management systems equivalent to the specified buildings.

In this assessment, maintenance includes cleaning management (i.e.: cleaning inside and outside the building) and public health management (i.e.: air environment, water supply/drainage, pest control, waste disposal).

Q2.1.3.1 Design That Considers Maintenance

Only the Entire Building and Common Properties section is evaluated for this item (refer to Table 66 and Table 67).

Table 66: CASBEE Iskandar Building Q2.1.3.1 Design That Considers Maintenance Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Apt, Fct
Level 1	(No corresponding level)
Level 2	Building plan includes insufficient level of consideration of maintenance. (0-2 applicable measures included)
Level 3	Building plan includes standard level of consideration of maintenance. (3-5 applicable measures included)
Level 4	Building plan includes higher-than-standard level of consideration of maintenance. (6-8 applicable measures included)
Level 5	Building plan includes excellent level of consideration of maintenance. (9 or more applicable measures included)

Table 67: CASBEE Iskandar Building Q2.1.3.1 Design That Considers Maintenance Efforts to Be Evaluated – Common Properties

Description
(1) Interior finishes: Interior walls use finish methods, materials, paints or coatings that are highly dirt resistant.
(2) Interior finishes: Floors use finish methods, materials, paints or coatings that are highly dirt resistant.
(3) Décor planning: The design and structure of floors enables washing with water.
(4) Décor design: Design of interior walls and floors avoids creating dust traps and places to leave objects.
(5) Décor design: The first and second doors of windbreak lobbies are distanced so that they are not open at the same time, or are otherwise designed to prevent the entry of dust, etc.
(6) Décor design: Floor materials with very different maintenance methods are not placed close together.
(7) Exterior finishes: Exterior walls and glass are designed with highly dirt resistant construction materials, or with finishes such as weather-resistant paint and hydrophilic properties.
(8) Facade design: exterior walls are designed to maintain clean surface conditions by preventing water pooling and wet-dry effects from rain water by using rain flashing.
(9) Facade design: Measures have been applied to prevent damage from the droppings of birds (pigeons, crows, starlings, etc.).
(10) Facade design: Metal parts exposed on the exterior are plated or otherwise treated against corrosion.
(11) Décor and exterior space design: Movement routes, including outdoor spaces and management areas, are designed to eliminate steps as far as possible (steps not exceeding around 5 mm).

(12) Other: Efforts have been made in areas other than the above, with consideration for maintenance.

Effort (1) –

Interior finishes: Interior walls use finish methods, materials, paints or coatings that are highly dirt resistant.

Judging from the design documents, choose at least one from:

i. Toilets;

ii. Elevator halls;

iii. Escalators;

iii. Rest and smoking rooms; and/or

iv. Waste handling spaces.

Effort shall be considered as having been made if consideration has clearly been given to it consistently throughout the building. Dirt-prone walls are generally finished in materials that are porous and water-absorbent or water-soluble (for example, cloth wall coverings and water-based paints). However, even if porous and water absorbent materials are used, effort can be judged to have been made if structural measures have been taken to avoid dirt, or if a dirt-preventive coating is applied. Also, avoid using construction materials that are extremely susceptible to deterioration, such as mud walls, plaster and diatom earth, or, if such materials are used, make sure the structure allows easy replacement.

Effort (2) –

Interior finishes: Floors use finish methods, materials, paints or coatings that are highly dirt resistant.

Judging from the design documents, choose at least one from;

i. Toilets;

ii. Rest and smoking rooms;

iii. Food handling spaces; and/or

iv. Waste handling spaces.

Effort shall be considered as having been made if consideration has clearly been given to it consistently throughout the building. Dirt-prone floors are generally finished in materials that are porous and water-absorbent or water-soluble, mainly carpet, concrete and natural stone. However, even if these materials are used, effort can be judged to have been made if the materials have a water-repellent treatment or dirt-resistant coating. Also, avoid using construction

materials that are extremely susceptible to deterioration, such as wood and sandstone, or, if such materials are used, make sure the structure allows easy replacement.

Effort (3) –

Décor planning: The design and structure of floors enables washing with water.

Judging from the design documents, effort can be judged to have been made if such consideration has clearly been given consistently throughout the building. The design and structure that allow washing with water assume daily dry cleaning using a wet mop. However, there should be no gaps or joints on the floor surface so it does not remain wet when very polluted or after regular cleaning. In the case of double floors, the materials must permit the use of water, and wiring, etc. must be waterproofed.

Effort (4) –

Décor design: Design of interior walls and floors avoids creating dust traps and places to leave objects.

Judging from the design documents, effort can be judged to have been made if such consideration has clearly been given consistently throughout the building. For a design that requires avoidance of dust traps and placement of objects, evaluate avoidance of protrusions and indentations wherever possible, and the use of curved finishing between walls and floors, and wall-mounted or movable structures for toilets and other fixtures.

Effort (5) –

Décor design: The first and second doors of windbreak lobbies are distanced so that they are not open at the same time, or are otherwise designed to prevent the entry of dust, etc.

Judging from the design documents, the basis for windbreak lobbies with primary and secondary doors should be to provide a space of at least 1 m in which the automatic doors will not detect movement within the lobby. If the space is less than 1 m, but the windbreak lobby has manual doors, the placement of windbreak walls, etc. can be counted as an effort.

Effort (6) –

Décor design: Floor materials with very different maintenance methods are not placed close together.

Judging from the design documents, effort can be judged to have been made if such consideration has clearly been given consistently throughout the building.

When floor materials for which a large amount of water should not be used for cleaning (flooring, cork, and natural fibre carpet) and those for which a large amount of water may be used for cleaning (vinyl, plastic sheets, stone, and tile carpet) are used in combination, regardless of the size of the area subject to construction, the washing water is expected to soak in from between

the joints, which would cause various problems to the floor such as warps, stains and changes in colour. However, if the possibility of the infiltration of washing water is taken into consideration, and the joint strip is made as wide as possible (about 5 cm), such efforts shall be included in the assessment.

When multiple floor materials, all of which allow water use for cleaning (vinyl, plastic sheets, stone and tile carpet), are used, if different materials are used in combination alongside each other for an extremely small space (about 30 to 50 m^2), since each material requires a different cleaning method, cleaning cycle and detergent, we cannot say that the actual maintenance and management is adequately taken into account. Therefore, ideally, when constructing the floor, a small number of materials should be used to cover as much space as possible.

Effort (7) –

Exterior finishes: Exterior walls and glass are designed with highly dirt resistant construction materials, or with finishes such as weather-resistant paint and hydrophilic properties.

Judging from the design documents, effort can be judged to have been made if consideration has clearly been given consistently throughout the facade design of the building. The design should include prevention of acid rain effects and other measures appropriate to the characteristics of the local area of the building (e.g.: proximity to the sea). Unless the building is located in an area where weather resistance is particularly desirable, when self-cleaning building materials or paints are used for the outer wall surfaces or glass portions that would save the trouble of cleaning the outer walls as much as possible, such efforts shall be taken into account in the assessment.

Effort (8) –

Facade design: exterior walls are designed to maintain clean surface conditions by preventing water pooling and wet-dry effects from rain water by using rain flashing.

Judging from the design documents, effort can be judged to have been made if consideration has clearly been given consistently throughout the facade design of the building. With respect to efforts made in the building design, if the building is designed to stay clean and avoid moisture (i.e., weathering at the opening portions or a sloping skylight that would drain rainwater), such efforts shall be taken into account in the assessment. The difference between (7) and (8) is that the former refers to the use of stain-resistant materials and the latter refers to the stain-resistant structure.

Effort (9) –

Facade design: Measures have been applied to prevent damage from the droppings of birds (pigeons, crows, starlings, etc.).

Judging from the design documents, effort can be judged to have been made if consideration has clearly been given consistently throughout the cladding or other building envelope finishes design to maintain an acceptable standard of sanitation and hygiene. For example, avoid the installation of structural elements above water tanks where birds could rest, shelter from rain, and make nests.

Effort (10) –

Facade design: Metal parts exposed on the exterior are plated or otherwise treated against corrosion.

Judging from the design documents, effort can be judged to have been made if consideration has clearly been given consistently throughout the facade design of the building. Metal elements such as external staircases, air-conditioning equipment stands and ladders which are only painted are difficult to protect from corrosion in the long term. It is preferable to use stainless steel, or to apply anti-corrosion treatments such as plating.

Effort (11) –

Décor and exterior space design: Movement routes, including outdoor spaces and management areas, are designed to eliminate steps as far as possible (steps not exceeding around 5 mm).

Judging from the design documents, effort can be judged to have been made if consideration has clearly been given consistently throughout the décor design and exterior space design within the area under the management of the building. A great deal of transportation of goods, devices and equipment is involved in maintenance and management; buildings designed to have as few steps or bumps as possible are rated highly in the assessment.

Effort (12) –

Other: Efforts have been made in areas other than the above, with consideration for maintenance.

Unusual efforts not included in (1)-(11) above items should be evaluated as one point. When evaluating "Other" efforts, state in the assessment software what kind of effort has been made, and attach documentation clearly comprehensible to a third party.

Q2.1.3.2 Securing Maintenance Functions

Only the Entire Building and Common Properties section is evaluated for this item (refer to Table 68).

Level 3 is awarded to all buildings with a total floor space of 500 m^2 or less.

Table 68: CASBEE Iskandar Building Q2.1.3.2 Securing Maintenance Functions Scoring Level – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Apt, Fct
Level 1	(No corresponding level)
Level 2	Insufficient level of measures has been taken to ensure functionality of the maintenance system. (0-3 applicable measures)
Level 3	Standard level of measures has been taken to ensure functionality of the maintenance system. (4-6 applicable measures)
Level 4	Higher than standard level of measures has been taken to ensure functionality of the maintenance system. (7-9 applicable measures)
Level 5	Extensive level of measures has been taken to ensure functionality of maintenance system. (10 or more applicable measures)

For this assessment, evaluate the basic measures for achieving a high level of maintenance. Verify that established measures correspond to the assessment criteria. Assessment levels are determined by the total number of applicable measures taken.

The efforts were determined with reference to the following:

i. MS 2015 – Public Toilets

ii. MS 1525 – Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings – Code of Practice

iii. Street, Drainage, and Building Act 1974

iv. Department of Safety and Health (DOSH)

v. National Water Services Commission (SPAN)

vi. Guidelines for Solid Waste Management Systems in New Developments

vii. General good practices

Table 69: CASBEE Iskandar Building Q2.1.3.2 Securing Maintenance Functions Efforts to Be Evaluated

Efforts to be evaluated:
[1] Adequate space has been used for cleaning staff rooms, relative to the floor area.
[2] Adequate space has been used for cleaning equipment rooms, relative to the floor area.
[3] The cleaning equipment rooms have washing areas with drainage channels to safe drainage facilities.
[4] Space is planned for washing and drying mops and rags, for the sake of hygiene.
[5] Adequate space has been provided for sorting waste, materials for recycling, and bulky waste items, and an easy way to move those materials outside has been planned.
[6] Cleaning sinks are installed for each toilet, or for each floor.
[7] Cleaning equipment for each type of floor material has been anticipated, and the layout of electrical receptacles (numbers and spacings) for use in cleaning work has been planned accordingly.
[8] Design ensures that maintenance work can be performed safely on exterior glass and walls, air supply and vent holes, light fixtures and other fixtures in high places.
[9] Suitable levels of lighting for cleaning purposes can be set.
[10] Valves and other devices requiring day-to-day adjustment are installed in positions which allow convenient operation.
[11] Inspection access holes for equipment concealed in ceiling voids are at least 600 x 600 mm.

[12] Equipment that is not in private areas can be accessed from common areas for maintenance.
[13] Other than the above, points related to securing maintenance functions have been identified and implemented.

Effort (1) –

Adequate space has been used for cleaning staff rooms, relative to the floor area.

Evaluated from design documents. Judge an effort to have been made if the area is at least 0.2% of the floor area. The staff room refers to the area for the cleaning personnel to rest, take a short nap, change clothes, conduct administrative work, or store personal items. Space shared with other occupants of the building for similar use can also be applied.

Effort (2) –

Adequate space has been used for cleaning equipment rooms, relative to the floor area.

Evaluated from design documents. Judge an effort to have been made if the area is at least 0.2% of the floor area. In buildings where space provided for storage of cleaning equipment or maintenance is inadequate, cleaning materials may have to be delivered in smaller quantities and more frequently, thus increasing transportation-related load. Cleaning equipment rooms are used to store cleaning chemicals and similar substances, so it is preferable that they be in a sterile location.

Effort (3) –

The cleaning equipment rooms have washing areas with drainage channels to safe drainage facilities.

Evaluated from design documents. A cleaning utensils storage area requires a space for washing cleaning utensils after use. It also needs to have drainage facilities connecting to the sewer or a septic tank, through which the washing water is properly drained.

Effort (4) –

Space is planned for washing and drying mops and rags, for the sake of hygiene.

Judge from design documents whether space has been provided for washing machines. A space, in which washing machines are installed, proportional to the building area, is also taken into account in the assessment. There should be cleaner's sinks for mops and hangers for mops to hang freely to dry, in accordance with recommendations in MS 2015.

Effort (5) –

Adequate space has been provided for sorting waste, materials for recycling, and bulky waste items, relative to the floor area, and an easy way to move those materials outside has been planned.

Evaluated from design documents. Judge an effort to have been made if the areas provided for waste collection and sorting, recycling, and bulky waste in accordance with the requirements and specifications determined the Guidelines for Solid Waste Management Systems in New Developments ("Garis Panduan Sistem Pengurusan Sisa Pepejal Bagi Pembangunan Baru") published by the Ministry of Housing and Local Governance (KPKT).

Effort (6) –

Cleaning sinks are installed for each toilet, or for each floor.

Evaluated from design documents. Performing cleaning work efficiently requires provision of cleaning sinks for every set unit of area, to shorten movement times and distances. Judge whether a cleaning sink has been installed for each toilet (meaning each group of male/female/multi-purpose toilets).

Effort (7) –

Cleaning equipment for each type of floor material has been anticipated, and the layout of electrical receptacles (numbers and spacings) for use in cleaning work has been planned accordingly.

Evaluated from design documents. The use of extension cables to compensate for lack of electrical receptacles increases hazards such as cables melting from over-heating and people tripping over cables. It is important to be careful not to interrupt users' on-going activities inside the building by providing electric outlets in a different power system at regular intervals for maintenance and management purposes. As electric cords for cleaning devices are usually about 8 m to 15 m long, if a private electric outlet in an independent power system is located within at least a diameter of about 30 m in common passageways, such effort shall be taken into account in the assessment.

Effort (8) –

Design ensures that maintenance work can be performed safely on exterior glass and walls, air supply and vent holes, light fixtures and other fixtures in high places.

Evaluated from design documents. Do not use designs that make work difficult, such as exterior glazing and walls with curves or extreme setbacks from the parapet, and design for safe work by installing a rooftop gondola system in buildings of 10 floors or more. Also judge whether design allows work from the ceiling down with hoist equipment for cleaning and replacing the bulbs, etc. in light fixtures in high places.

Effort (9) –

Suitable levels of lighting for cleaning purposes can be set.

Evaluated from lighting design documents. Lighting for cleaning should not use all lights, to save energy, but a minimum level is required to enable safe work, and for checking the results of cleaning, so judge whether a suitable level of lighting has been set for cleaning. The desired illuminance is at least 100 lx, the lowest average level of the illuminance range, in accordance with MS 1525 recommendations.

Effort (10) –

Valves and other devices requiring day-to-day adjustment are installed in positions which allow convenient operation.

Evaluated from design documents. For efficient maintenance, valves and other adjustment devices should be positioned where they are easy to operate.

Effort (11) –

Inspection access holes for equipment concealed in ceiling voids are at least 600 x 600 mm.

Evaluated from design documents. Adequate space must be provided for tasks such as replacing filters and adjusting humidifiers in equipment installed in ceiling voids. The minimum size of the access holes shall comply with the Uniform Building By-Laws 1984 and its applicable amendments.

Effort (12) –

Equipment that is not in private areas can be accessed from common areas for maintenance.

Evaluated from design documents. For efficient maintenance, a plan is required that allows the work to proceed without impeding the activities of residents.

Effort (13) –

Other than the above, points related to securing maintenance functions have been identified and implemented.

Unusual efforts not included in items [1]-[12] above should be evaluated as one point. When evaluating "Other" efforts, state in the assessment software what kind of effort has been made, and attach documentation clearly comprehensible to a third party.

Q2.2 Durability & Reliability

Evaluate the ability to maintain good operational condition over a long period of time. First, potential threats to human life such as a building collapse during a disaster and compromised occupant comfort during strong winds are taken into consideration as environmental factors for the space within virtual boundaries. Interruption of building functions in the event of a disaster or an accident is taken into consideration as a functionality issue.

Q2.2.1 Natural Catastrophe Resistance

Q2.2.1.1 Flood and/or Landslide Resistance

Evaluate the building's ability to avoid, withstand and mitigate the effects of floods and/or landslides (refer to Table 70 and Table 71).

Table 70: CASBEE Iskandar Building Q2.2.1.1 Natural Catastrophe Resistance Scoring Level

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No considerations have been taken.
Level 2	(No corresponding level)
Level 3	The building's flood resistance/landslide prevention measures meet the baseline requirement in guidelines published by the Department of Irrigation and Drainage and/or Public Works Department and PLANMalaysia (town planning for flood prevention and landslides). At least 2 total efforts can be evaluated for floor and landslide resistance.
Level 4	The building's flood resistance/landslide prevention measures exceed the baseline requirement in guidelines published by the Department of Irrigation and Drainage and/or Public Works Department and PLANMalaysia (town planning for flood prevention and landslides) by a 25% margin. No part of the building(s) involves Class III or Class IV slopes as defined by the Department of Land and Mines. 3-6 total efforts can be evaluated for floor and landslide resistance.

Level 5	The building's flood resistance/landslide prevention measures exceed the baseline requirement in guidelines published by the Department of Irrigation and Drainage and/or Public Works Department and planMalaysia (town planning for flood prevention and landslides) by a 50% margin. Alternatively, damage-control design has been used. No part of the site involves Class III or Class IV slopes as defined by the Department of Land and Mines. More than 6 total efforts can be evaluated for floor and landslide resistance.

Table 71: CASBEE Iskandar Building Q2.2.1.1 Natural Catastrophe Resistance Efforts to Be Evaluated - Landslides

Landslides
[1] Consideration of natural hazard / disaster in planning and design stage
[2] Hazard avoidance: selecting site away from disaster-prone areas
[3] Construction of landslide occurrence prevention (channels, drainage system, retention structure or deflection wall)
[4] Implementation of greenscapes for landslide occurrence prevention (groundcover plants or soil reinforcement using geo-synthetic materials).
[5] Avoidance of cut and fill works on site

Effort (1) –

Consideration of natural hazard / disaster in planning and design stage

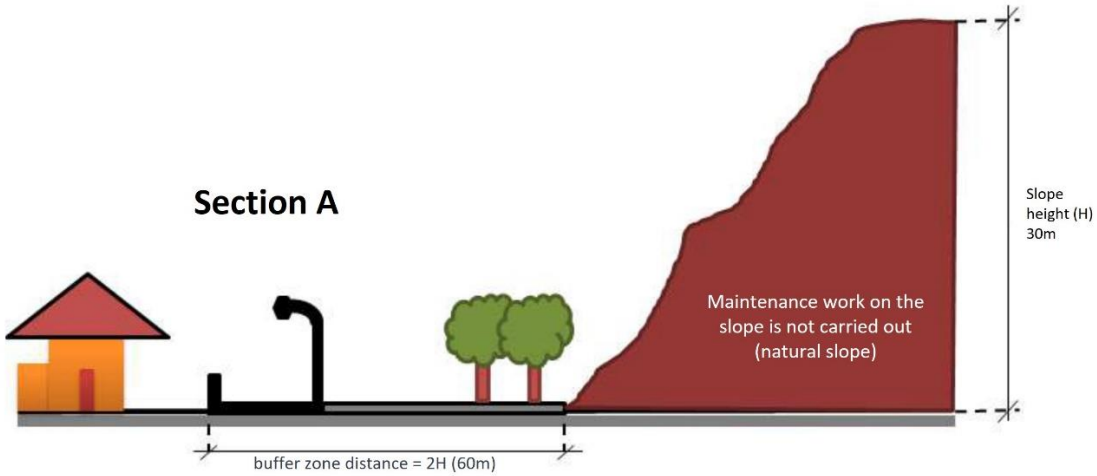
Evaluate based on preliminary design documents that show the structure design is based on natural hazard and disaster consideration – Landslides, such as designing the sub-structure as a foundation that can withstand landslides. The considerations also require a justification based on the soil-test on-site, prepared during the preliminary construction process.

The building(s) on the site shall not be erected on slopes categorised as Class III or Class IV under the Guidelines for the Planning of Hillside and Highland Developments ("Garis Panduan Perancangan Pembangunan di Kawasan Bukit dan Tanah Tinggi").

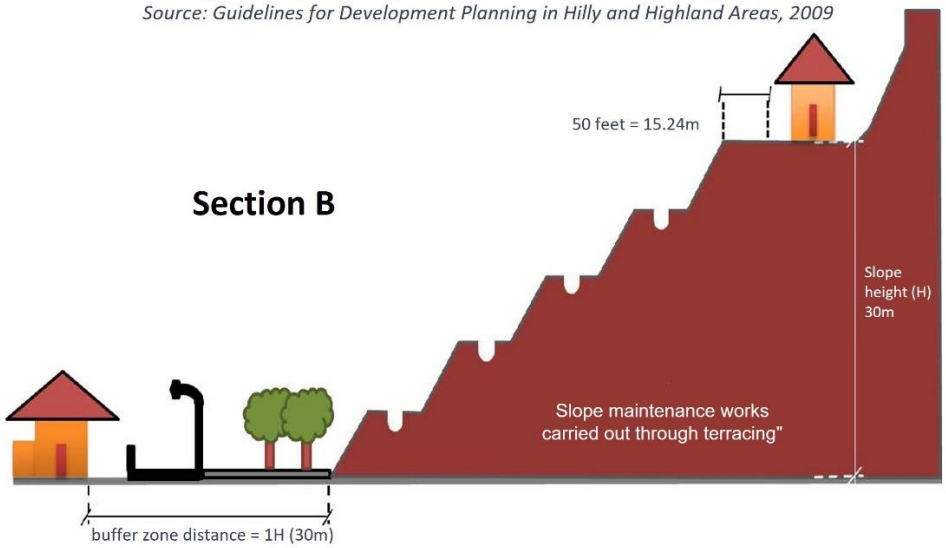
Effort (2) –

Hazard avoidance: selecting site away from disaster-prone areas

Evaluate based on site selection for the development process. The site shall not be situated on hilly areas or at foothills. Evaluate the slope profile of the natural or man-made slope to determine the minimum buffer zone between the sloped area and the site.



Minimum Buffer Zone for Cut Slopes or Natural Slopes Without Slope Stabilization
Source: Guidelines for Development Planning in Hilly and Highland Areas, 2009



Minimum Buffer Zone for Cut Slopes or Natural Slopes With Slope Stabilization
Source: Guidelines for Development Planning in Hilly and Highland Areas, 2009

Effort (3) –

Construction of landslide occurrence prevention (channels, drainage system, retaining wall or deflection wall)

Evaluate based on construction of structures, slope stabilisation techniques, or drainage systems that prevents landslides or mudslides on site. If retaining walls are used, they shall take into consideration factors such as location, geology, geomorphology, existing slope profiles, history of slope failures, and ease of access to the site. Generally, these shall comply with the Guidelines for Slope Management in Local Authority Jurisdictions ("Garis Panduan Pengurusan Cerun di Kawasan Pihak Berkuasa Tempatan").

Effort (4) –

Implementation of greenscapes for landslide occurrence prevention (groundcover plants or soil reinforcement using geo-synthetic materials)

Evaluate based on implementation or design of landscape or greenscape that reduces water flows from rain or any other discharge that corrodes the character of the soil.

Effort (5) –

Avoidance of cut and fill works on site

The evaluation is based on proven documents of the site condition before construction process or during design process that shows the site is not or does not require cut and fill process. Evaluation also can be done during the design process, to show that the building design does not require a cut and fill process.

Table 72: CASBEE Iskandar Building Q2.2.1.1 Natural Catastrophe Resistance Efforts to Be Evaluated - Flood

Flood
[1] Site is located close to at least one temporary or permanent flood relief centre
[2] Hazard avoidance: selecting site away from disaster-prone areas
[3] Building is designed elevated above expected level according to local meteorology
[4] Dry flood-proofing, or making the building water-tight to prevent water entry
[5] Wet flood-proofing, or making uninhabited or non-critical parts of the building resistant to water damage

Effort (1) –

Site is located close to at least one temporary or permanent flood relief centre

Evaluate based on site selection for the development process.

Effort (2) –

Hazard avoidance: selecting site away from disaster-prone areas

Evaluate based on site selection for the development process. To qualify for this effort, the existing level of the site should be higher than the minimum S.O.D. recommended by the Department of Irrigation and Drainage (JPS) for the area.

Effort (3) –

Building is designed elevated above expected level according to local meteorology

Evaluate based local meteorological results that shows level of flood in the area of site. The design of the Finish Ground Level (FGL), Finish Floor Level (FFL), and Finish Road Level (FRL) shall be elevated above the height of the flood level.

Effort (4) –

Dry flood-proofing, or making the building water-tight to prevent water entry

Evaluate based on construction method or materials that enhance the building's water tightness, to prevent water entry. Consideration is given as a priority to dry flood-proofing construction methods.

Effort (5) –

Wet flood-proofing, or making uninhabited or non-critical parts of the building resistant to water damage

The evaluation is based on design documents that show the usage of wet flood-proofing construction methods. Emphasise on water damage-resistant materials or methods at uninhabited or critical parts of the building.

Q2.2.1.2 Seismic Isolation & Vibration Damping Systems

Evaluate earthquake safety based on the building's seismic capacity.

Table 73: CASBEE Iskandar Building Q2.2.1.2 Seismic Isolation & Vibration Damping Systems Scoring Level

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No seismic isolation or vibration damping system is used.
Level 4	(No corresponding level)
Level 5	A seismic isolation or vibration damping system is used.

Where applicable, the building shall be designed in compliance with MS EN 1998 – Design of Structures for Earthquake Resistance.

Award Level 3 if no seismic isolation or vibration damping system is used in the building. Alternatively, award Level 5 if some form of seismic isolation or vibration damping system is used.

Q2.2.2 Service Life of Components

Evaluate the service life of building components by category (i.e. structural materials, exterior wall finishing materials, main interior finishing materials, ventilation ducts, water pipes for air conditioning system and plumbing systems, and main service equipment). In this assessment, service life does not refer to the social lifespan of construction materials.

For example, the social lifespan of building materials used in a project which operates for a short time ends at the time when the project is terminated and the building is no longer used. Service life refers to the expected period of life which ends when the material or equipment breaks down

or loses its required physical functions. In achieving the target performance set in the building plan, it is also important to ensure accurate construction.

For this assessment, it is assumed the building and the systems were constructed with sufficient accuracy. However, lower grades are given if the intended performance is not realized when the building is in operation.

Q2.2.2.1 Service Life of Structural Materials

Evaluate the whole building in terms of the expected service life of its structural materials, not of the structure itself. Fibre reinforcement is not included in this category as it is intended mainly to prevent building collapse in the event of fire.

Table 74: CASBEE Iskandar Building Q2.2.2.1 Service Life of Structural Materials

Entire Building	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Level equivalent in the assessment standards for wood, steel frame and concrete structures to follow CIDB's list of certified building materials and products under the Fourth Schedule of Act 520 Lembaga Pembangunan Industri Pembinaan Malaysia (CIDB) - Grade 1
Level 4	Level equivalent in the assessment standards for wood, steel frame and concrete structures to follow CIDB's list of certified building materials and products under the Fourth Schedule of Act 520 Lembaga Pembangunan Industri Pembinaan Malaysia (CIDB) - Grade 2
Level 5	Level equivalent in the assessment standards for wood, steel frame and concrete structures to follow CIDB's list of certified building materials and products under the Fourth Schedule of Act 520 Lembaga Pembangunan Industri Pembinaan Malaysia (CIDB) - Grade 3

Q2.2.2.2 Necessary Refurbishment Interval for Exterior Finishes

Evaluate the whole building in terms of the expected interval after which the exterior finishes of the building has to be refurbished (refer to Table 75).

Table 75: CASBEE Iskandar Building Q2.2.2.2 Necessary Refurbishment Interval for Exterior Finishes Scoring Levels

Entire Building	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Less than 10 years
Level 2	10 years or more, less than 20 years
Level 3	20 years
Level 4	21 years or more, less than 30 years
Level 5	30 years or more

In this assessment, repair intervals of exterior wall finishes refers to the intervals at which the walls no longer function properly and repair work requiring scaffolding is carried out. This may include repainting works, cladding replacement works, or crack repair.

Ideally, service life of components should be determined by a thorough investigation by the assessor with regard to material lifespan categorically based on the building life cycle plan and should be verified by the manufacturers.

Q2.2.2.3 Necessary Renewal Interval for Main Interior Finishes

Evaluate the whole building in terms of the expected interval after which the main interior finishes of the building have to be refurbished (refer to Table 76).

In assessing Hospital, Hotel and Apartment, evaluate based on the large occupied rooms in the building (i.e.: in-patient rooms, or examining rooms if larger, guest rooms, dwelling units).

Table 76: CASBEE Iskandar Building Q2.2.2.3 Necessary Renewal Interval for Main Interior Finishes Scoring Levels

Entire Building and Common Properties		
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct	Apt
Level 1	Less than 5 years	Less than 10 years
Level 2	5 years or more, less than 10 years	10 years or more, less than 15 years
Level 3	10 years	15 years
Level 4	11 years or more, less than 20 years	16 years or more, less than 25 years
Level 5	20 years or more	25 years or more

In this assessment, renewal intervals of interior finishes refer to the intervals at which reinstallation of finishing materials or replacement of surface components occur. Ideally, service life of components should be determined by a thorough investigation by the assessor with regard to material lifespan, categorically based on the building life cycle plan and should be verified by the manufacturers.

When multiple components are used, evaluate based on the shortest renewal interval.

Q2.2.2.4 Necessary Replacement Interval for Air-Conditioning and Ventilation Ducts

Evaluate the longevity of air-conditioning and ventilation ducts in the building (refer to Table 77 77). Exclude from assessment if no air-conditioning or ventilation ducts are used.

Table 77: CASBEE Iskandar Building Q2.2.2.4 Necessary Replacement Interval for Air-Conditioning and Ventilation Ducts Scoring Levels

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Zinc-plated steel sheet used almost throughout.
Level 4	Exposed exterior ducts, kitchen venting ducts, high-humidity venting ducts and similar applications that would have shorter service lives than other applications when made from zinc-plated steel sheet are made from stainless steel or Galvalume to extend service life. Alternatively, appropriate provision has been made for drainage of internal condensation.
Level 5	At least 90% of exposed exterior ducts, kitchen venting ducts, high-humidity venting ducts and similar applications that would have shorter service lives than other applications when made from zinc-plated steel sheet are made from stainless steel or Galvalume to extend service life.

The assessment method is based on the counter-measures used in duct specifications to lengthen the lifespan of ducts likely to have reduced service lives if they were built with standard specification (zinc-plated steel, etc).

Q2.2.2.5 Necessary Renewal Interval for ACMV and Water Supply and Drainage Pipes

Evaluate the longevity of ACMV and water pipes for water supply and drainage (refer to Table 78). In buildings with only water supply and drainage (no air-conditioning pipes), evaluate only the water supply and drainage pipes. Drainage pipes include rainwater downpipes.

Table 78: CASBEE Iskandar Building Q2.2.2.5 Necessary Renewal Interval for ACMV and Water Supply and Drainage Pipes Scoring Levels

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	D or better is used in almost all of the three main pipe systems (or two main pipe systems, if there are no air-conditioning pipes).
Level 4	C or better is used in at least two of the three main pipe systems (or at least one of the two main pipe systems, if there are no air-conditioning pipes).
Level 5	B or better is used in at least two of the three main pipe systems (or at least one of the two main pipe systems, if there are no air-conditioning pipes), and E is not used.

The method is to evaluate the materials and jointing methods used in the top three main pipe systems, and the degree of lifespan extension achieved.

The three main pipe systems to be evaluated are ACMV pipes, water pipes for water supply, and pipes for drainage (this includes rainwater downpipes). In buildings with only water supply and drainage pipes, apply the above criteria on a two-main-pipe-system basis.

Table 79: Assessment Criteria for Air Conditioning and Plumbing Pipes

Pipe system type		Type										Reference: joining method											
		Sanitation						A/C			Steam		Other	Screwed	Welded			Soldered		Mechanically-jointed			Other	
Pipe materials	Code	Water supply	Hot water supply	Sewage drain	Misc. drainage	Air venting	Cooling water	Hot and cold water	Hot water	Air supply	Water circulation	Fire extinguishing	Oil supply	Plated joints	Pipe-end core	Wrapping flange	Material welding	Electrical welding	TIG welding	Hard solder	Soft solder	Rubber water stop	Pull out resistant	No-hub joint	Adhesive	Lead caulking
Cast-iron pipe for water system	CIP	A		A	A																	B		B		A
Carbon-steel pipe for plumbing (white)	SGP	D		C	C	B	E	D	D			C		E				C				C	C	C		
Carbon-steel pipe for plumbing (white)	SGP							E	E	D	E	D	C					C				C	C			
PVC-lined steel pipe	VLP	B	C				C								E	A						C	C			
Polyethylene powder-lined steel pipe	PLP	B	C				C								E	A						C	C			
Stainless steel pipe for general plumbing	SUS	C	C				B	C	C		C							C	B			C	C			
Copper pipe	CUP	C	D	C	C			C	C			A				A				B	C	C	C			
Lead pipe for drainage	LP			C	C	B										A					A					
Rigid PVC pipe	VP	B		A	A		B										B							C	C	
Heat-resistant PVC pipe	HT		B	B	B	A		B	B								B								C	
Polyethylene pipe for water pipe	PEP	B															B						C		C	
Unplasticised polyvinyl chloride pipe	uPVC	B		B	B	B	B																		E	
High-density polyethylene pipe	HDPE	A		A	A												A	A								

*1 Expected service life: A: 60 years or more, B: 40 - 59 years, C: 30 - 39 years, D: 20 - 29 years, and E: 15 - 19 years
*2 Assumed setting: use in a general office building
*3 Based on interior conditions only; anticorrosion performance of pipe exterior not considered
*4 Based on pipe performance only; specific water treatment not considered
*5 Copper tubes used for refrigerant pipes shall be set as C.

Q2.2.2.6 Necessary Renewal Interval for Major Equipment and Services

Evaluate the repair and replacement intervals of main service equipment (refer to Table 80).

Table 80: CASBEE Iskandar Building Q2.2.2.6 Necessary Renewal Interval for Major Equipment and Services

Entire Building	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Less than 7 years
Level 2	7 years or more, less than 15 years

Level 3	15 years
Level 4	16 years or more, less than 30 years
Level 5	30 years or more

Main service equipment refers to the following devices:

For building types other than Apartment, this refers to major equipment and services necessary for the building to function, specifically power receiver and transformer equipment, generators, boilers, chillers, air-conditioners, water tanks, pumps and other equipment.

For Apartment, it refers to the devices necessary for people to live in the building, such as water heaters, room air-conditioning, water tank and pumps. Room air-conditioning within dwelling units may be excluded from the assessment if it is installed by the occupants.

Base data for renewal intervals for main service equipment are not yet complete. As such, a legal service life of 15 years is considered as Level 3 in this category, 16 to 30 years as Level 4, and 30 years or more as Level 5.

Evaluate using the following approach:

1. Identify the renewal interval of the devices most extensively used for each main service equipment based on the number of units and equipment capacity.
2. Of such devices, determine the level based on the device with the shortest renewal interval.

In cases where renewal work can be reasonably expected to take place when the device with the shortest service life reaches its renewal time, apply its service life value as a representative value. If the renewal of the device with the shortest service life can be postponed until other work becomes necessary, e.g.: through repair, maintenance, or replacement of components, use its service life value as the work time and apply it as a representative value.

Q2.2.3 Appropriate Renewal

Inapplicable under CASBEE for Building (New Construction).

Q2.2.4 Reliability

Reliability expresses the ability of the building to maintain its functions in the event of an emergency situation, such as a natural catastrophe or any huge accident. The following items (1)-(5) are evaluated here for the extent to which their functions can be maintained in the event of an emergency situation or other natural disaster.

1. ACMV system
2. Water supply and drainage
3. Electrical equipment
4. Artificial lighting
5. Communications and IT equipment

Q2.2.4.1 ACMV System

Only the Entire Building and Common Properties section is evaluated for this item. For Office, School, Retail, Restaurant, Hall, Hospital, Hotel, Factory, and Apartment, different qualifiers apply depending on the size of the building (more or less than 2,000m^2) (refer to Table 81).

Table 81: CASBEE Iskandar Building Q2.2.4.1 ACMV System Scoring Level

Entire Building and Common Properties			
Score	Off, Hal, Hsp, Htl, Fct	Sch, Rtl, Rst, Apt	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt [<2,000m^2]
Level 1	No efforts to be evaluated.	No efforts to be evaluated.	No efforts to be evaluated.
Level 2	(No corresponding level)	(No corresponding level)	(No corresponding level)

Level 3	Applicable to one of the efforts to be evaluated. Alternatively, there is no centralised ACMV system.	Applicable to one of the efforts to be evaluated. Alternatively, there is no centralised ACMV system.	No applicable measure is established.
Level 4	Applicable to two of the efforts to be evaluated.	(No corresponding level)	One applicable measure is established.
Level 5	Applicable to three or more of the efforts to be evaluated.	Applicable to two or more of the efforts to be evaluated.	Two or more applicable measures are established.

Table 82: CASBEE Iskandar Building Q2.2.3.1 ACMV System Efforts to Be Evaluated

Off, Hal, Hsp, Htl, Fct	Sch, Rtl, Rst, Apt	Off, Sch, Rtl, Rst, Hal, Hsp ,Htl, Fct, Apt [<2000m^2]
1) Circuits are divided according to the importance of their ventilation equipment, and more important circuits are given priority in operation after a disaster. Also, ways of running the ventilation with reduced load capacity have been examined.		
2) Dispersion and duplication of heat source types (electricity, gas, etc.), with back-ups.		
3) Counter-measures (such as suspended pipes) have been taken to ensure that overall function can continue even when the building is partially damaged in the event of a disaster.		
4) Circuits are divided according to the importance of their air-conditioning equipment, and more important circuits are given priority in operation after a disaster. Also, ways of running the air-conditioning with reduced load capacity have been examined.		

In this category, the reliability of air conditioning and ventilation systems is evaluated based on the number of reliability improvement measures that have been established. Assessment is intended for operation management systems for air conditioning and ventilation equipment that covers multiple occupied rooms.

Buildings with no such centrally-controlled operation system are awarded Level 3. Most buildings with a gross floor area of less than 2,000 m^2 are equipped with multi-split air conditioning systems. In these cases, redundancy measures for air-conditioning systems and key electrical systems for

areas such as a small-sized computer section earn additional points. Measures not listed but which are equivalent to items in the criteria can be included in the assessment.

Q2.2.4.2 Water Supply & Drainage

Evaluate the reliability of water and sanitation systems based on the number of reliability improvement measures that have been established (refer to Table 83).

Table 83: CASBEE Iskandar Building Q2.2.4.2 Water Supply & Drainage Scoring System– Common Properties

Entire Building and Common Properties		
Score	Off, Sch, Hal, Hsp, Htl, Fct, Apt	Rtl, Rst
Level 1	No efforts to be evaluated.	No efforts to be evaluated.
Level 2	Applicable to one of the efforts to be evaluated.	Applicable to one of the efforts to be evaluated.
Level 3	Applicable to two of the efforts to be evaluated.	Applicable to two of the efforts to be evaluated.
Level 4	Applicable to three of the efforts to be evaluated.	(No corresponding level)
Level 5	Applicable to four or more of the efforts to be evaluated.	Applicable to three or more of the efforts to be evaluated.

Table 84: CASBEE Iskandar Building Q2.2.3.2 Water Supply & Drainage Scoring System– Efforts to Be Evaluated

[1] Water-saving equipment is used. Said equipment has a WEPLS label. Water consumption based on the three (3) star rating system. (Basin, Sink, ablution Taps: <6 l/min, Water closet: approx. Full Flush fv* ≤ 5.0 @ Reduced Flush fv* ≤ 3.5, urinals: approx. 1.0 < fv* ≤ 1.5). *fv = flush volume
[2] Plumbing systems are separated as far as possible to reduce the portions that become unserviceable in the event of a disaster.
[3] The building has a pit for temporary waste water storage, in case the sewerage main is unavailable after a disaster.
[4] The building has two separate tanks, one for water reception and one elevated tank.
[5] Planning enables the use of well water, gray water, etc.
[6] The building is equipped with a simple filtration system allowing conversion of rain water to potable water in the event of a disaster (Not applied to Retail and Restaurant).
[7] A faucet is provided in the water tank so that the water may be used for drinking in case of a power outage due to a disaster.

Unlike assessment under "LR2.1.1 Water Conservation," the use of water-saving devices described in Effort No. 1 of this section is assessed with respect to effective use of potable water in the event of a disaster.

Also, a partitioned water receiving tank described in Effort No. 2 is not counted as two units. Measures not listed but which are equivalent to items in the criteria can be included in the assessment.

Q2.2.4.3 Electrical Equipment

Evaluate the reliability of electrical systems based on the number of reliability improvement measures that have been established.

Only the Entire Building and Common Properties section is evaluated for this item. For Office, School, Retail, Restaurant, Hall, Hospital, Hotel, Factory, and Apartment, different qualifiers apply depending on the size of the building (more or less than 2,000m^2)(refer to Table 85 and Table 86).

Table 85: CASBEE Iskandar Building Q2.2.4.3 Electrical Equipment Scoring Level

Entire Building and Common Properties		
Score	Off, Sch, Rtl, Rst, Hal ,Hsp, Htl, Fct, Apt	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt [<2000m^2]
Level 1	No efforts to be evaluated.	(No corresponding level)
Level 2	(No corresponding level)	(No corresponding level)
Level 3	Applicable to one or more of the efforts to be evaluated.	No efforts to be evaluated.
Level 4	Applicable to three of the efforts to be evaluated.	Applicable to one of the efforts to be evaluated.
Level 5	Applicable to four or more of the efforts to be evaluated.	Applicable to two or more of the efforts to be evaluated.

Table 86: CASBEE Iskandar Building Q2.2.3.3 Electrical Equipment – Efforts to Be Evaluated

Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt [<2000m^2]
[1] Emergency generator is installed.	
[2] Uninterruptible power supply system is installed	
[3] Redundant power receiving system for key service equipment is installed.	
[4] Measures described in Item A and B below have been established in order to avoid power outages or damage to data networks caused by flooding in power supply equipment or precision machinery (in apartments, circuit breakers, distribution boards, etc.), or Item C applies. A. Power supply equipment and precision machinery are not installed below ground level. B. Water blocking devices (e.g.: waterproof doors and panels, raised mounds, dry ditches) and drainage systems (e.g.: pumps) are installed to prevent flooding below ground level. C. No danger of flooding. (Not applicable to buildings with a total floor space of less than 2,000 m^2)	
[5] Wiring is installed for lighting and other equipment available when connected to a power-supply car.	
[6] Power supply is secured from two different substations.	

As with assessment under "Q2.2.4.1 Air Conditioning and Ventilation System," most large-sized buildings are equipped with emergency generators and an uninterruptible power supply system for areas such as a small computer section. In these cases, such measures earn additional points. Measures not listed but which are equivalent to items in the criteria can be included in the assessment.

Q2.2.4.4 Artificial Lighting

Evaluate the reliability of artificial lighting to provide illuminance during and after a disaster (refer to Table 87).

Table 87: CASBEE Iskandar Building Q2.2.4.4 Support Method of Machine & Ducts

Building type	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Not adequate for Level 3.
Level 2	(No corresponding level)
Level 3	Generator set (genset) serving essential supply to artificial lights is located higher than ground level, OR battery-powered emergency lights are provided if a genset is not required for the project.
Level 4	(No corresponding level)
Level 5	Level 3 is achieved, and a stand-by lighting system is provided to allow early reoccupation of the premises, should it be practicable.

If a genset is required for the project, award Level 3 if the genset is located higher than the ground level. It may be considered to be higher than the ground level if the Floor Finish Level (FFL) of the genset room is at least 300mm higher than the Finish Road Level (FRL) or FFL outside the room. This reduces the risk of a compromised genset in the event of a flood. Alternatively, if a genset is not required, the building can be eligible for Level 3 if it is designed with sufficient battery-powered emergency lights for safe evacuation.

The building may qualify for Level 5 if it achieves the Level 3 criteria and additionally provides a stand-by lighting system to allow early reoccupation of the premises, should it be practicable. Stand-by lighting may be a separate system, or it may be considered as having been provided by extending the design duration of the emergency lighting supply system beyond the minimum requirement for safe evacuation of the premises, in accordance with the requirements in the latest version of MS1038 – Specification for Emergency Lighting of Premises. Ideally, stand-by lighting for desirable (but not essential) illuminance are also provisioned for.

Q2.2.4.5 Communications & IT Equipment

Evaluate the reliability of communications cables installed in the building.

Table 88: CASBEE Iskandar Building Q2.2.4.5 Communications & IT Equipment Scoring System

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No efforts to be evaluated.
Level 2	Applicable to one of the efforts to be evaluated.
Level 3	Applicable to two of the efforts to be evaluated.
Level 4	Applicable to three of the efforts to be evaluated.
Level 5	Applicable to four of the efforts to be evaluated.

Table 89: CASBEE Iskandar Building Q2.2.4.5 Communications & IT Equipment Scoring System – Efforts to be Evaluated

Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
[1] Communications methods are diversified, using fibre optic cable, metal cable, cellular telephone network, and others.
[2] Connections are made from two telephone exchanges to secure two communications links.
[3] Counter-measures Items A and B below have been taken, or Item C applies, in order to avoid damage to data networks due to water percolation into precision machinery. A. Installation of precision machinery below ground is avoided. B. Devices to prevent the groundwater percolation (waterproof doors, waterproof panels, embankments, dry ditches) and drainage equipment (pumps, etc.) are installed. C. No danger of water percolation.
[4] Wire telephones, fax and community emergency radio systems are installed in case of a disaster.
[5] Disaster information is available through cable TV or other channels in the event of a disaster.
[6] An uninterruptible power supply system is installed for network devices.

In this category, the reliability of communications cables is evaluated based on the number of reliability improvement measures that have been established. Measures not listed but which are equivalent to items in the criteria can be included in the assessment.

Q2.3 Flexibility & Adaptability

Evaluate readiness for long-term use, including future renewals and changes of usage, in terms of the substitute functions allowance for land and allowance for space. Spatial Margin focuses on two aspects, allowance for story height and adaptability of floor layout evaluates consideration given to such renewal of building facilities in construction planning and equipment planning.

Q2.3.1 Spatial Margin

Evaluate the floor-to-floor height and flexibility in floor layout with respects to adaptability to potential change in building use. For Hospital, Hotel and Apartment, main occupied rooms on a standard floor are often located in residential or accommodation areas of the building. As such, evaluate those rooms under the residential and accommodation sections in this category. In the case of Hospital, the category includes in-patient rooms. Other rooms such as examination rooms are evaluated under the Common Properties section.

Q2.3.1.1 Allowance for Floor-to-floor Height

Evaluate whether the floor-to-floor height is sufficient to facilitate potential change in building use, system changes and/or system reinforcement, or for occupant comfort.

For Offices, Schools, Retail, Restaurants, Hospital, and Factory, different qualifiers apply depending on the size of the building (more or less than 2,000m^2) (refer to Table 90).

Table 90: CASBEE Iskandar Building Q2.3.1.1 Allowance for Floor-to-floor Height Scoring System – Common Properties

Entire Building and Common Properties		
Score	Off, Sch, Rtl, Rst, Hsp, Fct	Off, Sch, Rtl, Rst, Hsp, Fct [<2000m^2]
Level 1	Less than 3.3 m	Less than 3.1 m
Level 2	Between 3.3 m and 3.5 m	Between 3.1 m and 3.3 m

Level 3	Between 3.51 m and 3.7 m	Between 3.31 m and 3.5 m
Level 4	Between 3.71 m and 3.9 m	Between 3.51 m and 3.7 m
Level 5	More than 3.9 m	More than 3.7 m

Table 91: CASBEE Iskandar Building Q2.3.1.1 Allowance for Floor-to-floor Height Scoring System – Residential

Residential and Accommodation Sections		
Score	Hsp, Htl	Apt
Level 1	Less than 3.3 m	Less than 2.7 m
Level 2	Between 3.3 m and 3.5 m	Between 2.7 m and 2.8 m
Level 3	Between 3.51 m and 3.7 m	Between 2.81 m and 2.9 m
Level 4	Between 3.71 m and 3.9 m	Between 2.91 m and 3.0 m
Level 5	More than 3.9 m	More than 3.0 m

In assessing Office, Hospital, Hotel and Apartment, evaluate floor-to-floor height of a standard floor. For other building types, evaluate the average value of the entire building.

Q2.3.1.2 Flexibility in Floor Layout

Evaluate the flexibility in the floor layout based on the wall length/area ratio (refer to Table 92 and Table 93).

Table 92: CASBEE Iskandar Building Q2.3.1.2 Flexibility in Floor Layout Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Fct
Level 1	0.7 ≦ [Wall length/area ratio]
Level 2	0.5 ≦ [Wall length/area ratio] < 0.7
Level 3	0.3 ≦ [Wall length/area ratio] < 0.5
Level 4	0.1 ≦ [Wall length/area ratio] < 0.3
Level 5	[Wall length/area ratio] < 0.1

Table 93: CASBEE Iskandar Building Q2.3.1.2 Flexibility in Floor Layout Scoring System – Residential

Residential and Accommodation Sections	
Score	Hsp, Htl, Apt
Level 1	0.7 ≦ [Wall length/area ratio]
Level 2	0.5 ≦ [Wall length/area ratio] < 0.7
Level 3	0.3 ≦ [Wall length/area ratio] < 0.5
Level 4	0.1 ≦ [Wall length/area ratio] < 0.3
Level 5	[Wall length/area ratio] < 0.1

The wall length/area ratio indicates a fixed degree of a particular area. Lower values indicate a higher flexibility in the floor layout. The scores are based on the following rationales:

Level 1 : Scope for planning equipment and spaces is extremely limited by the building structure.

Level 2 : Scope for planning equipment and spaces is limited by the building structure.

Level 3 : There is freedom for planning equipment and spaces.

Level 4 : There is ample freedom for planning equipment and spaces.

Level 5 : There is a high level of freedom for planning equipment and spaces.

Wall length/area ratio is calculated by the following equation:

$$\text{Wall length/area ratio} = \frac{\text{Length of perimeter walls (m)} + \text{length of load bearing walls (m)}}{\text{Exclusive area (m}^2\text{)}}$$

If the calculation subject is a non-residential building type, calculate for one standard floor. For residential building types, take the main occupied rooms.

For Non-Residential Building Types:

1. Equipment spaces, including services shafts such as TEL, ELV, DCW, and ELEC risers, shall be considered to be "areas for which the room configuration cannot be altered to accommodate future usage", and these shall be excluded from the Exclusive Area computations.
2. The walls of equipment spaces, including services shafts such as TEL, ELV, DCW, and ELEC risers, could become constraints on the "areas for which the room configuration can be altered to accommodate future usage" under the Exclusive Area computations, so enter the length of such walls adjoining exclusive areas into the calculation as "Length of Load-Bearing Walls".
3. The walls around courtyards or air-wells surrounded by the building shall be entered into the calculation as "Length of Perimeter Walls".

Example 1: For the centre core

- Deduct the centre core portion from the Exclusive Area.
- If the centre core is surrounded by load-bearing walls, count them as load-bearing walls.
- Count other load-bearing walls, if there are any.
- The length of peripheral walls is the shaded area on the diagram on the left.

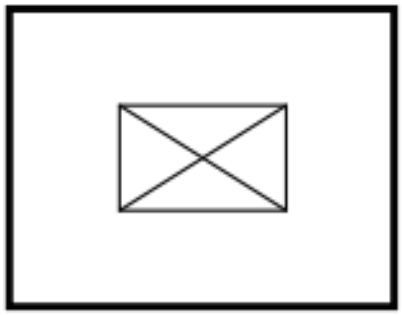


Figure 34: Load-bearing wall at the centre.

* The core is the portion containing staircases, elevators and other elements.

Example 2: For a side core

- Deduct the side core portion from the exclusive area.
- If there are load-bearing walls, count those in area A as load-bearing walls.
- Count other load-bearing walls, if there are any.
- The length of peripheral walls is the shaded area on the diagram on the left.

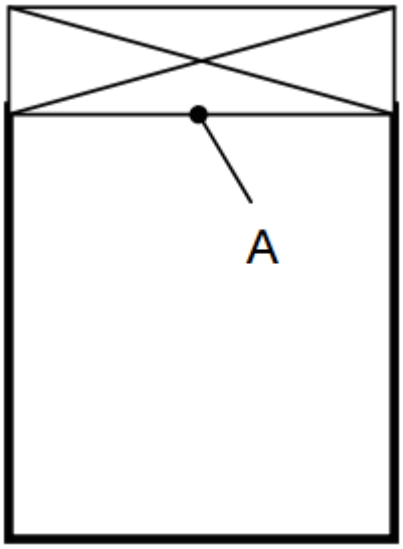


Figure 35: Load-bearing wall on the side.

For Residential Building Types:

1. Columns with attached walls (regardless of whether or not they are load-bearing walls), or free-standing internal columns, should be added to the numerator as three (3) times its longitudinal length (a x 3).
2. For Apartments, include water supply and drainage pipes (Pipe Shafts, "PS") in the Exclusive Areas computation. The calculation method for PS with attached walls or free-standing internal PS is to add three (3) times the longitudinal length of the PS box-ups (b x 3), or three (3) times the diameter of the largest exposed pipe (c x 3) to the numerator.
3. If there are PS along the perimeter walls, count the intersection point of the PS and the wall as the end of the perimeter or load-bearing walls ("d"), as the case may be.
4. For walls with braces installed, add the distance between centres ("e") to the numerator as a perimeter or load-bearing wall. Conversely, do not count party walls that are not load-bearing.
5. Measure the length of external walls to the centre of the wall ("f").
6. If there is an open corridor, take the length of the wall side of the corridor to be the length of the external wall. However, if there is PS facing the corridor, take the length of the PS wall separating the PS from the Exclusive Area, and the lengths of walls of other areas on the corridor side, as shown in the diagram below ("g"). If there is an intermediate corridor, do not add the length on the corridor side to the length of the exterior wall.

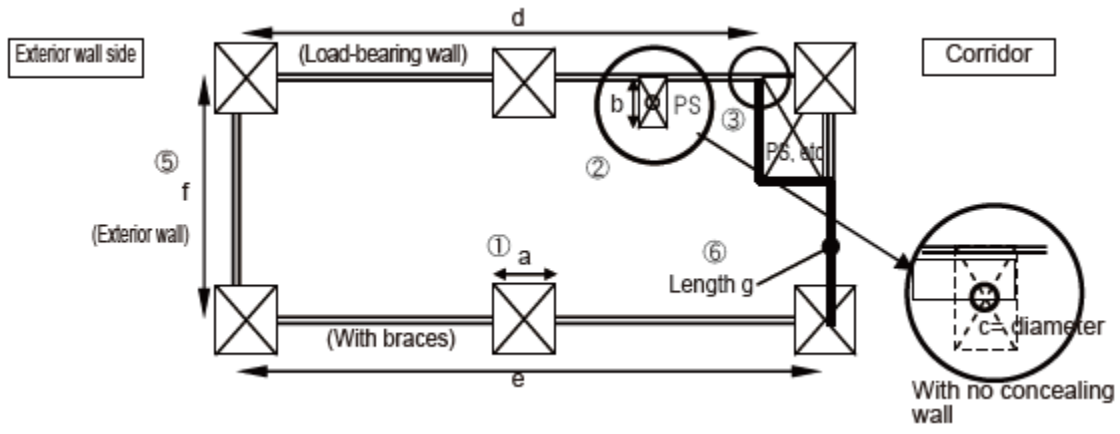


Figure 36: Reference diagram for residential building types (above depicts an example of an Apartment with an open corridor).

Q2.3.2 Floor Load Margin

Evaluate the floor load margin to consider the potential for future changes of the building typology.

For Hotel and Apartment, the main areas that correspond to occupied rooms of standard floors are the Residential and Accommodation sections, so evaluate this item under Residential and Accommodation section.

For Hospital, evaluate for both the main occupied rooms of the standard floor of Residential and Accommodation section (mainly wards) and the main occupied rooms of the standard floor of Common Properties (mainly examination rooms).

Table 94: CASBEE Iskandar Building Q2.3.2 Floor Load Margin Layout Scoring System – Common Properties

Entire Building and Common Properties						
Score	Off	Sch	Rst	Hal(fixed seats),Rtl	Hal(non-fixed seats), Fct	Hsp
Level 1	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)
Level 2	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)	(No corresponding level)
Level 3	At least 2,500 N/m^2	At least 3,000 N/m^2	At least 2,000 N/m^2	At least 4,000 N/m^2	At least 5,000 N/m^2	At least 2,000 N/m^2
Level 4	Between 2,501 N/m^2 and 4,000 N/m^2	Between 3,001 N/m^2 and 4,000 N/m^2	Between 2,001 N/m^2 and 2,500 N/m^2	Between 4,001 N/m^2 and 5,000 N/m^2	Between 5,001 N/m^2 and 5,500 N/m^2	Between 2,001 N/m^2 and 3,000 N/m^2

Level 5	4,001 N/m^2 or more	4,001 N/m^2 or more	2,501 N/m^2 or more	5,001 N/m^2 or more	5,501 N/m^2 or more	3,001 N/m^2 or more

Table 95: CASBEE Iskandar Building Q2.3.2 Floor Load Margin Layout Scoring System – Residential

Residential and Accommodation Sections		
Score	Apt	Htl, Hsp
Level 1	(No corresponding level)	(No corresponding level)
Level 2	(No corresponding level)	(No corresponding level)
Level 3	At least 1,500 N/m^2	At least 2,000 N/m^2
Level 4	Between 1,501 N/m^2 and 2,000 N/m^2	Between 2,001 N/m^2 and 3,000 N/m^2
Level 5	2,001 N/m^2 or more	3,001 N/m^2 or more

Level 3 corresponds to the minimum imposed floor loads set in BS 6399:Part 1 – Code of Practice for Dead and Imposed Loads. However, rather than considering ample allowance for such short-term, current-usage situations, evaluate whether there is potential for conversion to other building types in the future. The ability to potentially convert the building typology shall be awarded Levels 4 or 5.

For example, Apartment may achieve Level 5 if it is designed to cater for the possibility of being converted into a Hotel (minimum imposed live loads of 1,500 N/m^2 and 2,000 N/m^2, respectively).

In this category, evaluation is based solely on the structural calculation values for floors, with the assumption that an equivalent increase of the allowable load is applicable to principal beams, studs, and basic and seismic structural calculations.

Q2.3.3 System Renewability

Evaluate system renewability per category with respect to versatility in potential change in building use. In this category, repair work refers to the replacement of components with the same dimension and specification, while renewal work refers to the replacement of components with different specifications as part of a system upgrade.

Q2.3.3.1 Ease of Air-Conditioning Duct Renewal

Evaluate the renewability of the air-conditioning ducts. Select Level 3 if there is no central air-conditioning equipment in the building. Table 96 shows CASBEE Iskandar Building Q2.3.3.1 Ease of Air Conditioning Duct Renewal Scoring System.

Table 96: CASBEE Iskandar Building Q2.3.3.1 Ease of Air Conditioning Duct Renewal Scoring System

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Air-conditioning ducts cannot be replaced or repaired without damaging structural elements.
Level 2	In some cases, the air-conditioning ducts can be replaced or repaired without damaging structural elements, if spare sleeves are used, but that method cannot be applied to all ducts.
Level 3	Space and routes for future use (future replacement work) have been provided, so that nearly all air-conditioning ducts can be replaced or repaired without damaging structural elements. Alternatively, there is no central air-conditioning equipment.
Level 4	Exterior air-conditioning ducts are used or ceiling space provided so that ducts can be replaced or repaired without damaging either structural elements or surface finishes.

Level 5	ISS* equipment floor installation or other measures allow easy replacement or repair of air-conditioning ducts without damaging surface finishes.

*ISS: Interstitial Space System (System that architecture and facilities are integrated)

Evaluate the specifications for the parts that support the main functions corresponding to the building's function (main parts of the air-conditioning pipes themselves). An absence of considerations for renewal of air-conditioning ducts, or where ducts cannot be replaced or repaired without partial demolition of structural elements such as beams, columns, and load-bearing walls, will result in new repair works and generation of solid waste. Such cases are assigned Level 1, the lowest level.

If replacement or repair work can be carried out without damage to surface finishes, Level 4 or Level 5 is assigned, depending on the ease of the work. Buildings where space and routes for future use (future replacement work) have been provided, so that nearly all air-conditioning ducts can be replaced or repaired without damaging structural elements, are assigned Level 3.

Q2.3.3.2 Ease of Water Supply and Drain Pipe Renewal

Evaluate the renewability of water pipes.

Table 97: CASBEE Iskandar Building Q2.3.3.2 Ease of Water Supply and Drain Pipe Renewal Scoring System– Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Repair and replacement are not possible without damaging structural elements and finishes.
Level 2	Repairs can be made without damaging structural elements, but replacements cannot.
Level 3	Repairs can be made without damaging structural elements and finishes, but replacements cannot.
Level 4	Repairs and replacements can be made without damaging structural elements.

Level 5	Repair and replacement are possible without damaging structural elements or finishes.

Evaluation is based on specifications of sections that provide key functions required for each type of building use (i.e. the main sections of the building's plumbing system). Cases where there is no plan for the renewal of water supply and drainage pipes, and the pipes cannot be repaired or replaced without partial demolition of structural elements such as beams, columns, load-bearing walls, exterior walls and floor slabs result will in new repair works and generation of solid waste. Such cases are assigned Level 1, the lowest level. In this case, repair means work to replace water supply and drainage pipes with new pipes of the same dimensions and specifications, while renewal means upgrades, etc. to replace pipes with others of different specifications.

Award Level 3 if repair is possible without damaging structural elements and finishes, but renewal is not. Award Level 4 or Level 5 if spaces and routes have been provided for future use, facilitating renewal, choosing between the two levels according to the amount of repair and waste generation from elements other than water supply and drainage pipes.

Determine levels according to the details of pipe types and positions as shown in the table next page. All criteria from main riser pipes to exterior wall joints for the same level must be satisfied (if these vary, award the lowest level that applies). In cases where special measures have been established (e.g.: modified pipe specifications), determine levels solely on such measures. Table 96 shows Q2.3.3.2 Ease of Water Supply and Drain Pipe Renewal Scoring System.

Table 98: Q2.3.3.2 Ease of Water Supply and Drain Pipe Renewal Scoring System

Level	Pipe types and positions					Evaluation reference			
	Method 1: Determine the level at which all criteria are satisfied * If results vary, award the lowest level that applies * Ignore these criteria if evaluated in Method 2.				Method 2: Determine the level based on this item alone * Applies only when used in more than half of the corresponding area.	Degree of potential damage to building materials during repair		Degree of potential damage to building materials during renewal	
	Main riser pipe	Other pipes	Lateral pipe	Exterior wall joint	Pipe specifications, etc.	Structural material	Finishes	Structural material	Finishes
1	Through-slab (excl. piping in pipe shaft)	Embedded in walls (RC, etc.)	Embedded in structure (slab)	Sleeved	(N/A)	High*2	High	High	High
2	In pipe shaft	Embedded in walls (LGS, etc.)	Embedded in cinder concrete	Sleeved	(N/A)	Low*1	High	High	High
3	In pipe shaft	In pipe shaft	In ceiling voids of the floor spaces below	Sleeved	(N/A)	Low	Low	High	High
4	Spare space	Spare space	In ceiling void of said floor (gyptone boards, rockwool acoustic ceiling panels) or Inside raised floor space	Spare sleeve	(N/A)	Low	Low	Low	High
5	Spare space or Mechanical void	Spare space or Mechanical void	In ceiling voids of said floor or ISS or under floor pipe space	Spare sleeve or Through-panel	Unit-type plumbing or washroom system plumbing	Low	Low	Low	Low

*1 "Other pipes" stands for those that constitute a separate system diverging from the main pipe (in cases where a riser pipe system serving as a sub-riser pipe exists).

*2 The degree of potential damage to structural and finishing materials is indicated in "high" and "low" terms of whether solid waste is generated, or new repair work is required (excluding handling of the pipes necessary for system operation).

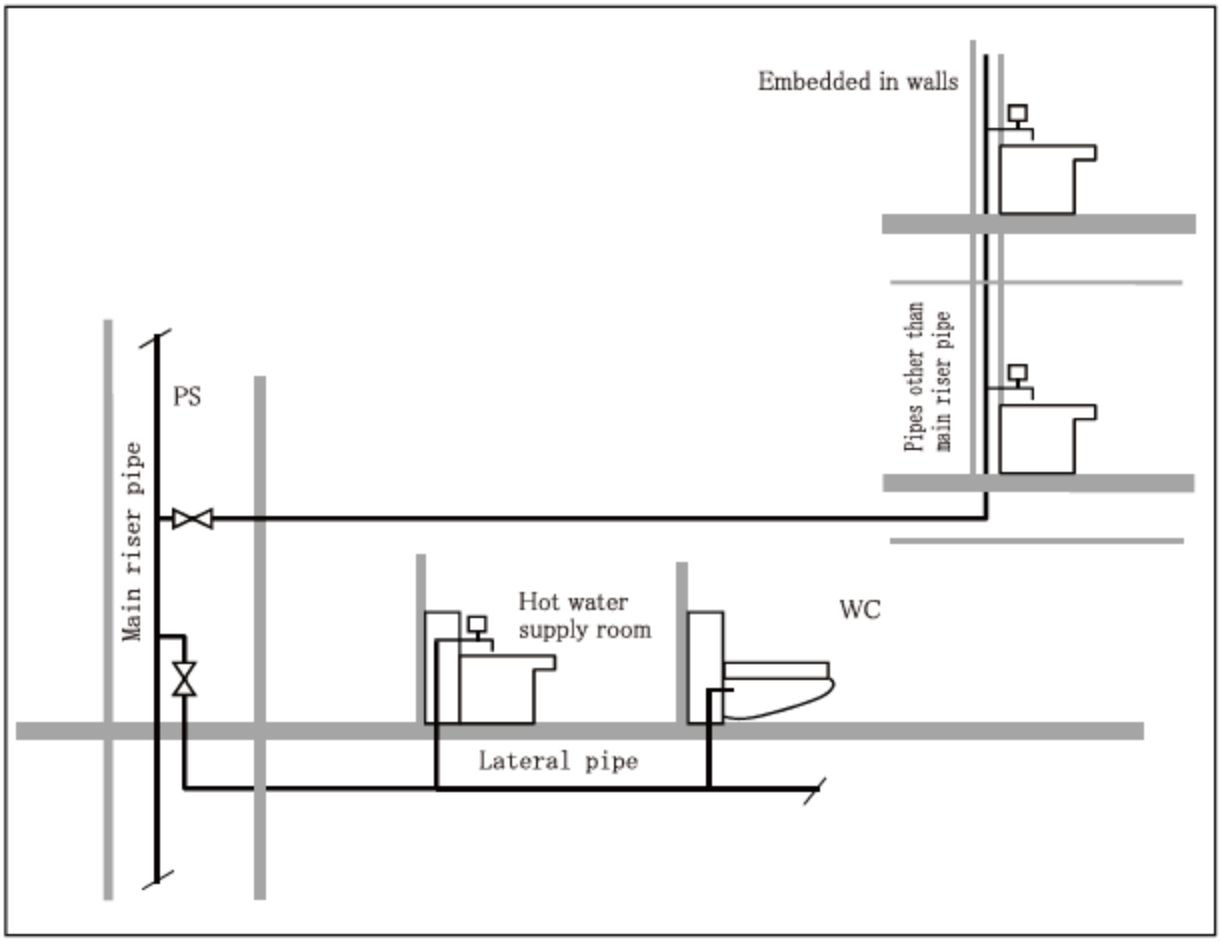


Figure 37: Example of a main riser pipe, lateral pipe, and other pipes.

Q2.3.3.3 Ease of Electrical Wiring Renewal

Evaluate the renewability of the electrical wiring. Table 99 shows CASBEE Iskandar Building Q2.3.3.3 Ease of Electrical Wiring Renewal Scoring System – Common Properties.

Table 99: CASBEE Iskandar Building Q2.3.3.3 Ease of Electrical Wiring Renewal Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Wiring cannot be replaced or repaired without damaging structural elements.
Level 2	(No corresponding level)
Level 3	Wiring can be replaced or repaired without damaging structural elements.
Level 4	(No corresponding level)
Level 5	Wiring can be replaced or repaired without damaging structural elements or surface finishes.

Evaluation is based on specifications of sections which provide key functions required for each type of building use (i.e.: the main sections of the building's wiring system). Award Level 3 when renewal or repair work can be carried out without damage to the structural components.

Q2.3.3.4 Ease of Communications Cable Renewal

Evaluate the renewability of the communications cables. Table 100 shows CASBEE Iskandar Building Q2.3.3.3 Ease of Electrical Wiring Renewal Scoring System – Common Properties.

Table 100: CASBEE Iskandar Building Q2.3.3.4 Ease of Communications Cable Renewal Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Communications cables cannot be replaced or repaired without damaging structural elements.
Level 2	(No corresponding level)
Level 3	Communications cables can be replaced or repaired without damaging structural elements.
Level 4	(No corresponding level)
Level 5	Communications cables can be replaced or repaired without damaging structural elements or surface finishes.

Evaluation is based on specifications of the sections which provide key functions required for each type of building use (i.e.: the main sections of the building's communications cables). As with Section Q2.3.3.3 above, award Level 3 when renewal or repair work can be carried out without damage to the structural components.

Q2.3.3.5 Ease of Equipment Renewal

Evaluate for non-generation of solid wastes and new repair requirements, and the ability to maintain building functions during renewal and repair, using backup equipment. Table 101 shows CASBEE Iskandar Building Q2.3.3.5 Ease of Equipment Renewal Scoring System – Common Properties.

Table 101: CASBEE Iskandar Building Q2.3.3.5 Ease of Equipment Renewal Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No machine hatches or routes to accommodate the replacement of major service equipment are provided, and building functions cannot be maintained through replacement and repair.
Level 2	(No corresponding level)
Level 3	Machine hatches or routes to accommodate replacement of major service equipment are provided, but building functions cannot be maintained through replacement and repair.
Level 4	A temporary space to accommodate replacement of major service equipment is secured, and building functions can be maintained through replacement and repair.
Level 5	Machine hatches or routes to accommodate replacement of major service equipment are provided, and building functions can be maintained through replacement and repair.

In this category, the ability to maintain the building's functionality during renewal or repair work refers to when worker access to system routes or machine hatches does not cause disruption in other service functions and when backup devices for use during the work are installed (including multiple devices with divided service loads which can be used as backups during the work).

Evaluate Level 3 if there are routes and machine hatches that accommodate renewal and repair, but some destruction of simple partition walls, etc. is required.

The term “major service equipment” refers to the following:

1. For buildings other than Apartment, this refers to major equipment and services necessary for the building to function, specifically power receiver and transformer equipment, generators, boilers, chillers, air-conditioners, water tanks, pumps, and other equipment.
2. For Apartment, it refers to the devices necessary for people to live in the building, such as power receiver and transformer equipment, generators, water tanks, pumps, water heaters, and air-conditioners (the latter two are excluded if installed by occupants).

Q2.3.3.6 Provision of Backup Space

Evaluate whether adequate back-up space is provided. Table 102 shows CASBEE Iskandar Building Q2.3.3.6 Provision of Backup Space Scoring System – Common Properties.

Table 102: CASBEE Iskandar Building Q2.3.3.6 Provision of Backup Space Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	There is no planned provision of space for backup equipment.
Level 4	There is planned provision of space for backup equipment.
Level 5	(No corresponding level)

In this category, evaluate whether adequate backup space is provided. Evaluate the specifications for the parts which support the main functions corresponding to the building's function (main building service systems).

If the plan for equipment replacement or repair works secures space to install backup equipment, the building's functions can be maintained while the replacement or repair takes place. Therefore, if plans have been made for securing backup space, the assessment can be awarded Level 4.

Q3 - Outdoor Environment (On-site)

In the assessment under Section Q3, evaluate each criterion's item based on the point scoring system. Use the total points in a five-level assessment. Most items included in Section Q3 are assessed qualitatively.

Q3 evaluates improvement of the environmental quality of the outdoor environment (on-site) and its surroundings, derived from efforts within the building and within the site. It comprises "Preservation & Creation of Biotope," "Townscape & Landscape" and "Local Characteristics & Outdoor Amenity." However, there is no assessment from the perspective of aesthetic and design characteristics. Table 101 CASBEE Iskandar Building Q3 Outdoor Environment (On-site) Item Explanation.

Table 103: CASBEE Iskandar Building Q3 Outdoor Environment (On-site) Item Explanation

Primary Item	Secondary Item
Q3 - Outdoor Environment (On-site)	Q3.1 Preservation & Creation of Biotope
	Evaluate efforts to conserve and create a natural habitat for wildlife. In new constructions, since plants are not fully grown, evaluate potential to sustain wildlife habitation.
	Q3.2 Townscape & Landscape
	Evaluate how well urban context and scenery have been considered. There are now many moves by national and regional governments to place legal regulations on scenery. This assessment should examine the level of consideration that has been given to rules for the urban context and scenery (urban context guidelines, etc.)
	Q3.3 Local Characteristics & Outdoor Amenity

Primary Item	Secondary Item
	Make a wide-ranging assessment of efforts to preserve local characteristics and cultural heritage, community relations and amenity improvement in and around the property. Also evaluate measures to improve the thermal environment of the site as part of initiatives for alleviating the heat island effect.
	Q3.4 Pre-Construction and Pre-Completion Consideration
	Evaluates the efforts to choose a site that can be beneficial both to the surrounding context and the occupants. The site can be considered to be developed and increases infrastructures (Greenfield) or improve the site context from the development (Brownfield).

Q3.1 Preservation & Creation of Biotope

Table 104: CASBEE Iskandar Building Q3.1 Preservation & Creation of Biotope Scoring System – All Building

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No consideration has been given to the conservation and creation of habitat, and efforts are inadequate. (0-3 points)
Level 2	Some consideration has been given to the conservation and creation of habitat, but efforts are still somewhat inadequate.(4-6 points)
Level 3	Consideration has been given to the conservation and creation of habitat, and a standard level of efforts are being carried out.(7-9 points)

Level 4	Consideration has been given to the conservation and creation of habitat and a relatively high level of efforts are being carried out. (10-12 or more points)
Level 5	Thorough consideration has been given to the conservation and creation of habitat and a high level of efforts have been carried out. (13 or more points)

Table 105: CASBEE Iskandar Building Q3.1 Preservation & Creation of Biotope Assessment – Efforts to be Evaluated

Assessment Item	Description
I. Identification of local characteristics and biotope plan policy	1) Local characteristics of the site and surrounding areas regarding habitat are identified and an appropriate biotope plan policy has been established (2 points)
II. Conservation and restoration of biological resources	1) Biological resources on site are protected or restored (e.g.: flora and fauna, topsoil, wetland area composition) (2 points)
III. Use of green space	1) Green areas account for 10% or more but less than 20% of the total outside property area and mid/high trees are planted, OR (1 point)
	- Green areas account for 20% or more but less than 50% of the total outside property area, OR (2 points)
	- Green areas account for 50% or more of the total outside property area. (3 points)
	2) Provide additional open green space amounting to 5% to 20% more than local authority's minimum requirements, OR (1 point)
	- Provide additional open green space amounting to >20% more than local authority's minimum requirements (2 points)
	1) The greenery plan facilitates conservation of native/local species.

IV. Quality of green space	2) The greenery plan is appropriate for site and building characteristics.
	3) The greenery plan facilitates conservation of natural areas inhabited by small animals.
V. Management and use of biological resources	1) Equipment necessary for the maintenance of green areas at the building operation stage have been installed, and management policies have been established.
	2) An environment and facilities have been provided in which building users and local people can encounter living creatures and enjoy nature.
VI. Other	1) Independent efforts other than the above evaluated items have been implemented to protect and create habitat.

Under this item "Q3.1 Preservation & Creation of Biotope," evaluate the content of efforts made for each of six assessment items (I-VI) for whether consideration has been given to conservation and creation of habitat by the building (the site as a whole, including the building and exterior areas), with a view of protecting and restoring the national natural environment and securing biodiversity.

The term "habitat" used here refers to areas inhabited by small wild animals and which support the growth of plants (biotopes).

Effort 1 –

Identification of local characteristics and setting of biotope plan policies

Conservation of the local habitat requires setting conservation goals suitable for the local characteristics of the site, and consideration of conservation policies and related efforts to achieve such goals. From that standpoint, evaluate this item as to whether the habitat-related local area characteristics of the planned site have been identified, and whether the plan policies for conservation and creation of habitat are suitable for the above characteristics.

Award 2 points when an appropriate biotope plan policy has been clearly established based on the local characteristics of the site and surrounding areas. No points are awarded when such characteristics are not identified or reflected in the plan.

Furthermore, as the spatial scope and targets under assessment in this category vary greatly, establish an appropriate assessment area for the building site.

Provide documentation that supports the relation between the local characteristics of the site and the biotope plan policy. Minimum documentation requirements for third-party verification are as follows:

i. Aerial photograph of the site and surrounding area
ii. Topographic or land usage map covering the photographed area
iii. Baseline information on existing biotopes and source information (if independent research is carried out, include details of research methods, etc.)
iv. Plan policy statement that reflects the identified characteristics

Effort 2 –

Conservation and restoration of biological resources

Trees and wetlands on the building site, as well as nutrient-rich topsoil comprised of compost and other organic matter, are local, established ecological elements. As such, handling of these resources should be given priority in the building's biotope conservation plan. From this perspective, this section evaluates the environmental protection measures of such resources on the building site with respect to conservation and restoration.

Conservation refers to measures to maintain biological resources already existing on the site. In addition to measures to preserve the existing conditions, evaluate resource relocation (replanting) within the site.

Restoration refers to measures to recreate biological resources within the site that were lost during construction. Also evaluate measures to restore biological resources within the site which were assumed/confirmed to have existed prior to building construction.

Measures to relocate (or recreate) local biological resources from surrounding areas to the building site are also included in the evaluation. Provide documentation that supports the conservation and restoration status of the site. Minimum documentation requirements for a third-party verification are as follows:

i. Aerial photograph/topographical map indicating past and present land uses of the site and surrounding areas
ii. Descriptions of biological resources targeted in conservation/restoration measures, plan objectives and details
iii. Descriptions of current status and locations, as well as planned locations, of biological resources targeted in conservation measures, with an up-to-date photograph
iv. Descriptions of current status and locations, as well as planned locations, of biological resources targeted in restoration measures, with a photograph

Effort 3 –

Use of green space

1. Exterior (perimeter) green space

Evaluate the efforts to green the site under this item, which considers efforts to provide an amount of greenery, according to the amount of greenery in the exterior of the site and of the building. Assessment in this category includes vegetation targeted in conservation/restoration measures under the previous section and new trees and plants added to the site. Award points based on calculation of the exterior (perimeter) planting index, as follows:

$$\text{Exterior planting index} = \frac{\text{Exterior planting area (Horizontal projected area of medium and tall trees + area planted with low trees and ground cover etc.)}^{*1}}{\text{Exterior area}^{*2}} \times 100\ (\%)$$

*1 In cases where the horizontal projected area of medium/tall tree canopies and the area planted with low trees and ground overlap, apply the area values of both types.
*2 Exterior area = site area – building area (including areas of supplementary facilities)

2. Building green space

Evaluate the amount of green space to ascertain the degree to which the project exceeds the minimum green space requirements set by the relevant local authority. For example, if the local authority requires a minimum green space area of 10%, the project has to provide at least another 5% of that 10% (total 10.5%) in order to score 1 point.

Effort 4 –

Quality of green space

High quality green space contributes to habitat conservation and creation, and improved sustainability. From this standpoint, this category evaluates measures to promote the healthy growth of plants and development of green space that supports local biodiversity. Specifically, assess measures which facilitate biological stability of green space (e.g.: planting native species, selecting appropriate tree types, attracting small animals such as birds to the area, etc.). Such stability creates sustainable biological resources and eases management burdens (e.g.: reduction in agrichemicals).

Award one point each for the following types of measures: planting native species, selecting appropriate tree types, and creating a natural habitat for small animals. Determine levels based on the total points where multiple measures listed above are established.

Effort 5 –

Management and use of habitat

Proper management of green space etc. at the building operation stage is essential for maintenance of healthy habitat, and it is important to give thorough consideration in advance, at the planning and design stages, to habitat management and related measures. From that perspective, this item evaluates the efforts for the maintenance of conserved or created habitat.

Award one point if a facility necessary for the maintenance of green space, such as irrigation facilities, and a plan is in place for maintenance of such facilities (e.g.: appropriate installation of irrigation equipment; provision of suitable planting conditions, such as suitable soil volume; annual process plan for supervision patrols, tree pruning, grass-cutting), and one point if facilities have been provided for enjoying close contact with nature (e.g.: installation of nature observation trials, flowerbeds, trees, plant nameplates, benches, or installation of facilities providing information on nature).

Effort 6 –

Other

Unusual efforts not included in I to V above items should be evaluated as one point. When evaluating "Other" efforts, state in the assessment software what kind of effort has been made, and attach documentation clearly comprehensible to a third party.

Q3.2 Townscape & Landscape

Evaluate Level 3 if the building is almost entirely unseen from public spaces, or if there is no way to give consideration to urban context and scenery. Evaluate Level five if scenery is clearly stated as a reason for winning a local scenery prize, or any similar situation indicating the building has gained a certain level of positive assessment. Table 106 CASBEE Iskandar Building Q3.2 Townscape & Landscape Scoring System.

Table 106: CASBEE Iskandar Building Q3.2 Townscape & Landscape Scoring System

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(0 points)
Level 2	A sufficient level of measures for the surrounding strategic landscape has not been established. (1-2 points)
Level 3	A sufficient level of measures for the surrounding strategic landscape has been established. (3 points)
Level 4	More than a sufficient level of measures for the surrounding strategic landscape has been established. (4 points)
Level 5	Extensive levels of measures for the surrounding strategic landscape have been established. (or the building has won local landscape-related awards; 5 or more points)

Table 107: CASBEE Iskandar Building Q3.2 Townscape & Landscape Scoring System – Efforts to Be Evaluated

Assessment Item	Description
1) Integration with the surrounding landscape through positioning and design of the building	Building features are designed in harmony with the surrounding landscape (i.e. height, wall positions, colour and form of exterior finish, roof, eaves, openings fences, etc.) (2 points)
2) Use of green space to enhance landscape	Aesthetic landscape is created by the building's green space. (1 point)
3) Conservation of historic landscape	Historic landscape is maintained through conservation, restoration or recreation of the exterior of historic buildings and the existing natural environment of the area. (1 point)

4) Use of local materials to enhance landscape	Locally significant materials are used in the building exterior to create an aesthetic landscape. (1 point)
5) Aesthetics from main viewpoints of surrounding area	Aesthetic panoramic view of the building and surrounding areas is offered from nearby parks and gathering space or distant viewpoints. (1 point)
6) Other	Describe other measures. (1 point)

Local landscape offers a sensory experience of the environment that encompasses the interaction of nature, buildings and people in the area, thus creating a sense of community for both residents and visitors. In the time of globalization, it has become an important cultural medium (social asset) for the expression of local individuality. As such, this category evaluates reduction of the negative impact of the building (including its outside areas) on the surrounding landscape as well as contributions to enhance the landscape. In this regard, note that the level of aesthetics is not evaluated in CASBEE. Therefore, the visual superiority of buildings and the surrounding environment is not included in the scope of this assessment.

Assessing landscape aesthetics poses the question of who (occupants/users, passers-by, etc.) and where (short-, mid-, and long-distant views) the viewpoints should be based. In this section, apply the following approach.

Firstly, evaluate the fundamental aesthetic element, that is, whether the building's location and shape are in harmony with the surrounding area. Then evaluate whether the building contributes to enhancement of the landscape in terms of improvement of local green space, heritage conservation and the active use of local materials in the building exterior design. Furthermore, measures to improve the aesthetics of the panoramic view of the building and surrounding areas from main viewpoints are also included in the assessment. Evaluate the building as Level three if it is almost entirely unseen from public spaces, or if there is no way to give consideration to urban context and scenery. Further, evaluate as Level five if scenery is stated as a reason for winning a local scenery prize, or any similar situation, indicating the building has gained a certain level of positive assessment.

The following are examples of matters that should generally be considered and specific measures which could be used for forming good scenery. State the specific content of the efforts to be evaluated, and append documents that will be comprehensible to a third party.

Effort 1 –

Integration with the surrounding landscape through positioning and design of the building

Harmonise the positioning and form etc. of the building with nearby urban context. The building's location and shape are the most fundamental elements in integration with the surrounding landscape. Insufficient consideration of these elements creates difficulty in enhancing the

landscape even with excellent architectural details. In this category, evaluate whether the building's location and shape are in harmony with the surrounding area based on the following criteria:

i. Consider the positions of wall lines of adjacent buildings with a view to the consistency of wall lines in the urban context.

ii. Consider how the building will look from roads, and take measures to avoid creating an oppressive atmosphere, such as reducing the number of floors in roadside portions of the building.

iii. Bear in mind that low-rise portions have a more approachable "human scale" when composing the form of the building.

iv. Consider roads and other public spaces and take steps to create an impression of openness in those areas.

v. Consider the skyline formed with surrounding building groups.

vi. Make the aesthetic design of building rooftops, openings; walls etc. harmonise with the urban context.

vii. Consider the effect of the building's colour on the surrounding scenery.

viii. Avoid harming the urban scenery with the size and coloration of the building itself, or with billboards, etc.

ix. If there is equipment on the roof or top of the building, consider how it is viewed from the surroundings.

Effort 2 –

Use of green space to enhance the landscape

In this category, evaluate measures that offer a soothing green landscape that integrates the planting of trees around the building to contribute to the enhancement of the area's natural landscape.

i. Trees are planted along the streets to provide continuity of the green landscape.

ii. Tree selection is based on symbolic significance and integration with existing trees on adjacent properties and streets.

iii. Large-sized parking space facing the public roads is landscaped with trees, water features, etc.

Effort 3 –

Conservation of historic landscape.

Evaluate conservation measures for historic landscapes that reflect local history and culture. It may be maintained through conservation, restoration, or recreation of the exterior of historic buildings and the existing natural environment of the area.

i. Historic structures which have contributed to forming the scenery of the region are partially preserved.
ii. Existing trees on street corners are preserved for continuity in local scenery.
iii. Existing plants, landforms, springs are preserved, restored or recreated to conserve historic landscape.

Effort 4 –

Use of local materials to enhance landscape

"Local materials" are those that are traditionally used locally, or associated with the site. There are examples of exterior wall materials traditionally available in a region being used to make the design harmonise better with the existing urban context. Such materials have relaxed tones and easily become familiar. It is preferable to choose colours that will harmonise with the surroundings. In recent years there has been a trend away from primary colours, and more relaxed earth tones are commonly selected.

i. Locally significant materials such as stones, roof tiles and lumber are used effectively in the building exterior to create an aesthetic landscape.

Effort 5 –

Aesthetics from main viewpoints of the surrounding area*

Evaluate the measures to enhance aesthetics from the viewpoints identified in the landscape base plan of the area that includes the building. In cases where no such plan exists, initiatives based on self-established viewpoints can be assessed. Specify the policy and details of such initiatives including descriptions of viewpoint selection, target view areas and building characteristics.

* A viewpoint refers to a specific location that provides an opportunity for viewing the landscape. Generally, it is a point from which an aesthetic panoramic view is offered such as a hilltop, bridge, or a location that involves many people as observers such as a station or wide street. Creating an aesthetic panoramic view from such visual points means conservation and creation of areas that offer excellent views in the community, thus enhancing the public benefit of the landscape. Viewpoints are established based on a comprehensive analysis of positional relationship with the target area (view angle and distance), landforms, background views and the number of visitors. It is important to develop a building plan that includes consideration of views from such locations with an appropriate verification process.

Effort 6 –

Other

Award one point for independent measures other than the above assessment items. When evaluating "Other" efforts, state in the assessment software what kind of effort has been made, and attach documentation clearly comprehensible to a third party.

Q3.3 Local Characteristics & Outdoor Amenity

Q3.3.1 Local Character & Improvement of Comfort

Q3.3.1.1 Attention to Local Character & Improvement of Comfort

Table 108: CASBEE Iskandar Building Q3.3.1.1 Attention to Local Character & Improvement of Comfort Scoring System

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No efforts have been made for local characteristics and outdoor amenity. (0 points)
Level 2	Efforts based on local characteristics and outdoor amenity are inadequate. (1 point)
Level 3	Efforts based on local characteristics and outdoor amenity are at a standard level. (2-3 points)
Level 4	Efforts based on local characteristics and outdoor amenity are at a relatively high level. (4 points)
Level 5	Efforts based on local characteristics and outdoor amenity are thorough and extensive. (5 or more points)

Table 109: CASBEE Iskandar Building Q3.3.1.1 Attention to Local Character & Improvement of Comfort Scoring System

Assessment Item	Description
I. Continuation of unique local character, history and culture	1) Conservation of historic built spaces etc. (1 point) Historic interior and exterior spaces building remain preserved, restored or regenerated, contributing to local culture. (Do not evaluate if measures here overlap with areas evaluated under urban context and scenery.)
	2) Use of locally-significant materials (1 point) Local materials are partially used in the building's structure, interior finishes or exterior space. (Do not include measures evaluated under the local landscape section.)
II. Local contribution through the provision of functional spaces and facilities	1) Local contribution by provision of space (1 point) Structural measures such as the provision of alcoves, piloti and eaves are used to provide amenity for people using urban spaces, in the form of places to shelter from rain or wait for people. Or, space is provided in plazas, paths and side streets to provide amenity for people using the local area, in the form of rest areas and similar spaces.
	2) Local contribution by provision of facilities and functions (1 point) Part of the building is equipped to provide public facilities and functions, such as meeting rooms, community halls and exhibition spaces, community centres, and community use of schools, contributing to greater activity in the community.
III. Formation of rich intermediate zones linking the building interior and exterior	1) Formation of rich intermediate zones linking the building interior and exterior (1 point) Open spaces that allow the passage of wind and light, such as courtyards, terraces, balconies, sunrooms, roofed plazas, light and air voids, and atria are skilfully linked to interior spaces. Or, in areas where private and public spaces intersect, such as around entrances and balconies, light and air voids, flower beds, pergolas, deep balconies and similar

	elements have been built to form rich intermediate spaces which give a lived-in atmosphere.
IV. Consideration for crime prevention	1） Consideration for crime prevention (1 point) Refer to guidelines for Crime Prevention Through Environmental Design (CPTED) issued by the relevant local authority. Crime prevention performance is considered, so that in spaces outside the building, such as plazas, trees are placed to avoid blocking lines of sight, nocturnal lighting and security cameras are installed, windows are placed where they will be useful for crime prevention, and other measures are used. Or, if there are no plazas or pedestrian walkways, consideration is given to crime prevention in the form of avoiding the creation of blind spots, such as blind alleys and paths out of lines of sight, placing windows where they will be useful for crime prevention, and other measures. Or, if there are boundary barriers around the site, crime and disaster prevention are considered, in the form of fences or low hedges which afford clear lines of sight, rather than continuous walls or similar barriers which block lines of sight.
V. Participation of building users etc.	1）Participation of building users etc. (1 point) User satisfaction assessments (POE) are used to involve building users in the design process for cooperative housing etc. Or, residents and occupants work directly on plant management and cleaning activities and formulate operation plans, and are otherwise participating in the maintenance of the building.
VI. Other	Describe other measures. (1 point)

The goal under this item is to evaluate efforts such as the continuation of local history, contribution to city and district amenities, activities and vitality, formation of rich intermediate spaces on the plot, local crime prevention and participation by building users, for the sake of a living environment with a high level of local amenity.

Effort 1 –

Continuation of unique local character, history and culture

There are many historical and cultural resources that reflect the unique way of life of a region or community. It is important that the building plan should discover such resources and reflect them in various forms while building a modern environment. Local memory, which has been built up in the long course of history on that land, is an important environmental asset, which should be passed down as it is told between generations.

Assess how that kind of local context is picked up and reflected in plans. Examples include the preservation, restoration and regeneration of historic spaces inside and outside the existing building, and of building remains, and the use of materials with local character (locally-produced materials, traditional materials of the region or district, other materials associated with the site).

It is difficult to judge the range within which locally-produced materials can still be called local, but if efforts to use such materials are related to measures by local authorities to promote the use of locally-produced materials, follow the definition employed by the local authority. Other measures envisaged include use of exterior areas or designs which reflect aspects of local context, such as character, history and culture, or serve to promote local industries by, for example, using local personnel, skills and other resources for building construction and operation. If there are such efforts, state their specific details in the "Other" column.

Effort 2 –

Local contribution by provision of functional spaces and facilities

This item evaluates diverse forms of amenity through use of the building, with the aim of creating a rich local environment.

Effort 3 –

Formation of rich intermediate zones linking the building interior and exterior

Rather than isolating the interior of the building from the exterior, and the site from its surroundings, they can be joined attractively through intermediate and semi-outdoor spaces, with reference to the site's orientation and surrounding environment. Providing such buffer zones alleviates psychological stress for building users and thermal loads for the building, creating expansive and rich spaces.

Effort 4 –

Consideration for crime prevention

The goal of considering crime prevention performance is to evaluate the ability of the building to exert an influence to resist crime and disasters in public spaces, to create safe local environments where people will not feel at risk. Where applicable, the building shall comply with the guidelines for Crime Prevention Through Environmental Design (CPTED) issued by the relevant local authority.

Effort 5 –

Ease of participation for building users, etc

Facility user satisfaction assessments accurately identify the needs of facility users and existing problems, and examine those needs before the design stage begins, to evaluate them for use in programming. POE (Pre/Post Occupancy Evaluation) is a kind of facility user satisfaction assessment that evaluates facilities before and after they are occupied. It uses methods such as group interviews and questionnaires to make a scientific investigation and assessment of how easy the facilities are to use.

Effort 6 –

Other

Award one point for independent measures other than the above assessment items. When evaluating "Other" efforts, state in the assessment software what kind of effort has been made and attach documentation clearly comprehensible to a third party. Table 108 shows CASBEE Iskandar Building Q3.3.2 Improvement of the Thermal Environment on Site Scoring System.

Q3.3.2 Improvement of the Thermal Environment on Site

Table 110: CASBEE Iskandar Building Q3.3.2 Improvement of the Thermal Environment on Site Scoring System

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	0 points in the table of the efforts to be evaluated.
Level 2	1-5 points in the table of the efforts to be evaluated.
Level 3	6-11 points from the table of the efforts to be evaluated.
Level 4	12-17 points from the table of the efforts to be evaluated.
Level 5	18 points or more in the table of the efforts to be evaluated.

Table 111: CASBEE Iskandar Building Q3.3.2 Improvement of the Thermal Environment on Site – Efforts to be Evaluated

Assessment Item	Description
I. Guide wind into the site to relieve the thermal environment	1) The planned form and layout of buildings guides wind onto the plot.
	2) Secure paths for air movement by providing green spaces of lawn, meadow and bushes etc., and suitable spaces and paths within the plot. Open space ratio is >60% of plinth area (1 point) 50-60% of plinth area (2 points) <50% plinth area (3 points)
II. Shaded space is created to alleviate thermal impact on pedestrian areas on the site	1) Shaded areas are created with the use of medium/tall trees, piloti, eaves, pergolas, or other similar measures. Rate of horizontal projection area of medium and tall trees, piloti, etc. is 10% or more, less than 20% (1 point) 20% or more, less than 30% (2 points) 30% or more (3 points)
III. Green and water spaces are provided to alleviate thermal impact on pedestrian areas on the site	1) Surface and near-surface temperatures are controlled by establishing green and water spaces. Total rate of green-covered areas, water-covered areas and horizontal projection areas of medium and tall trees is: 10% or more, less than 20% (1 point) 20% or more, less than 30% (2 points) 30% or more (3 points)
	2)Endeavor to reduce the area of paving on the plot.
	Percentage of paved area is: 20% or more, less than 30% (1 point) 10% or more, less than 20% (2 points)

	Less than 10% (3 points)
IV. Exterior finishes of the building promote alleviation of thermal impact on pedestrian areas on the site	1) The green space plan includes accessible rooftop areas (including artificial base). The building has an accessible rooftop area that is partially covered with plants. (2 points) The building has an accessible rooftop area that is extensively covered with plants. (3 points)
IV. Exterior finishes of the building promote alleviation of thermal impact on pedestrian areas on the site	2) Appropriate exterior wall materials for thermal control are used. Percentage of exterior walls with appropriate materials is: Less than 10% (1 point) 10% or more, less than 20% (2 points) 20% or more (3 points)
V. Heat vents for service equipment are appropriately located to alleviate thermal impact on pedestrian areas on the site	1) Heat vents for main service equipment (e.g.: air-conditioning system) are installed in high locations. At least half of cooling towers or outdoor units generating waste heat are installed 10 meters or higher above ground level. (1 point) Most cooling towers or outdoor units generating waste heat are installed 10 meters or higher above ground level OR no units are installed. (2 points)
	1) High-temperature heat vents for main service equipment (e.g.: combustion equipment) are installed in high locations. At least half of high-temperature heat venting units are installed 10 meters or higher above ground level. (1 point) Most high-temperature heat venting units are installed 10 meters or higher above ground level OR no units are installed. (2 points)

Evaluate measures to alleviate thermal impact on pedestrian areas on the site by creating a wind corridor, shaded space and green and water surfaces, as well as using appropriate exterior materials for thermal control and effective placement of heat vents. Verify measures which have been established and award an appropriate level according to the total number of points. Note that thermal measures to improve the off-site environment are evaluated under "LR3.2.2 Heat Island Effect."

Effort 1 –

Guide wind into the site to relieve the thermal environment

Wind corridors which include pedestrian areas on the site are created to alleviate thermal impact.

1. The planned form and layout of buildings guides wind onto the plot

Evaluate the building's layout and shape with respect to wind corridors which include pedestrian areas on the site. Evaluate qualitatively and award 2 points when any measures are included.

- Wind corridors which also includes adjacent open spaces are considered in the layout design
- Both daytime and night-time wind patterns are considered in the layout design

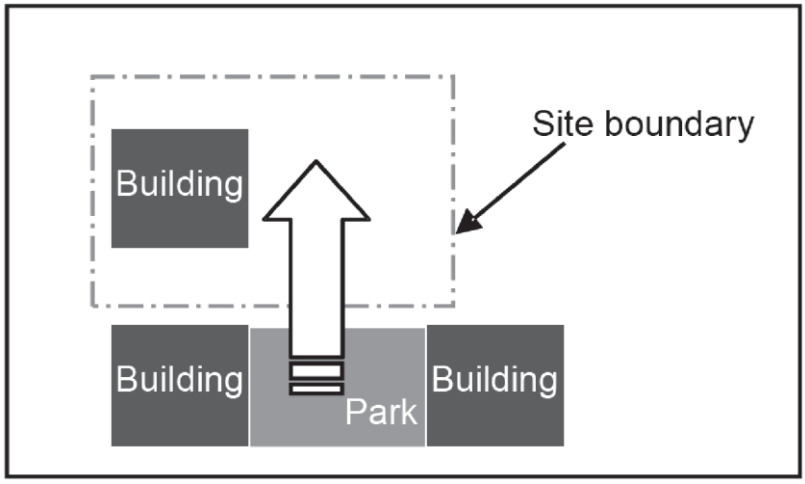


Figure 38: Layout of a wind corridor including the adjacent space

2. Secure paths for air movement by providing green spaces of lawn, meadows, bushes, etc, and suitable spaces and paths within the plot.

- Evaluate based on percentage of open space to the total site area.

  <Open space ratio> = 100 (%) - <Building coverage ratio> (%)

  Piloti and eaves more than 1 m deep are generally included in a building coverage ratio. In this assessment, however, they can be included as open space based on the following formula:

  (<Site area> - <1F Floor area>) / <Site area> x 100 (%)

- Award 1 point to open space of 60% or more, 2 points for 50% - 60%, and 3 points for 50% or less.

Provide documentation for third-party verification that supports corresponding measures (e.g.: wind pattern analysis of the site and surrounding areas; drawings that include design measures, such as building layout and shapes, green spaces, open spaces, and paths).

Effort 2 –

Shaded spaces are created to alleviate the thermal impact on pedestrian areas on the site

In this category, evaluate measures to alleviate the thermal impact on pedestrian areas of the site such as creating shaded spaces, specifically in areas that are under direct daylight (south and west sides of the building), by placing objects such as medium/tall trees, piloti, eaves or pergolas.

- Evaluate effectiveness based on percentage of Horizontal Projection Areas of medium/tall trees, piloti, eaves, or pergolas
- Obtain the percentage of Horizontal Projection Area using the following formula:

$$\text{<Percentage of Horizontal Projection Area>} = \frac{\text{<Horizontal projection areas of medium/tall trees>} + \text{<Horizontal projection areas of piloti, eaves, pergolas, etc.>}}{\text{<Site area>}} \times 100(\%)$$

- Horizontal shaded area of medium/tall trees is based on the canopy of the trees.
- Horizontal shaded area of piloti, eaves, pergolas, etc. is determined based on the methods shown in Figure 39 and Figure 40.

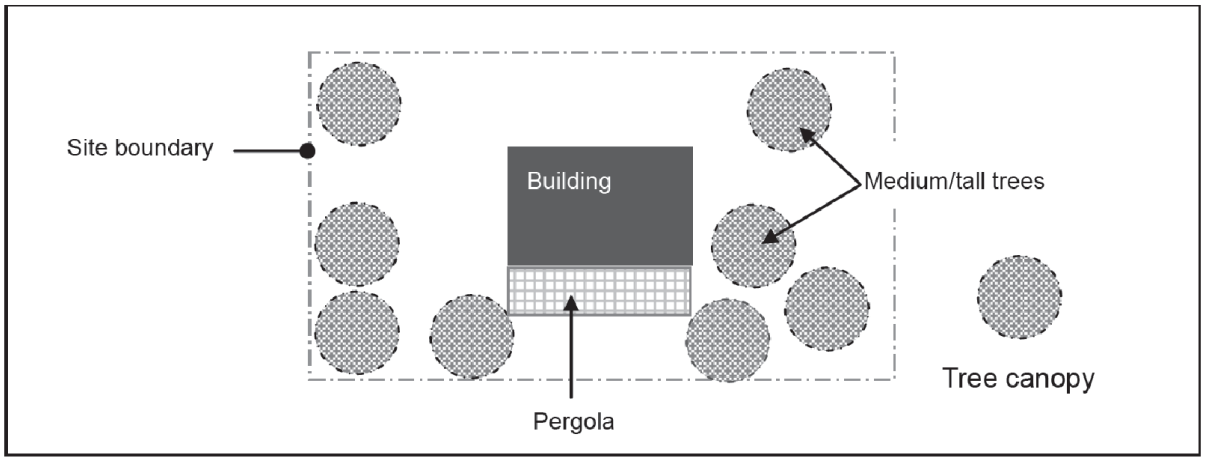


Figure 39: Horizontal projection areas of medium/tall trees and pergolas.

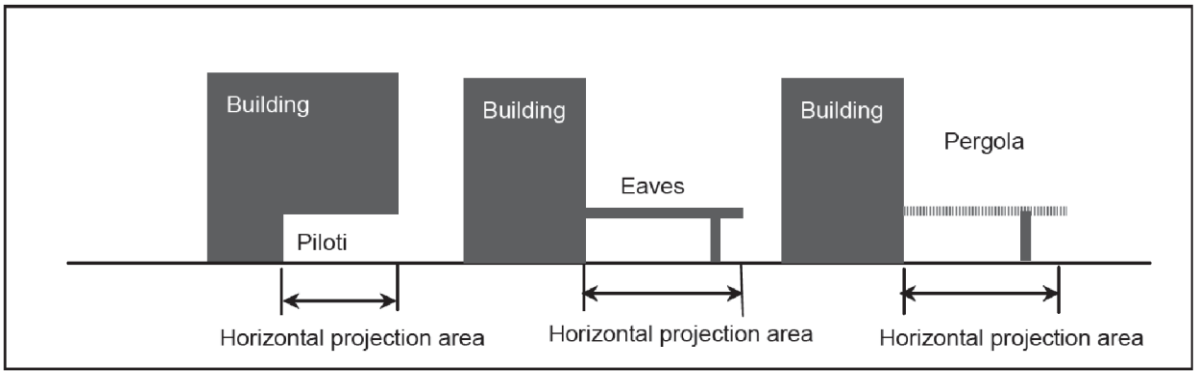


Figure 40: Horizontal projection areas of medium/tall trees, piloti, eaves, pergolas, etc.

Effort 3 –

Green and water spaces are provided to alleviate thermal impact on pedestrian areas on the site

1. Surface and near-surface temperatures are controlled by establishing green and water spaces

Evaluate measures to control surface and near-surface temperatures by creating water and green spaces (e.g.: lawn, meadows, shrubs, medium/tall trees) in order to alleviate the thermal impact on pedestrian areas of the site.

The assessment is carried out based on the sum of percentages of the green-covered area utilising lawn, meadows and shrubs, water-covered area, and horizontal projection area of medium/tall trees, obtained in the following formulas:

Formula 1:

<Sum of the percentages of green-covered area, water-covered area, and horizontal projection area of medium/tall tree> = <Percentages of green-covered area> + 2.0 x <Percentage of water-covered area> + 1.5 x <Percentage of the horizontal projection area of medium/tall tree>*

** Coefficient values that multiply the percentages of water-covered area and horizontal projection area of medium/tall trees. Water surface has a higher water evaporation rate compared to green-covered space such as a lawn area, thus it is considered to provide a greater temperature control effect. As such, apply the coefficient value of 2. Similarly, leaves on medium/tall trees that spread three-dimensionally have a higher evaporation rate compared to the green space with the same projection area. Thus, apply the coefficient value of 1.5.*

Formula 1a:

<Percentage of green-covered area> = <Green area>/<Site area> x 100 (%)

Formula 1b:

<Percentage of water-covered area> = <Water surface area>/<Site area> x 100 (%)

Formula 1c:

<Percentage of horizontal projection area of medium/tall tree> = <Horizontal projection area of medium/tall tree>/<Site area> x 100 (%)

In cases where an evaporation cooling system, such as water misting, is used as a temperature control measure, evaluate by converting the transpiration rate during misting to an equivalent size of green area. Obtain the equivalent green space (lawn) area value using the formula below. The transpiration rate for the lawn space is set as 0.01 L/(min-m^2) on a sunny daytime condition.

Formula 2:

<Equivalent green space for water misting>

= (Mist volume per nozzle (L/min-unit) x number of nozzles) / (transpiration rate of lawn space (L/min-m^2))

Evaluate based on a total percentage of green-covered areas (e.g.: lawn, meadows, shrubs), water-covered area and horizontal projection area of medium/tall trees. Award 1 point to a total of 10% or more, less than 20%, 2 points to 20% or more, less than 30%, and 3 points to 30% or more.

2. Endeavour to reduce the area of paving on the plot

Evaluate measures to alleviate thermal impact on pedestrian areas of the site such as minimizing paved areas, or more specifically, not placing a large paved space (e.g.: parking lots) under direct daylight (east and west sides of the building).

Obtain the percentage of paved area using the formula below:

<Percentage of paved area> = <Paved area> / <Site area> x 100 (%)

- Exclude areas with water-retentive paving materials, which provide effective thermal control performance can be excluded.
- Exclude paved areas that are clearly not under direct daylight and piloti areas can be excluded.
- Award 1 point for a percentage of paved area of 20% or more but less than 30%, 2 points to 10% or more but less than 20%, and 3 points to less than 10%.

Effort 4 –

Exterior finishes of the building promote alleviation of thermal impact on pedestrian areas on the site

1. The green space plan includes accessible rooftop areas (including artificial base)

Qualitatively evaluate the use of green space on accessible rooftop areas in order to promote alleviation of thermal impact on pedestrian areas. When approximately 80% or more of the rooftop area is covered with greenery, it is considered as extensive.

2. Appropriate exterior wall materials for thermal control are used

Evaluate the use of greenery or water-retentive materials, especially on the east and west sides of the exterior walls, to promote alleviation of thermal impact on pedestrian areas on the site.

Obtain a percentage of the thermal-efficient exterior walls using the following formula:

<Percentage of thermal-efficient exterior walls> = <Green-covered exterior wall area> + <Exterior wall area with water-retentive materials> x 100 (%) <Total exterior wall area>

Effort 5 –

Heat vents for service equipment are appropriately installed in a way to alleviate thermal impact on pedestrian areas on the site

1. Heat vents for main service equipment are installed at high locations

Evaluate whether heat vents for main service equipment (e.g.: air-conditioning system) installed at high locations to alleviate thermal impact on pedestrian areas on the site.

- Evaluate the locations of the cooling towers and external units
- A high location in this assessment refers to 10 meters or higher above ground (generally the height of the 3rd floor or higher).
- Award 2 points where a district cooling system is used.
- Award 2 points for residential sections.
- In Apartments, establish appropriate points based on points from non-residential sections and residential sections (i.e. 2 points) using the building's gross floor area ratio.

2. High-temperature heat vents for main service equipment are installed at high locations

Evaluate whether the high-temperature heat vents for main service equipment (e.g. combustion equipment) that are installed at high locations to alleviate thermal impact on pedestrian areas on the site.

- Evaluate heat vents with chimneys (e.g. co-generation units, absorption refrigerators, boilers).
- High-temperature heat here refers to approximately 100°C or higher.
- A high location in this assessment refers to 10 meters or higher above ground (generally the height of the 3rd floor or higher).
- Award 2 points where a district cooling system is used.
- Award 2 points for Residential sections.
- In Apartments, establish an appropriate level based on points from Non-Residential sections and Residential sections (i.e. 2 points) using the building's gross floor area ratio.

6.2 LR: Environmental Load Reduction of Building

The aspects of environmental load reduction of buildings that are considered by CASBEE for Building (New Construction) are largely narrowed down to energy consumption, resource consumption and diverse impact on the off-site environment (pollution, etc.), as shown below, and evaluate each of these items. Table 112 shows the CASBEE Iskandar Building Load Reduction (LR) Table of Items.

Table 112: CASBEE Iskandar Building Load Reduction (LR) Table of Items

Major Item	Primary Item	Secondary Item	Criteria
LR	LR1 - Energy	LR1.1 Control of Heat Load on the Outer Surface of Buildings	
		LR1.2 Natural Energy Utilisation	
		LR1.3 Efficiency in Building Service System	
		LR1.4 Efficient Operation	LR1.4.1 Monitoring
			LR1.4.2 Operation & Management System
	LR2 - Resources & Materials	LR2.1 Water Resources	LR2.1.1 Water Saving
			LR2.1.2 Rainwater & Grey Water
		LR2.2 Reducing Use of Non-renewable Resources	LR2.2.1 Reducing Use of Materials
			LR2.2.2 Continuing Use of Existing Structural Frame, etc

Major Item	Primary Item	Secondary Item	Criteria
			LR2.2.3 Use of Recycled Materials and/or MyHijau/SIRIM Eco Labelled as Structural Materials
			LR2.2.4 Use of Recycled Materials and/or MyHijau/SIRIM Eco Labelled as Non-structural Materials
			LR2.2.5 Timber from Sustainable Forestry
			LR2.2.6 Efforts to Enhance the Reusability of Components and Materials
		LR2.3 Avoiding the Use of Materials with Pollutant Content	LR2.3.1 Use of Materials without Harmful Substances
			LR2.3.2 Elimination of CFCs and Halons
	LR3 - Off-site Environment	LR3.1 Consideration of Global Warming	
		LR3.2 Consideration of Local Environment	LR3.2.1 Air Pollution
			LR3.2.2 Heat Island Effect
			LR3.2.3 Load on Local Infrastructure
		LR3.3 Consideration of Surrounding Environment	LR3.3.1 Noise, Vibration & Odour
			LR3.3.2 Light Pollution

LR1: Energy

Efforts to reduce the energy load caused by the operation of the building are classified into "1 Control of Heat Load on the Outer Surface of Buildings," "2 Natural Energy Utilisation," "3 Efficiency in Building Service System" and "4 Efficient Operation," which are all evaluated. Reductions in CO_2 emissions caused by energy consumption are to be evaluated under "LR3.1 Consideration of Global Warming". Table 113 shows CASBEE Iskandar Building LR1 Energy Item Explanation.

Table 113: CASBEE Iskandar Building LR1 Energy Item Explanation

Primary Item	Secondary Item
LR1 – Energy Energy saving measures from a wider viewpoint are also required, such as the active use of natural energy and unused energy, introduction of the BEMS, and adjustments or streamlining during the building's operation. Therefore, CASBEE has newly established a comprehensive assessment frame that covers these new energy conservation standards and efforts from wider aspects in the scope of the assessment.	LR1.1 Control of Heat Load on the Outer Surface of Buildings
	Improvements in the performance of outer surfaces in building plans closely related to the reduction of energy consumption due to air conditioning are evaluated in accordance with Overall Thermal Transfer Value (OTTV), and other related standards.
	LR1.2 Natural Energy Utilisation
	The assessment is carried out regarding the direct use of natural energy (daylighting, ventilation, etc.)
	LR1.3 Efficiency in Building Service System
	The degree of increased efficiency in terms of air conditioning, ventilation, lighting, hot water supply, escalators, and the like, is evaluated in accordance with the Building Energy Index (BEI), a standard of the primary energy consumption. Transformation of natural energy for power use including solar power generation, which is has becoming increasingly popular, is also evaluated in this section.
	LR1.4 Efficient Operation

Primary Item	Secondary Item
	Evaluates the operation and maintenance system and whether there is an energy consumption monitoring system in running since the building went into operation.

LR1.1 Control of Heat Load on the Outer Surface of Buildings

The Overall Thermal Transfer Value (OTTV) of the building envelope shall be calculated in accordance with the latest version of MS 1525 – Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings – Code of Practice. Table 114 shows CASBEE Iskandar Building LR1.1 Control of Heat Load on the Outer Surface of Buildings Scoring System.

Table 114: CASBEE Iskandar Building LR1.1 Control of Heat Load on the Outer Surface of Buildings Scoring System

Entire Building and Common Properties		
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl	
	Assessment based on [OTTV]	
	Zone 7	
Level 1	[OTTV] ≧ 55 W/m^2	Those that fall between the above levels are evaluated based on the nearest rounded figure.
Level 2	50 W/m^2 < [OTTV] < 55 W/m^2	
Level 3	45 W/m^2 < [OTTV] < 50 W/m^2	
Level 4	40 W/m^2 < [OTTV] < 45 W/m^2	

Level 5	[OTTV] ≦ 40 W/m^2	

Evaluate the efforts to improve the reduction of thermal gains due to insolation and interior-exterior temperature gradients, and thermal load control as a means of reducing energy consumed by cooling.

1. Measures in the building site plan, such as building form and core position, to reduce thermal loads.
2. Level of use of highly-insulated construction methods and materials in walls, roof and elsewhere.
3. Level of use of louvres, eaves and other sun-shading methods on windows
4. Use of measures such as highly insulated multi-panel glass windows, air-flow windows and double skins.

The relevant OTTV formulas are given as follows:

$$OTTV = \frac{(A_1 \times OTTV_1) + (A_2 \times OTTV_2) + \ldots + (A_n \times OTTV_n)}{A_1 + A_2 + \ldots + A_n}$$

Where A_i = gross exterior wall for orientation *i*; and

$OTTV_i$ = the OTTV value for orientation *i*, derived from the formula below:

$OTTV_i = 15a(1 - WWR)U_w + 6(WWR)U_r + (194 \times OF \times WWR \times SC)$

Where WWR = window-to-gross wall area ratio for the orientation under consideration;

a = solar absorptivity of the opaque wall (refer Table 8 in MS 1525);

U_w = thermal transmittance of opaque wall (W/m^{2}K);

U_f = thermal transmittance of the fenestration system (W/m^{2}K);

OF = solar orientation factor (refer Table 7 in MS 1525); and

SC = effective shading coefficient of the fenestration system, whereby Solar Heat Gain Coefficient (SHGC) = SC x 0.87

Table 115: Solar orientation factors as per MS 1525:2019.

Orientation	Orientation Factors (OF)
North	0.90
North-East	1.09
East	1.23
South-East	1.13
South	0.92
South-West	0.90
West	0.94
North-West	0.90

NOTES:

1. This table specifies OF for the various orientation of the fenestration. For the calculation of OF, it is recommended that the nearest predominant orientation be selected.

2. A fenestration system may consist of a glazing material such as glass, a shading device and a combination of both.

Table 116: Suggested solar absorptivity values as per MS 1525:2019.

Colour	Suggested value of α
Light	0.20 to 0.40
Medium	0.41 to 0.70
Dark	0.71 to 0.95

The shading coefficient (SC) is the product of the shading coefficients of its sub-systems, excluding non-permanent shading devices such as curtains, blinds, or films. The relevant graphs may be referred to in the latest version of MS 1525. The formula for SC is as follows:

SC = SC1 x SC2

Where SC = the effective shading coefficient of the fenestration system;

SC1 = the shading coefficient of glass; and

SC2 = the shading coefficient of external shading devices. Where there are no shading devices, SC2 = 1

For the Residential and Accommodation section of Apartment, the emphasis shall be on energy efficiency. Award Level 3 if all light fittings, A/C, fans, refrigerators, televisions, water heaters, washing machines, electric irons, microwaves, and/or ovens/stoves pre-installed in the dwelling units by the developer comply with the Minimum Energy Performance Standards (MEPS) rating recommended by MS 2680. Level 3 may also be selected if none of the aforementioned fittings are provided at the point of delivery of Vacant Possession, such as in bare (unfurnished) units. Table 117 shows CASBEE Iskandar Building LR1.1 Control of Heat Load on the Outer Surface of Buildings Scoring System – Apartment

Table 117: CASBEE Iskandar Building LR1.1 Control of Heat Load on the Outer Surface of Buildings Scoring System - Apartment

Residential and Accommodation Section	
Score	Apt
Level 1	(No corresponding level)
Level 2	Minimum Energy Performance Standards (MEPS) rating of light fittings, A/C, fans, refrigerators, televisions, water heaters, washing machines, electric irons, microwaves, and/or ovens/stoves do not comply with the minimum requirements of MS 2680.
Level 3	Minimum Energy Performance Standards (MEPS) rating of light fittings, A/C, fans, refrigerators, televisions, water heaters, washing machines, electric irons, microwaves, and/or ovens/stoves comply with the minimum requirements of MS 2680, or none of the afore-mentioned fittings are pre-installed at the point of delivery of Vacant Possession.
Level 4	(No corresponding level)
Level 5	Minimum Energy Performance Standards (MEPS) rating of light fittings, A/C, fans, refrigerators, televisions, water heaters, washing machines, electric irons, microwaves, and/or ovens/stoves exceed the minimum requirements of MS 2680.

LR1.2 Natural Energy Utilisation

In terms of natural energy utilisation, the assessment is based on direct use only. The converted use is evaluated in LR1.3 Efficiency in Building Service System. Forms of natural energy utilisation in CASBEE are defined as follows:

Form of use	Definition	Notes
Direct use	Natural energy is used directly as energy, without the use of mechanical force, as in the use of daylight and natural air movement and ventilation.	Evaluated in LR1.2 Natural Energy Utilisation
Converted use	Photovoltaic generation, solar heat use, and other semi-mechanical means are used to convert natural energy to electrical power, hot and cold water, and other forms, before it is used as energy.	Evaluated in LR1.3 Efficiency in Building Service System

In principle, the assessment is based on the introduction method and scale in a qualitative manner. In order to obtain Level 5, the quantitative assessment based on the amount used per unit floor space equivalent to the annual primary energy consumption would be required. In this regard, however, the assessment of apartments and schools is carried out based solely on the introduction method and scale in a qualitative manner. Table 118 shows CASBEE Iskandar Building LR1.2 Natural Energy Utilisation Scoring System – Common Properties.

Table 118: CASBEE Iskandar Building LR1.2 Natural Energy Utilisation Scoring System – Common Properties

Entire Building and Common Properties		
Score	Off, Sch (Tertiary,etc), Rtl, Rst, Hal, Hsp, Htl, Fct	Note
Level 1	(No corresponding level)	Exclude usage in production rooms in Factory. Factories with only production area are not applicable. (Select "N.A." in the effort to be evaluated, below)
Level 2	(No corresponding level)	
Level 3	No measures of the assessment criteria are implemented. Although some methods are used, their effectiveness, however, has not been examined.	
Level 4	In some of the methods used as part of the efforts subject to the assessment, their effectiveness has been confirmed. (Excludes monument design)	
Level 5	Same as Level 4 and direct energy usage of 15 MJ/m^2-yr or more.	

- 1kWh = 3.6MJ

Table 119: CASBEE Iskandar Building LR1.2 Natural Energy Utilisation Scoring System

Residential and Accommodation Section	
Score	Sch (Primary/Secondary),Apt
Level 1	(No corresponding level)
Level 2	Natural lighting and ventilation do not meet Level 3.
Level 3	Nearly all private areas (at least 80%) of classrooms or apartments face exterior walls on two sides, ensuring effective natural lighting and ventilation.
Level 4	In addition to the above, building measures, such as ventilation voids, have been used to enhance efficacy. They influence a majority (50% or more) of the building.
Level 5	The above building measures cover at least 80% of the building.

In assessing direct use of natural energy in Apartment and School (Primary/Secondary), evaluate measures implemented in private areas of apartments or classrooms. Many such buildings have natural lighting and ventilation as basic energy-saving measures. As such, the Level 3 standard for these building types requires most of the private areas or classrooms to have natural light and ventilation on at least two sides. Furthermore, the orientation and layout of the building also contribute to natural energy measures and are recognised as Levels 4 and 5.

Table 120: CASBEE Iskandar Building LR1.2 Natural Energy Utilisation – Efforts to Be Evaluated

Effort
[1] Use of natural light: Planning for natural light systems that use daylight in place of lighting equipment. (E.g., light shelves, top lights, high side lights*, etc.)
[2] Use of natural ventilation: Planning for the use of natural ventilation and ventilation systems that are effective in replacing the use of air conditioning equipment and reducing cooling loads. (E.g., automatic dampers, manually operated openings and windows (those with a plan for an operational management method), night purging, ventilation systems linked to atria, solar chimney ventilation towers, etc.)
[3] Use of solar thermal as a renewable resource and sustainable initiative.
[4] Other: Planning for the effective use of nature in other systems.
The above building measures shall cover at least 80% of the building.

* High side light are windows installed at high elevations, closer to the ceiling, for a more effective distribution of natural light.

LR1.3 Efficiency in Building Service System

The assessment of increased efficiency of building service systems is carried out by obtaining the Building Energy Index, or Building Energy Intensity (BEI) value based on the primary energy consumption of the entire service system. Table 121 shows CASBEE Iskandar Building LR1.3 Efficiency in Building Service System Scoring System – Entire Building and Common Properties

Table 121: CASBEE Iskandar Building LR1.3 Efficiency in Building Service System Scoring System – Entire Building and Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct
	Assessment based on [BEI] in kWh/m^2/year
Level 1	[BEI] > 260
Level 2	220 < [BEI] < 260
Level 3	180 < [BEI] < 220
Level 4	100 < [BEI] < 180
Level 5	[BEI] ≦ 100

At the Design Assessment stage, the BEI value is derived from estimated loads to gauge the energy efficiency of a building based on its floor space. The latest version of MS 1525 benchmarked the BEI of an Office at 200 kWh/m^2/year. Generally, BEI can be derived from the following formula in accordance with MS 1525:2019:

BEI = ((TBEC – CPEC) x 52) / ((GFA$_{excl\ carpark}$) x WOH

Where TBEC = Total Building Energy Consumption in kWh/year;

CPEC = Car Park Energy Consumption in kWh/year;

$GFA_{excl\ carpark}$ = Gross Floor Area of the building, excluding carpark floors; and

WOH = Weight Weekly Operating Hours in hours/week

The BEI calculation excludes the energy consumed by parking floors. It also assumes a default operational period of 52 hours/week, subject to normalisation using WOH. Dividing 52 with WOH accommodates for buildings with different operating hours (those that operate more or less than 52 hours a week).

At the Completion and Verification stage, the BEI value determined during the Design Assessment stage shall be verified through the submission and analysis of actual electricity bills.

LR1.4 Efficient Operation

LR1.4.1 Monitoring

The assessment of all building types except Apartment is carried out in terms of on-going monitoring of energy consumption in the operational phase of the building after its construction is completed, and subsequent efforts to establish measurement and qualification systems that would lead to more efficient operations. Table 122 shows CASBEE Iskandar Building LR1.4.1 Monitoring Scoring System – Common Properties

Table 122: CASBEE Iskandar Building LR1.4.1 Monitoring Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct
Level 1	(No corresponding level)
Level 2	(No corresponding level)

Level 3	It must be possible to identify the annual consumption of each kind of energy used in the building and use the base unit for energy consumption, or other means, for benchmark comparison.
Level 4	Beyond Level 3, the breakdown of energy consumption*1 for each major building type must be identified, trends in consumption identified and analysed, and their appropriateness confirmed.
Level 5	Beyond Level 4, the system efficiency*2 of major equipment systems must be evaluated in order to evaluate the performance of the systems.

*1 Broadly, monitoring must be planned which will be able to identify the breakdown, by application, of a majority of the total energy consumption.

*2 Broadly, efficiency assessment must be performed on at least four of the types listed in Table 124. If there are many systems, such as air-conditioning, lighting and ventilation, it is permissible to estimate the whole from the assessment of representative systems.

Table 123: CASBEE Iskandar Building LR1.4.1 Monitoring Scoring System – Residential

Entire Building and Common Properties	
Score	Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No efforts to be evaluated.
Level 4	Equipment that indicates the amount of energy consumed, environmental-load-reducing devices and the like, are employed.
Level 5	A system for managing energy is established and efforts for reducing energy consumption are made therein.

"Monitoring" evaluates ongoing monitoring of energy consumption quantities used in the operation of the building in the Completion and Verification stage, and subsequent efforts to establish measurement and quantification systems that would lead to more efficient operation.

In evaluating the level of these kinds of monitoring, award higher levels to systems that are capable of more detailed assessment and analysis for the objectives (1)-(3) below:

1. It must be possible to identify the annual consumption of each kind of energy used in the building and use the base unit*3 for energy consumption, or other means, for benchmark comparison.
2. Furthermore, the breakdown of energy consumption*4 for each major building type must be identified, trends in consumption identified and analysed, and their appropriateness confirmed.
3. BEMS or a similar tool must be introduced so that the system efficiency*5 of major equipment systems can be evaluated in order to evaluate the performance of the systems. Assessment of four or more systems, such as the examples in Table 124123, must be possible.

*3 Primary energy consumption per unit floor area for each building type, based on statistical data.

*4 Breakdown of primary energy consumption. The breakdown should include items that account for particularly large shares of consumption, such as heat sources, air conditioning motor power, lighting, receptacles and hot water supply.

*5 It must be possible to compare the energy-saving effects of introducing various methods, using the COP of heat source systems, system COP (of compound equipment), the WTF of pumped conveyance and the ATF of air movement (see Table 124).

However, if district heating and cooling have been introduced, it is possible to evaluate according to a well-defined system COP, so evaluating efficiency is sufficient.

Furthermore, data obtained by devices with control sensors can also be applied in the efficiency assessment. Table 124 shows Efficiency Assessment Examples.

Table 124: Efficiency Assessment Examples

Equipment Item		Assessment Item	Assessment Summary
1		Heat source machine COP assessment	Amount of generated heat/energy consumed by the heat source (based on primary energy)/Available heat of heat storage tank/Utilisation efficiency of heat storage tank

	Heat source equipment	COP assessment of heat source systems	Amount of generated heat/energy consumed by the heat source and related equipment (based on primary energy). This includes the introduction of district heating and cooling, if applicable.
		Heating medium conveyance WTF	Amount of heat carried/energy consumed by pump (based on secondary energy)
2	Air conditioning equipment	Air-conditioner conveyance ATF	Amount of heat carried/energy consumed by fan (based on secondary energy)
		Total enthalpy heat exchange effect	Amount of heat reduced, amount of energy
		Cooling effect by external air	Amount of heat reduced, amount of energy
		Multi-COP assessment for buildings	Efficiency in multi-split A/C system
3	Ventilation equipment	Assessment of variable air volume control	
4	Lighting equipment	Assessment of various types of control	Amount of energy saved by the use of daylight, occupant sensors, etc.
5	Hot water supply equipment	Heat source machine COP assessment	Amount of generated heat/energy consumed by the heat source (based on primary energy)
		COP assessment of heat source systems	Amount of generated heat/energy consumed by the heat source and related equipment (based on primary energy)

		Heating medium transmission WTF	Amount of heat carried/energy consumed by pump (based on secondary energy)
6	Elevator	Individual control operation effect	Reduced energy
7	Other	Assessment of solar power generation facility	Power generation efficiency/Rating efficiency/Annual efficiency
		CGS assessment	Electricity generation efficiency, overall efficiency, energy saving rate
		Coordinated controls	Lighting/ventilation on/off control linked with security sensors
		Other	A/C CO_2 control effect, Ventilation CO_2 control effect, Task ambient A/C effect, Task ambient lighting effect, etc.

In Apartment, the assessment is carried out in accordance with "LR_{HU}1.3.2 Management and Control of Energy" in CASBEE for Dwelling Unit, a CASBEE rating tool for a unit in an apartment building. Level 4 is awarded when one of the following measures (1-3) is taken:

1. Equipment that indicates the amount of energy consumed is installed for one of the following services: electricity, gas or water. (The energy consumption may be expressed as the amount of energy consumed, energy costs, or any other related forms.)
2. Devices that indicate the amount of electricity or gas consumed are installed, which are connected to terminals such as electric plugs and gas valves rather than connected directly to the devices.
3. A distribution board having a function of breaking the branch circuit (a distribution board with a peak-cut function) depending on the use of power-consuming devices is installed.

Level 5 is awarded when, in terms of the information concerning the energy consumption of the dwelling, the amount of electricity for air-conditioning, lighting and the like, used by the building owner or occupant, is individually measured, the related information may be accumulated and provided as necessary.

LR1.4.2 Operation & Management System

As an assessment of all building types except Apartment, the operation and management system is not, in itself, design content, but rather a system that would be applied by the building owner. Therefore, the assessment is carried out based on how far the designer went for proposing the establishment of the Operation and Management System in relation to the reduction of environmental loads to the building owner. Table 125 shows CASBEE Iskandar Building LR1.4.2 Operation & Management System Scoring System – Common Properties.

Table 125: CASBEE Iskandar Building LR1.4.2 Operation & Management System Scoring System – Common Properties

Entire Building and Common Properties	
Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct
Level 1	No operation and management has been planned.
Level 2	Organisations, systems or management policies have been planned for operation and management.
Level 3	In addition to Level 2, there must be an organised operation and management system, designated manager.
Level 4	In addition to Level 3, target values for energy consumption in the whole buildings have been planned and presented to the building owner, based on calculation of annual energy consumption.
Level 5	In addition to Level 4, there must be regular verification of equipment performance during building operation, with specific actions planned for repair of malfunctions etc. (commissioning system)

Table 126: CASBEE Iskandar Building LR1.4.2 Operation & Management System Scoring System – Residential

Score	Apt
Level 1	No efforts to be evaluated.
Level 2	(No corresponding level)
Level 3	User manuals for individual facilities are provided to the occupants.
Level 4	In addition to satisfying the requirements for Level 3, general instructions regarding an energy-saving way of living are given to the occupants.
Level 5	In addition to satisfying the requirements for Level 3, appropriate instructions regarding the facilities and specifications installed in the subject dwelling unit, suitable for the respective building and lifestyle, are given to the occupants.

The operation and management system is not, in itself, design content, but rather a system that would be applied by the building owner. Therefore, this assessment should examine how far the designer went in preparing such a system, for cutting environment loads, and proposing it to the building owner.

The assessment should cover management systems and goal setting for planned and organised operation, maintenance and preservation of the building, the setting of target values for annual energy consumption, and the implementation of a target management plan to achieve the goals and targets. Level 5 is for "target management is applied to energy consumption," with marks allocated for the anticipated final targets. Evaluate energy-saving efforts in the area of operation and management, such as the use of data gained from various monitoring systems to reduce energy consumption through testing and verification of equipment performance in operation, equipment diagnostics, and support for optimum operation.

In Apartment, even if the building or facility focuses on energy saving, the expected effects may not be achieved depending on how they are used. In this section, the assessment is carried out as to whether information for promoting an energy-saving way of living is available to the occupants.

LR2 - Resources & Materials

In this section, "LR2.1 Water Resources," "LR2.2 Reducing Use of Non-renewable Resources" and "LR2.3 Avoiding the Use of Materials with Pollutant Content" are evaluated as ways of reducing the consumption of resources and materials through the life cycle of the building.

Various methods using existing environmental performance assessment tools are employed for evaluating the environmental load generated using resources in buildings. However, they have their own assessment indices and no common standard method has been established. Table 127 shows CASBEE Iskandar Building LR2 Resources and Materials Item Explanation.

Table 127: CASBEE Iskandar Building LR2 Resources and Materials Item Explanation

Primary Item	Secondary Item
LR2 - Resources & Materials The development of CASBEE collected and analysed the assessment Indicators used by existing Malaysia assessment tools in connection with the use of resources in buildings. The CASBEE assessment items were based on that analysis, so that the concepts are incorporated in a new group of assessment indicators that avoids redundancy.	LR2.1 Water Resources
	Regard water shortage due to the rapid use of large volumes of potable water as an environmental problem beyond the virtual enclosed space boundary and evaluate reduction of potable water usage, referring to whether or not there are efforts for saving water, using rainwater, and reusing grey water.
	LR2.2 Reducing Use of Non-renewable Resources
	Regard depletion of non-renewable resources as an environmental problem beyond the virtual enclosed space boundary and evaluate efforts to reduce consumption of such resources.
	LR2.3 Avoiding the Use of Materials with Pollutant Content
	To reduce the environmental load associated with use of resources. it is important to reduce the amount of the resources used, and also to reduce the use of materials that include pollutants. This item evaluates performance in reducing the emission of pollutants associated with the use of resources, and also improvements on issues such as ozone depletion.

LR2.1 Water Resources

LR2.1.1 Water-Saving

Evaluate the water-saving methods installed on the building's water supply equipment.

Table 128: CASBEE Iskandar Building LR2.1.1 Water Saving System Scoring System-Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No systems for saving water.
Level 2	(No corresponding level)
Level 3	Major faucets are equipped with water-saving valves.
Level 4	In addition to the water-saving valve, other water-saving equipment (such as flush-mimicking sound systems, water-saving toilets) is used.
Level 5	(No corresponding level)

In this context, "major faucets" refers to faucets in everyday use. For example, in a home, the term would refer to those in the kitchen, bathroom, restrooms, etc. This also depends on the level of water-saving effect, but it is generally necessary to have water-saving measures attached to a majority of faucets. The water-saving fittings shall have a WEPLS rating. Table 129 shows Examples of Water-Saving Equipment.

Table 129: Examples of Water-Saving Equipment

Faucets	(1) Save water by regulating water flow volume	Water- saving valve
		Fixed flow volume valves
		Foaming faucets etc.
	(2) Simplify operation of the equipment to save water by reducing wasteful flow.	Automatic faucets
		Fixed flow faucets (self-closing faucets)
Water-saving toilets	(1) Toilet bowls (Approx. 6 L/use)	Water-saving appliances (Improvements to water supply routes and bowl and trap shapes secure waste evacuation performance while saving water).
		Water-saving flush valves (Continuous flush prevention mechanism, with regulatable discharge volume).
	(2) Urinals (Approx. 4 L/use)	Flushing in response to usage, with user sensor.
		Fixed-time control system (Combination with lighting, fan switch linkage and 24-hour timers).
Other		Privacy noise generators, etc.

LR2.1.2 Rain Water & Grey Water

LR2.1.2.1 Rain Water Use System

Evaluate the level of rain water use based on the system and usage rates.

Table 130: CASBEE Iskandar Building LR2.1.2.1 Rain Water Use System Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No systems for using rainwater.
Level 4	Rain water is used.
Level 5	Rain water usage brings the rain water usage rate to at least 20%.

The rain water usage rate specified in Level 5 is calculated by the formula below:

$$\text{Rain water usage rate} = \frac{\text{Rain water use } (m^3)}{\text{Potable water use } (m^3) + \text{Rain water use } (m^3) + \text{Waste water use } (m^3)}$$

In this case,

Waste water use (m3) = grey water use (m3) + sewage water use (m3) + industrial water use (m3)

The denominator indicates the overall water demand in the formula. Apply annual values for calculation. In areas where a recycled water/grey water infrastructure is provided, use of such a system is considered as industrial water use.

Groundwater use is included in rain water use except in the cases below:

1. Groundwater is used only as heat source water Groundwater used only in a water heat pump system is excluded from this assessment since it does not contribute to reduction of regular domestic water use. However, groundwater can be included if it is recycled for domestic use after it is used as a heat source.

2. Groundwater used for disaster response such groundwater use is limited to emergency situations and does not affect regular domestic water use and is thus excluded from this assessment.
3. Groundwater is stored but not utilised.
4. Use of groundwater may cause land subsidence, or the amount of water pumped may exceed the limit prescribed in the regulations.

LR2.1.2.2 Grey Water Use System

Small buildings with a gross floor area of less than 2,000 m^2 are excluded from this assessment. Table 131 shows CASBEE Iskandar Building LR2.1.2.2 Grey Water Use System Scoring System.

Table 131: CASBEE Iskandar Building LR2.1.2.2 Grey Water Use System Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No systems for reusing grey water.
Level 4	Grey water is reused.
Level 5	More than two types of waste water are used

In CASBEE for Building (New Construction), evaluate utilisation of grey water, sewage water and industrial water (collectively referred to as waste water) based on how many types of waste water are being used. Level 5 is awarded where more than two types of waste water are used. In areas where recycled water/grey water infrastructure is provided, the use of such systems is considered as industrial water use.

LR2.2 Reducing Use of Non-renewable Resources

LR2.2.1 Reducing Use of Materials

Buildings with wood as the main structural component are excluded from this assessment. Table 132 shows CASBEE Iskandar Building LR2.2.1 Reducing Use of Materials Scoring System.

Table 132: CASBEE Iskandar Building LR2.2.1 Reducing Use of Materials Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	(No corresponding level)	Buildings with wood as the main structural component are excluded from this assessment.
Level 2	Major structural elements are made of non-wood materials (RC/SRC/S), and earned 0 points in the table of the efforts to be evaluated.	
Level 3	Major structural elements are made of non-wood materials (RC/SRC/S), and earned 1 point or more in the table of the efforts to be evaluated.	
Level 4	Major structural elements are made of non-wood materials (RC/SRC/S), and earned 3 points or more in the table of the efforts to be evaluated.	
Level 5	Major structural elements are made of non-wood materials (RC/SRC/S), and earned 5 points or more in the table of the efforts to be evaluated.	

Table 133: CASBEE Iskandar Building LR2.2.1 Reducing Use of Materials Scoring System – Efforts to Be Evaluated

Score	Assessment Item	Description
	Buildings with wood as the main structural component	
1	Concrete strength FC and main rebar strength F of main structure (unit: N/mm^2)	More than Fc = 36, and less than F = 390
3		More than Fc = 60, and less than F = 490
4		More than Fc = 100, and less than F = 590
1	Steel frame strength F in main structure frame (unit: N/mm^2)	F = 325 or more but less than 355
3		F = 355 or more but less than 440
4		F = 440 or more
1	Other measures related to major structural elements	Use of prestressed concrete (which reduces material cross section, thereby reducing materials used).
1 point each		Equivalent measures.

High-strength materials contribute to a reduction in overall material use. As such, evaluate use of various components in RC, S and other structures. Apply the assessment criteria to all building types, as it may be difficult to determine the type of structure in some cases. In cases where multiple methods are combined, such as SRC, evaluate each structure and combine all points to determine the result for the entire building. In cases where more than two types of materials are used, evaluate the material that is used most. Exclude assessment of concrete-filled steel tube (CFT) structures as reduction in the use of steel material is not clearly demonstrated.

Examples of other structural measures:

1. Use of BCPs (cold-press-formed rectangular steel tubes)
2. Reduction in steel reinforced using specific embedding methods, etc.

In cases of multiple measures, combine all points earned for each measure. Exclude measures intended mainly to prevent building collapse caused by explosion or rupture in the event of a disaster or to reduce overall material use during the entire life cycle of the building.

LR2.2.2 Continuing Use of Existing Structural Frame, etc

Recycled use of existing building frames in temporary buildings is excluded from this assessment. Table 134 shows CASBEE Iskandar Building LR2.2.2 Continuing Use of Existing Structural Frame, etc Scoring System.

Table 134: CASBEE Iskandar Building LR2.2.2 Continuing Use of Existing Structural Frame, etc Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The existing building frame is not reused.
Level 4	(No corresponding level)
Level 5	Existing building frame is reused.

Usually the weight of the existing building skeleton of non-wooden structures consists of about 90% of the entire building and about 70% in case that it is the energy consumption rate of the material production. Therefore, when construction is to be carried out on a site with an existing building, the resource productivity of the new building will differ greatly depending on whether the skeleton of the existing building is reused or entirely removed in favour of a completely new building. This item evaluates the level of reuse of existing building structural elements, such as reuse of existing piles and preservation of existing building perimeter walls, from the point of view of resource productivity.

Further, reuse, removal and reconstruction of parts of the frames used for a building located on-site or off-site are included in the assessment of the reuse of the existing building frames. It is natural that existing buildings cannot be reused unconditionally, considering their load bearing capacity and state of deterioration, but if the existing building skeleton is not used for such reasons, the new

building should be able to achieve a high level on the Q (Quality) item. Further, parts of the reused existing building frames used for temporary-use purposes are excluded from the assessment.

LR2.2.3 Use of Recycled Materials and/or MyHijau / SIRIM Eco Label as Structural Materials

Table 135: CASBEE Iskandar Building LR2.2.3 Use of Recycled Materials and/or MyHijau / SIRIM Eco Label as Structural Materials -Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	(No corresponding level)	Describe recycled materials applied to the building when Level 5 is awarded, below.
Level 2	(No corresponding level)	
Level 3	No recycled / MyHijau / SIRIM Eco Labelled Products materials are used in the main parts for structural strength.	
Level 4	(No corresponding level)	
Level 5	Recycled materials / MyHijau / SIRIM Eco Labelled Products are used in the main parts for structural strength.	

Evaluate whether recycled materials are used in the building's main structure. This category covers recycled materials used for building structure.

Wooden materials produced from sustainable forests, such as timbers from forest thinning, are evaluated in "LR2.2.5 Timber from Sustainable Forestry." Unless the quantity is extremely limited, include all materials used. Recycled materials used in the foundation of wooden structures are deemed used in the main parts for the building's structural strength in the assessment. Table 136 shows Examples of recycled materials.

Table 136: Examples of recycled materials

<table>
<tr><td colspan="3">Material name</td></tr>
<tr><td colspan="3">(1) Green procurement items (public works)</td></tr>
<tr><td></td><td>Blast furnace slag aggregate</td><td>FA cement</td></tr>
<tr><td></td><td>Ferronickel slag aggregate</td><td>Eco cement</td></tr>
<tr><td></td><td>Copper slag aggregate</td><td>Lumber</td></tr>
<tr><td></td><td colspan="2">Electric furnace oxidized slag aggregate</td></tr>
<tr><td></td><td colspan="2">Blast furnace cement</td></tr>
<tr><td colspan="3">(2) Wood board (Malaysian Timber Certification Scheme (MTCS))</td></tr>
<tr><td colspan="3">(3) Products using thinned lumber, reused and unused wood materials, etc.</td></tr>
</table>

Since the list of the Designated Procurement Items is constantly updated, it is advisable to refer to the following websites prior to the assessment.

- Garis Panduan Perolehan Hijau Kerajaan (GPP) 3.0 https://www.myhijau.my/wp-content/uploads/2021/01/GGP-Guidelines-3.0.pdf

- https://www.myhijau.my/green-procurement/

LR2.2.4 Use of Recycled Materials and/or MyHijau / SIRIM Eco Label as Non-structural Materials

Table 137: CASBEE Iskandar Building LR2.2.4 Use of Recycled Materials and/or MyHijau / SIRIM Eco Label as Non-structural Materials- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct,Apt	Note
Level 1	No recycled materials / MyHijau / SIRIM Eco Labelling Products is are used.	Describe recycled materials applied to the building when Level 3 or higher is awarded, below.
Level 2	(No corresponding level)	
Level 3	One type of recycled materials / MyHijau / SIRIM Eco Labelling Products is used.	
Level 4	Two types of recycled materials / MyHijau / SIRIM Eco Labelling Products are used.	
Level 5	Three or more types of recycled materials / MyHijau / SIRIM Eco Labelling Products are used.	

Evaluate the use of recycled materials and/or MyHijau / SIRIM Eco Label in non-structural applications. This category covers recycled materials / MyHijau / SIRIM Eco Label used for non-structural materials. The assessment is based on the number of items used as recycled materials. When multiple materials belonging to the same category are used, count them all as one item. Unless it is a very small quantity, include all materials used. Table 138 shows Examples of Recycled Materials from CASBEE Japan.

Table 138: Examples of Recycled Materials from CASBEE Japan

Material name	
Designated Procurement Items under the Green Procurement Law	
Recycled soil processed from construction sludge	Paving blocks (fired) using recycled materials materials
Granulated blast furnace slag for earthworks	Paving blocks (precast, non-reinforced concrete) using recycled
Caisson filler using copper slag	Ceramic tile
Caisson filler using ferronickel slag	Lumber
Steelmaking slag for ground improvement	Laminated wood
Recycled heated asphalt mixtures	Plywood
Asphalt mixtures with added ferrous slag	Laminated veneer lumber
Roadbed material with added ferrous slag	Flooring
Steel slag blocks	Particle board
Sprayed concrete using FA	Wooden-type cement panels
	Vinyl flooring
Tiles and blocks that have been awarded the Eco Mark (Product category No. 109)	
Tile	Brick
Block	
Boards using wood materials that have been awarded the Eco Mark (Product category No. 111)	
Boards	
Products using thinned lumber, reused and unused materials, etc. that have been awarded the Eco Mark (Product category No. 115)	
Outdoor materials (Civil engineering and construction materials: Small lc Interior materials (Doors)	
Exterior materials (Civil engineering and construction materials: Laminated wood)	
Exterior materials (Civil engineering and construction materials: Plywood)	
Exterior materials (Exterior)	
Interior materials (Floor materials)	Activated carbon (for moisture regulation)
Interior materials (Wall materials)	Soil improvement materials
Interior materials (Sliding door frames)	
Construction products (for interior decorating finishes) that have been awarded the Eco Mark (Product category No. 123)	
Wood flooring	Thermal insulation
Paper screens and sliding partitions	Acoustic absorption materials and anti-vibration mats
Paper to cover paper screens and sliding partitions	Vinyl floor covers
Board	Staircase anti-slip treatment
Tatami matting	Braille nails
Wallpaper	Free access floor
	Accordion doors
Construction products (cladding and exterior parts and materials) that have been awarded the Eco Mark (Product category No. 137)	
Roofing	Plastic decking materials
Roof materials	Composite materials of recycled wood and plastic
Cladding materials	
Construction products (material-type parts and materials) that have been awarded the Eco Mark (Product category No. 138)	
Construction stone	Sumps for residential land
Hard PVC pipes for drainage and ventilation	

Since the list of the Designated Procurement Items are constantly updated, it is advisable to refer to the following websites prior to the assessment.

- Garis Panduan Perolehan Hijau Kerajaan (GPP) 3.0 https://www.myhijau.my/wp-content/uploads/2021/01/GGP-Guidelines-3.0.pdf

- https://www.myhijau.my/green-procurement/

LR2.2.5 Timber from Sustainable Forestry

Inapplicable if no timber is used. Table 139 shows CASBEE Iskandar Building LR2.2.5 Timber from Sustainable Forestry Scoring System.

Table 139: CASBEE Iskandar Building LR2.2.5 Timber from Sustainable Forestry Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	(No corresponding level)	N.A. if no timber is used
Level 2	Timber from sustainably managed forests is not used.	
Level 3	Timber from sustainably managed forests supplied less than 10% of timber usage, or no timber is used, even in the structural skeleton.	
Level 4	Timber from sustainably managed forests supplies 10-50% of timber usage.	
Level 5	Timber from sustainably managed forests supplies 50% or more of timber usage.	

Use the formula below to calculate the proportion of timber used.

$$\text{Proportion of timber used} = \frac{\text{Total quantity of timber used from sustainable forests (volume)}}{\text{Total quantity of timber used in the building (volume)}}$$

Timber is a material that should be renewable, and this item expresses the level of timber use in a building. However, when timber comes from tropical rainforests or illegally logged forests, it cannot be described as renewable. Therefore, the level of use of timber from sustainably managed forests is evaluated here. The assessment procedure is as provided below.

1. Method for determining timbers produced in sustainable forestry

Wooden materials and timbers from forest thinning accompanied by a certificate of origin that guarantees their places of origin as sustainable forests are treated as timbers from sustainable forestry. They must be evinced by the submission of the MTCS/PEFC Chain of Custody (CoC) certification for the forest-and tree-based products.

Reference may be made to the Malaysian Timber Council (MTC) on the application of the Malaysian Criteria, Indicators, Activities and Standards of Performance for Forest Management Certification (Forest Management Unit (FMU) Level) in Peninsular Malaysia [MC&I (Natural Forest) 2013] as evidence of forest sustainability compliance.

Wooden materials including laminated wood and plywood made from wood that conforms to the above definition may also be treated as timbers from sustainable forestry. However, moulding materials and frame members are excluded from the assessment.

2. Method for calculating the proportion of timbers used
    a. Identify building condition
    b. List the timber materials used, by position and tree type.
    c. Identify the volumes of wood materials used, by position and type.
    d. Calculate the total volume of timber used.
    e. Use the formula below to calculate the proportion of timber used that is produced from sustainable forests.

$$\frac{\text{Total quantity of timber used from sustainable forests (volume)}}{\text{Total quantity of timber used in the building (volume)}}$$

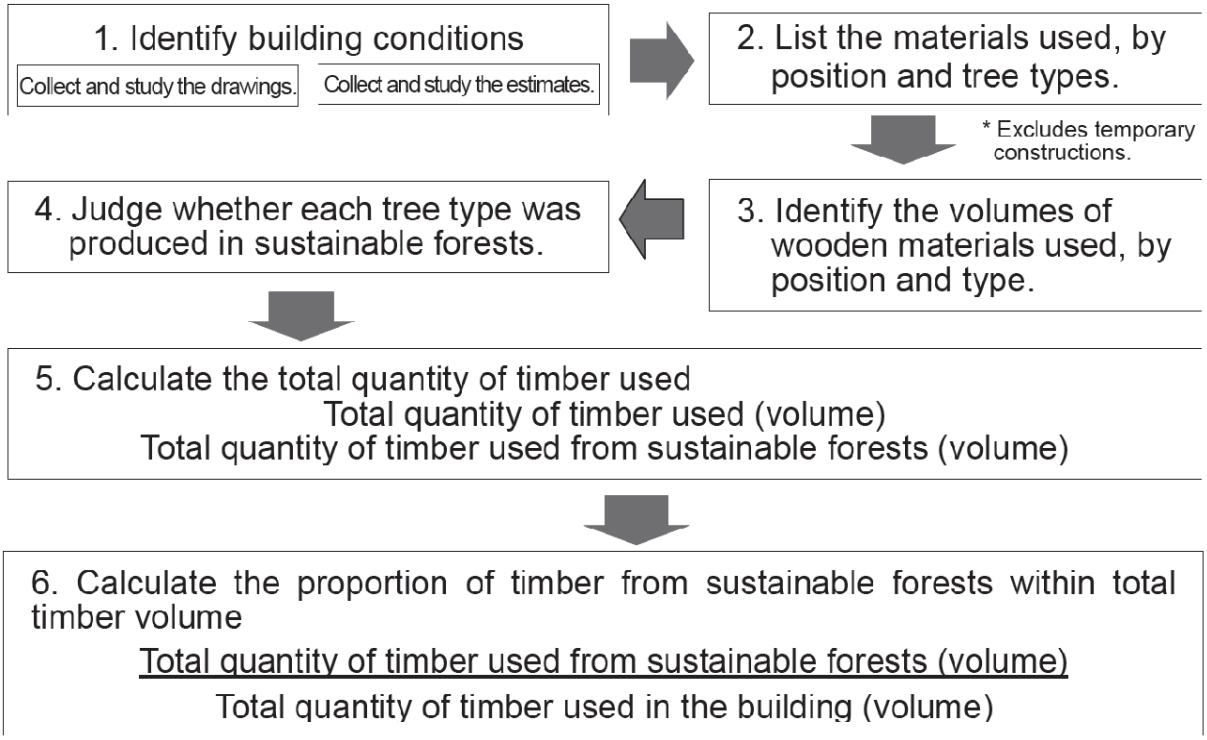


Figure 41: Method for calculating the proportion of timbers used

LR2.2.6 Efforts to Enhance the Reusability of Components and Materials

Table 140: CASBEE Iskandar Building LR2.2.6 Efforts to Enhance the Reusability of Components and Materials Scoring System-Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	(No corresponding level)	N.A. if no timber is used
Level 2	(No corresponding level)	
Level 3	No measures, as the efforts to be evaluated, to encourage recycling of materials on demolition have been used.	
Level 4	One point of measure to be evaluated, which is taken as an effort to promote material recycling on demolition, has been used.	
Level 5	Two or more of measures to be evaluated, which are taken as efforts to promote material recycling on demolition, have been used.	

Table 141: CASBEE Iskandar Building LR2.2.6 Efforts to Enhance the Reusability of Components and Materials Scoring System – Efforts to Be Evaluated

Description
The structure of finishing materials can be separated easily.
Interior finishes and equipment are not entangled, and each can easily be removed separately for demolition, refurbishment and remodelling.
Reusable unit materials are used.
Structural materials or their units can easily be disassembled and reused.

"

LR2.2.3 Use of Recycled Materials and/or MyHijau / SIRIM Eco Label as Structural Materials" and "LR2.2.4 Use of Recycled Materials and/or MyHijau / SIRIM Eco Label as Non-structural Materials" expresses the degree of reused materials in the building at the time of its new construction or refurbishment, as the starting point of its life cycle. This item evaluates measures such as easier recycling which can promote recycling at the demolition and disposal stage, which is the end of the building lifecycle. In this category, evaluate measures to facilitate recycling at the end of the building lifecycle (i.e. demolition and disposal stage) such as material segregation.

"The structure and finishing materials can be separated easily" for this assessment means that structural materials and internal finishes, including underlay materials, can be separated easily. Therefore, S structures with cement panels, or RC structures with curtain walls, are not evaluated under this item.

The following are specific examples. In these examples, measures indicated as "easy separation," "relatively easy separation" and their equivalent may be included in the scope of assessment.

Examples of easy separation:

- Structural frames with painted finishes
- Structural frames + light steel + finishing materials (FP panels used for insulation)

Examples of relatively easy separation:

- GL construction method (Sprayed insulation (urethane etc.) used)

Examples of difficult separation:

- Plastered walls
- Mortar and tile

"Interior finishes and equipment are not entangled" means cases designed for changing interior décor, such as SI (skeleton/infill) methods, and cases in which pipes and wires are not embedded in structural frames and finishing materials, as with the GL method (GL bonding using gypsum-based adhesives) and others. Conversely, do not evaluate in cases of mortar and tile or plastered walls on the structure.

"Reusable unit materials" include OA floors and movable partitions.

In "Reusable structural materials or their units," the assessment is carried out regarding design efforts in which structural materials and their units can be easily detached from each other and reused,

the examples of which include a case where beam-column joints of a steel construction are all replaced with bolted connections.

LR2.3 Avoiding the Use of Materials with Pollutant Content

LR2.3.1 Use of Materials without Harmful Substances

Table 142: CASBEE Iskandar Building LR2.3.1 Use of Materials without Harmful Substances Scoring System-Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	There are no building materials that are certified to comply with the CIDB Act 520 (Amendment 2011) and the CIDB (Amendment of the Fourth Schedule) Order 2021, or the inspection has not been carried out.
Level 4	There are 1-3 building materials that are certified to comply with the CIDB Act 520 (Amendment 2011) and the CIDB (Amendment of the Fourth Schedule) Order 2021.
Level 5	There are 4 or more building materials that are certified to comply with the CIDB Act 520 (Amendment 2011) and the CIDB (Amendment of the Fourth Schedule) Order 2021.

Table 143: Examples of Materials to be confirmed as Free of Harmful Substances

Category	Building materials
Adhesives	For vinyl tile floors and seating
	For tile
	For wallpaper
	For floor board
Sealants	For sash
	For glass
	For tile joint
	For wall joint
Waterproofing materials	Primer for waterproofing
	For paint (surface coating)
Paints	For fittings (wooden and metal)
	For wooden parts (frames for floor and ceiling)
	For structural materials
	For walls
Anti-corrosion treatment	For frames

	For materials other than frames
Undercoats	For materials for coated floors
Floor coverings	For finishing wax
Preservatives	For wooden parts

In this assessment, evaluate the reduction of chemicals that may affect interior air quality and also the overall environment. Various materials are used in buildings and these contain various chemical substances. These chemicals may have a harmful impact on human health and cause problems such as Sick Building Syndrome and endocrine disruption due to environmental hormones. Materials with a low risk of causing health problems (except for Sick Building Syndrome caused by VOCs) are considered materials with no harmful substances in this assessment.

Targeted substances include Class I and II chemicals referred to in the law governing improved reporting and management of specific chemicals released into the environment. Class I designated chemical substances are defined as follows:

1. The chemical substance concerned threatens to harm human health, or to impair the lives or growth of animals.
2. Condition (1) is applicable to chemical substances which can easily be generated from the substance concerned through the action of nature.
3. The chemical substance concerned depletes the ozone layer, harming human health through the increased penetration of ultraviolet radiation to the surface. In addition to any one of the above, the following condition must apply to designated substances.
4. The physical or chemical state of the chemical substance and the conditions of its manufacture, import, use and generation are recognized to result in its continuing presence in the environment over a wide area.

LR2.3.2 Elimination of CFCs and Halons

Atmospheric emissions of CFCs and halons pose a global threat to the ozone layer. In the construction field, such substances have been used frequently as flame retardants, foaming agents (insulation materials, etc.) and refrigerants. In this assessment, evaluate use of low-ODP and GWP CFCs and halons in flame retardants, foaming agents (insulation materials, etc.) and refrigerants. ODP, or ozone depletion potential, is a relative scale which compares the global loss of ozone caused by 1 kg of a given substance with the global loss of ozone due to 1 kg of CFC-11, which is fixed at an ODP of 1.0. A substance with absolutely no potential for ozone depletion has an ODP of zero. GWP (Global Warming Potential), or global warming potential, is a relative scale that compares the gas in a given substance with that of the same mass of carbon dioxide, which is fixed at a GWP of 1.

LR2.3.2.1 Fire Retardant

Buildings that have no fire-extinguishing equipment or have sprinklers only and those having no gas fire extinguishing facilities are excluded from the assessment. A foam extinguisher is also excluded from the assessment. Table 144 shows CASBEE Iskandar Building LR2.3.2.1 Fire Retardant Scoring System.

Table 144: CASBEE Iskandar Building LR2.3.2.1 Fire Retardant Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	Halon flame retardants with high ODP/GWP are used (incl. critical uses).	Excluded from the assessment; buildings with no fire-extinguishing equipment, or sprinklers only, or no gas fire extinguishing facilities, foam extinguisher
Level 2	Halogenated flame retardants are used.	
Level 3	(No corresponding level)	
Level 4	Inert gas flame retardants are used. Or, flame retardants with 0 ODP and less than 50 GWP are used.	
Level 5	(No corresponding level)	

Evaluate flame retardants based on ODP/GWP impacts. In this assessment, chemicals in flame retardants are evaluated. In this assessment, critical and non-critical uses of halon are both avaluated as Level 1 from the standpoint of their impact on the global environment. Buildings with absolutely no fire-extinguishing system or buildings which contain only a fire sprinkler system are excluded.

Assessment levels are defined as follows:

Level 1: high ODP/GWP

Level 2: low ODP/low GWP

Level 4: zero-ODP/very low GWP

Table 145: Critical-uses for which Halon Fire Retardants May Be Used.

Types of facility		Examples of facility
Communications equipment etc.	Communications equipment rooms etc.	Communications equipment rooms, wireless equipment rooms, telephone exchange rooms, magnetic disk rooms, computer rooms, telex rooms, telephone exchange switching rooms, communications equipment control rooms, data print rooms
	Broadcasting studios etc.	TV relay rooms, remote centers, studios, lighting control rooms, musical equipment rooms, adjustment rooms, monitor rooms, broadcasting equipment rooms
	Control rooms etc.	Electrical power control rooms, operation rooms, control rooms, management rooms, disaster prevention centers, dynamometer rooms
	Film storages etc	Film storage rooms, lighting control rooms, relay desks, VTR rooms, tape rooms, projector rooms, tape storerooms
	Measurement equipment rooms in hazardous material handling facilities	Measurement equipment rooms in hazardous material handling facilities

Historical assets	Exhibition rooms etc.	Important cultural assets, artwork repositories, exhibition rooms, showrooms
Other	Workshops etc.	Print rooms containing rotary presses
Car parks	Car parks, etc.	Automated parkade, mechanical parkade (where drivers enter fire-protected areas))

LR2.3.2.2 Foaming Agents (Insulation Materials, etc.)

Table 146: CASBEE Iskandar Building LR2.3.2.2 Foaming Agents (Insulation Materials, etc.) Scoring System-Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Insulation foaming materials with ODP = 0.2 or above are used.
Level 2	Insulation foaming materials with ODP = 0.01-0.2 are used.
Level 3	Insulation foaming materials with ODP = 0.0-0.01 are used.
Level 4	Insulation foaming materials with ODP=less than 0.01 and low GWP (less than 50, 100-year value) are used.
Level 5	Insulation foaming materials with zero-ODP and low GWP (100-year value is 1 or less) are used; or, no insulation foaming material used.

Evaluate foaming agents (insulation materials, etc.) based on ODP/GWP impacts. Insulation materials are classified into mineral fiber materials (e.g. glass wool, rock wool, and asbestos), expanded plastic materials (e.g. polyurethane, polystyrene, and polyethylene), and natural materials (e.g. carbonized cork, cellulose fiber, and wool). Of these, CFCs and HCFCs have been used in the expanded plastic materials listed below in Table 147.

Table 147: Reference 1) Foaming agents used in expanded plastic insulating materials

Types of expanded insulation materials	Period of use	Foaming agent name	ODP	GWP (100-year value)
Urethane foam	Before 1995	CFC-11	1	4,750
	Start of 2000s	HCFC-141b	0.11	725
Urethane modified isocyanurate foam	Next generation	HFC-134a	0	1430
		HFC-245fa	0	560
		Cyclopentane C5H10	0	3
Styrene olefin foam	Before 1995	CFC-12	1	10,900
	Start of 2000s	HCFC-142b	0.065	2,310
	Next generation	HFC-134a	0	1,430
Phenol foam	Before 1995	CFC-113	0.8	6,130
	Since 2000	Dichloromethane CH2Cl2	0	

ODP = 0-0.01 is considered standard and defined as Level 3. However, GWPs of currently used foaming agents are not necessarily low. Therefore, materials with ODP = 0 and a very low GWP are considered Level 5. ODPs and GWPs of various foaming agents are shown below in Reference 2. Table 147 shows Reference 2) ODP and GWP values of foaming gases.

Table 148: Reference 2) ODP and GWP values of foaming gases

Substance	Persistence in atmosphere	ODP (CFC standard)	GWP (CO_2 standard) 100 years
CFC-11	50	1.0	4,750
CFC-12	120	1.0	10,900
CFC-113	85	0.8	6,130
CFC-114	300	1.0	10,000
CFC-115	1700	0.6	7,370
HCFC-22	13.3	0.055	1,810
HCFC-123	1.4	0.02 - 0.06	77
HCFC-124	5.9	0.022	609
HCFC-141b	9.4	0.11	725
HCFC-142b	19.5	0.065	2,310
HCFC-225ca	2.5	0.25	122
HCFC-225cb	2.6	0.033	595
HFC-23	264		14,800
HFC-32	5.6		675
HFC-125	32.6		3,500
HFC-134a	14.6		1,430

HFC-143a	48.3	0	4,470
HFC-152a	1.5		124
HFC-227ea	36.5		3,220
HFC-236fa	209		9,810
HFC-245ca	6.6		560
FC-14	50000		6500
FC-116 FC-218	10000 2600	0	9200 7000
FC-C318	3200		8700

LR2.3.2.3 Refrigerants

Exclude from assessment if no refrigerant gases are used. Table 149 shows CASBEE Iskandar Building LR2.3.2.3 Refrigerants Scoring System.

Table 149: CASBEE Iskandar Building LR2.3.2.3 Refrigerants Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	(No corresponding level)	Exclude from assessment if no refrigerant gases are used.
Level 2	HCFC is used as the refrigerant.	
Level 3	Refrigerant of ODP = 0 is used as the refrigerant.	
Level 4	Natural refrigerants and new chilling systems (ODP = 0) with GWP less than 50 are used.	
Level 5	(No corresponding level)	

Exclude all specified CFC refrigerants and evaluate the use of CFC substitutes. Due to the widespread use of CFC substitutes as refrigerants, zero-ODP is considered as level 3.

Natural refrigerants and new chilling systems in level 4 include the following items:

1. Natural refrigerants are CO_2 and hydrocarbons such as ammonia, propane and butane.
2. New chilling systems (MH chilling systems) are those using hydrogen-occluded alloy (MH alloy). MH alloy is able to store up to 1,000 times its own volume of hydrogen. When it absorbs hydrogen, it emits heat, and absorbs heat when it emits hydrogen, and these properties are used for refrigeration

LR3 - Off-site Environment

LR3 Off-site Environment evaluates the efforts to reduce the impact that environmental loads generated in the building and its site that affects the global environment, local environment and surrounding area beyond site boundaries.

If the planned content actually applies to the content of each of the efforts to be evaluated, add the corresponding points, and determine the level according to the point total.

Some points can be selected as "Not Applicable," according to factors such as the building types and site conditions. The cases which are to be excluded are stated in the commentary for each point. Select "Not Applicable" on the scoring software, and the item concerned will be automatically excluded from the scoring subjects.

The "Other" column contains arbitrarily added items, which are special efforts that do not appear in the scoring table. When scoring the "Other" column, describe the efforts in the "Summary for Design for Environment (DfE)" column of the software. Table 150 shows CASBEE Iskandar Building LR3 Off-site Environment Item Explanation.

Table 150: CASBEE Iskandar Building LR3 Off-site Environment Item Explanation

Primary Item	Secondary Item
LR3 - Off-site Environment Pollution of soil and groundwater is not classified as an assessment item, because with strict observance of the law there is little risk of such pollution by the building, and assessment is based on the assumption that laws and regulations are strictly observed.	LR3.1 Consideration of Global Warming
	Evaluate the following CO_2 reduction initiatives using the quantitative $LCCO_2$ indicators: Efforts to reduce operating energy affecting climate change. Use of existing structural frames and recycled construction materials, which contribute to the reduction of embodied CO_2 related to the manufacture of construction materials. Efforts to extend building lifespan that contribute to $LCCO_2$ reduction The assessment is based on the emission ratio (%) against the $LCCO_2$ (kg-CO_2/year-m^2) in terms of buildings having all assessment items other than this item (excluding LR1 Energy) at Level 3 equivalent.
	LR3.2 Consideration of Local Environment
	Under "LR3.2.1 Air Pollution" evaluate the reduction of atmospheric pollutants emitted from buildings or from within the property. This includes measures such

Primary Item	Secondary Item
	as the control of pollutants from the operation of building equipment and pollutants removal by plants. Under "LR3.2.2 Heat Island Effect", evaluate efforts that contribute to mitigation of the heat island effect of surrounding areas. This includes enhanced airflow leaving the site, greening of the building, and reductions in solar absorption and artificial heat discharge. On- site mitigation of the heat island effect is evaluated under "Q3.3.2 Improvement of the Thermal Environment on Site." Efforts to reduce the environmental load imposed on local infrastructure facilities by the operation of the building are evaluated under " LR3.2.3 Load on Local Infrastructure." The four elements to consider are rainwater runoff, sewage treatment, traffic volume and waste disposal.
	LR3.3 Consideration of Surrounding Environment
	Under "LR3.3.1 Noise, Vibration & Odour," evaluate noise, vibration and odour generated during the operation of the building. Noise and vibration generated during the operation of the equipment are evaluated according to whether measures for source elimination and propagation control have been established. Assessment of odour is based on reduction measures for odours generated from chemical substances. Buildings that would occur wind hazards (e.g.:, large structure buildings) should be carefully considered during the design stage. Light pollution, such as light spillage from exterior lighting, billboard lighting, the building itself, and daylight glare reflecting off exterior walls, has become an important urban issue.
	LR3.4 Construction Management
	Construction management criteria are only considered during the period of construction of the project. It emphasises the control of waste of construction materials and the construction process. Other than construction waste the assessment also touches the quality of construction which refers to QLASSIC. The amenities for the site workers are also a part of the assessment.

LR3.1 Consideration of Global Warming

Table 151: CASBEE Iskandar Building LR3.1 Consideration of Global Warming Scoring System-Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	
Level 1	Level 1: Lifecycle CO_2 emission rate is 125% or more of the reference value.	Those that fall between the above levels are evaluated based on the $LCCO_2$ emission rate, utilising the linear interpolation to the first decimal place.
Level 2	(No corresponding level)	
Level 3	Level 3: Lifecycle CO_2 emission rate is 100% of the reference value.	
Level 4	(No corresponding level)	
Level 5	Level 5: Lifecycle CO_2 emission rate is 50% or less of the reference value.	

Use lifecycle CO_2 ($LCCO_2$) as the index for evaluating the level of effort for consideration of global warming. Among the global environmental problems, global warming causes the greatest concern. In general, the level of impact on global warming is expressed by converting to the equivalent amount of CO_2, as the representative GHG. $LCCO_2$ is the total amount of that kind of CO_2 emission generated by the building in its entire lifespan.

The calculation of $LCCO_2$ for a building is normally a very large task, but CASBEE uses an approximate calculation method (i.e. Standard Calculation) in order to simplify the process. For details of the calculation procedure and conditions, refer to Chapter 3.0 Scoring and Assessment Method.

Specifically, a reference $LCCO_2$ emission for each building application is set based on the $LCCO_2$ emission of a standard building that satisfies the evaluation criteria for building owners.

Using the reference values, calculation is performed more-or-less automatically based on the CO_2-related assessment results (scores) at each stage of a building lifecycle (i.e. construction, operation, maintenance/upgrade/demolition).

1. Construction stage

LR2 Resources & Materials evaluates "Continuing Use of Existing Structural Frame, etc." and "Use of Recycled Materials." The CO_2 related to the manufacture of construction materials (embodied

CO_2), which is considered in relation to these measures, is approximately calculated from the usage rate of existing structural skeletons and the blast furnace cement usage rate.

2. Operation stage

Use BEI, the building energy intensity, which is evaluated under LR1 Energy, to make a simple estimate of the CO_2 emission at the operation stage.

3. Maintenance/Upgrade/Demolition

Extension of service life by improving longevity is evaluated under "Q2 Quality of Service." However, it is difficult to estimate the actual extension of service life with sufficient precision to use it as a calculation condition for $LCCO_2$. Therefore, take service life as a constant for all non-residential buildings for $LCCO_2$ estimation.

- Offices, hospitals, hotels, schools and halls: Fixed 60 years
- Retailers, restaurants and factories: Fixed 30 years
- Apartments: 30, 60 or 90 years, according to the deterioration countermeasure grades

There are many other measures that affect CO_2 emissions, but here we have focused on those with relatively large impacts, which are also relatively easy to set assessment conditions for. Therefore, narrow the assessment subjects to a certain range of efforts and do not evaluate others. Also, the precision of the process may not be high, because the assessment results for other scoring items are only calculated simply.

However, for the promotion of global warming countermeasures, it is important to widely publicise CO_2 emissions, their values and reduction effects, so we have decided to present approximate figures.

LR3.2 Consideration of Local Environment

LR3.2.1 Air Pollution

Evaluate as level 5 if absolutely no atmospheric pollution is generated on the site. Table 152 shows CASBEE Iskandar Building LR3.2.1 Air Pollution Scoring System.

Table 152: CASBEE Iskandar Building LR3.2.1 Air Pollution Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	Gas and dust concentrations at sources of NOx, SOx and dust exceeds the emission standards set by the Clean Air Regulations (2014), Environmental Quality Act 1976, and the Clean Air Quality Guidelines by the Department of Environment.
Level 2	(No corresponding level)
Level 3	Gas and dust concentrations at sources of NOx, SOx and dust are reduced to below the emission standards* set by the Clean Air Regulations (2014), Environmental Quality Act 1976, and the Clean Air Quality Guidelines by the Department of Environment.
Level 4	Gas and dust concentrations at sources of NOx, SOx and dust are considerably reduced to below the emission standards* set by the Clean Air Regulations (2014), Environmental Quality Act 1976, and the Clean Air Quality Guidelines by the Department of Environment.
Level 5	No incineration equipment is used, and no atmospheric pollutants leave the virtual enclosed space boundary of the building to the outside.

*[1] For Level 3, the concentration level should be limited to below the standard value and over 90% of the standard value.

*[2] For Level 4, the emission concentration should be limited to below 90% of the standard value.

In cases where specification/performance values are not yet established, evaluate based on the equipment intended for use or on target performance values of equipment in operation. If absolutely no atmospheric pollutants are generated on site, level 5 should be awarded (evaluated as no load is emitted from the virtual enclosed space boundary to space outside).

Accordingly, Level 5 may be given when no combustion equipment is used on-site. If combustion equipment is used, evaluate at Level 3 or 4, according to the reduction rate. In the above scoring criteria, level 4 is for 90% or less of the standard value, but that figure will be revised as appropriate in future, to take into account future trends in technical development and cost. Emergency generation equipment and other devices which are not normally in operation are not evaluated under this item.

If there are multiple types of relevant devices, emitting differing concentrations of atmospheric pollutants, take a weighted average of the standard outputs of each installed device.

Table 153: Calculation Method for Multiple Devices (with Sample Values)- Entire Building

(1) Specifications	(2) Combustion capacity of equipment (kW)	(3) Coefficient	(4) = (1) x (3)
Concentration level 80%	300	300/450=0.67	0.536
Concentration level 85%	100	100/450=0.22	0.187
Concentration level 100%	50	50/450=0.11	0.11
	450	Total	0.833(83%)

LR3.2.2 Heat Island Effect

Table 154: CASBEE Iskandar Building LR3.2.2 Heat Island Effect Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	0 points in the table of the efforts to be evaluated.
Level 2	1-5 point(s) in the table of the efforts to be evaluated.
Level 3	6-12 points in the table of the efforts to be evaluated.
Level 4	13-19 points in the table of the efforts to be evaluated.
Level 5	20 points or more in the table of the efforts to be evaluated.

Evaluate measures that contribute to reduction in off-site thermal load such as due to heat island. Verify measures are implemented and award the appropriate level according to the point total. Note that the corresponding on-site measures are evaluated in the assessment under "Q3.3.2 Improvement of the Thermal Environment on Site."

Table 155: CASBEE Iskandar Building LR3.2.2 Heat Island Effect Scoring System – Efforts to Be Evaluated

Score	Assessment Item		Description
1～2	I. Preliminary investigation of heat environment	1) Preliminary investigation of the local heat environment	[1] Existing data such as data from nearby meteorological stations and regional meteorological observation data (METMalaysia data) was used to identify the wind environment, including directions, speeds and prevailing direction. (1 point)

			[2] In addition to [1] above, on-site measurements were taken, or a supplementary detailed investigation was performed using a wide-area environmental forecasting system based on wide-area meteorological data and topographical data. (2 points)
1～2	II. Thermal impact reduction in surrounding area	2) Thermal impact reduction in surrounding area by facilitating the flow of air toward downwind areas	[1] Position and shape of the building are arranged in the planning to promote the flow of air downwind. The building has no practical impact on the flow of air downwind (1 point) The building does not obstruct the flow of air downwind (2 points)
1～3			[2] Exposed area of the building facing the prevailing Malaysia wind rose based on METMalaysia data is increased. Exposed area facing the prevailing wind direction is: Less than 40% (1 point) 40% or more but less than 60% OR the ground floor, with a minimum floor-to-floor height of 4m, is at least 50% open to promote windflow downwind through the building (2 points) 60% or more AND the ground floor, with a minimum floor-to-floor height of 4m, is at least 50% open to promote windflow downwind through the building (3 points)
1～3			[3] Height, shape and spacing of building are arranged to recover the flow of air.

			Open space ratio is >60% plinth area (1 points) 50-60% of plinth area (2 points) <50% of plinth area (3 point)
1～3		3) Consider ground surface coverage to reduce thermal impact beyond the site	[1] Ground covering materials are used to reduce thermal impact.
			Percentage of ground covered with appropriate materials is: 15% or more but less than 30% (1 point) 30% or more but less than 45% (2 points) 45% or more (3 points)
1～3		4) Consider the building cladding materials to reduce thermal impact beyond the site	[1] Rooftop greenery system or high reflective roof material is used to reduce thermal impact.
1～3			Percentage of roof covered with appropriate system/material is: Less than 20% (1 point) 20% or more but less than 40% (2 points) 40% or more (3 points)
1～3			[2] Appropriate exterior wall materials are used to reduce thermal impact.
			Percentage of exterior walls covered with appropriate material is: Less than 10% (1 point) 10% or more but less than 20% (2 points) 20% or more (3 points)
1～3		5) Reduce atmospheric emission of heat	[1] Appropriate measures to prevent heat loss via exterior walls/windows and to improve energy efficiency for A/C systems have been implemented.

		from building equipment	Score (results) in the "LR1 Energy" assessment is: 3.0 or more but less than 4.0 (1 point) 4.0 or more but less than 4.5 (2 points) 4.5 or more (3 points)
1～3			[2] Air temperature increase is reduced by measures such as cooling of waste heat emitted from building service systems.
			Measures established to control air temperature increase are: at standard level (1 point) at intermediate level (2 points) at advanced level (3 points)
1～2	III. Confirmation of effects	6) Use simulations or other means to confirm effects in mitigating deterioration of the heat environment	[1] Building form and positioning, relative to wind direction, were considered at the desk plan stage (desktop prediction). (1 point)
			[2] Numerical simulation of fluid flow, or other methods, was used for the current situation and the planned building, considering topography of the site area, the building and surrounding green space, to predict impact. (2 points)

Assessment Item 1 -

Preliminary investigation of heat environment

Appropriate implementation of a preliminary survey is a necessary beginning to devising measures to reduce thermal impact beyond the site. Evaluate according to the level of the preliminary survey.

For Item [1], award 1 point in cases where a preliminary analysis of wind characteristics (directions, velocity and prevalence) is conducted using existing data from nearby meteorological stations.

For Item [2], award 2 points in cases where, in addition to the preliminary analysis, wind characteristics are identified more thoroughly based on field measurements or are supplemented with a wide-area atmospheric environment forecasting system based on wide-area metrological/topographical data.

Provide documentation or drawings to support the analysis for third party verification.

Assessment Item 2 -Thermal impact reduction in surrounding areas

Thermal impact reduction in surrounding areas by promoting the flow of air to downwind areas to ensure effective airflow to downwind/surrounding areas, a structure's wind resistance requires review from a broader perspective.

For Item [1], evaluate whether the building obstructs the flow of air to surrounding areas. Perform a qualitative evaluation on how the positioning of the building affects the airflow to surrounding areas (e.g.: residential areas, parks, schools, greenbelt, etc.). Award 2 points for effective positioning, such as the example shown in Figure 42, which does not obstruct flow. Award 0 points where the building seems to obstruct flow and one point where the building has no practical impact on airflow. In analysing wind conditions of the building's surroundings, collect and review all available data such as local wind characteristics.

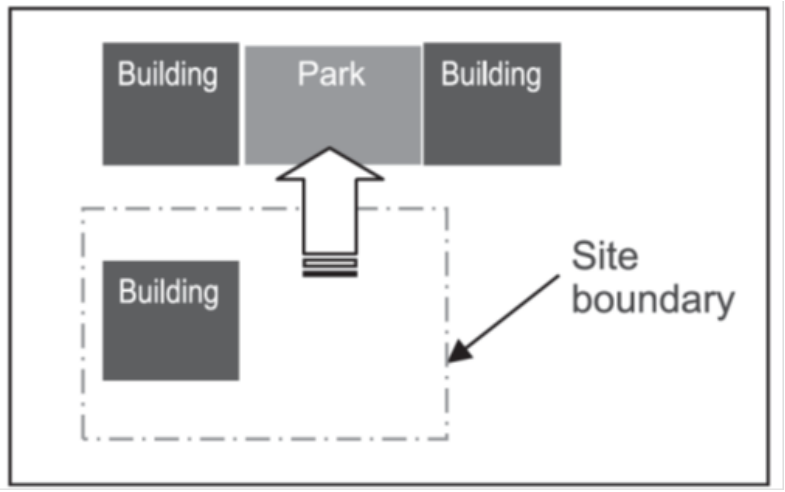


Figure 42: Example of building position for unobstructed air flow

For Items [2] and [3], evaluate the building's effectiveness in promoting airflow to downwind areas from a broader perspective.

i. A decrease in wind velocity occurs in downwind areas due to building wind resistance. The impact can thus be greatly reduced by ensuring that the smallest possible exposed area faces the prevailing wind. However, facades that face prevailing wind may be able

to increase the amount of wind entering the building, promoting natural ventilation. For Item [2], evaluate the exposed area of the building facing the prevailing wind.

ii. At the same time, decreased wind velocity due to a building is expected to regain somewhat on the site if the space between buildings is wider (i.e. building units are positioned sparingly in the direction of the prevailing wind). Thus, for Item [3], evaluate recovery wind velocity based on building spacing.

iii. In cases where the maximum floor space ratio of the subject site is not specified according to any of the following: urban planning, the width of the frontal road, or by-laws, 1 point is given to [2] and [3].

iv. To promote the continuity of wind flow through the site near the ground plane, additional consideration is given if the ground floor has a minimum floor-to-floor height of 4m and if it is at least 50% open (unenclosed throughout its depth or width) to allow prevailing wind to flow through and out of the building to downwind sites.

v. The percentage of exposed area of the building facing the prevailing wind direction is calculated by using the following formula:

Percentage of exposed area = Sb / (Ws x Hb) x 100(%)

where Sb = Exposed area of the building facing the prevailing wind

Hb = Standard height

Ws = Maximum width of site perpendicular to the prevailing wind direction

a. The exposed area (Sb) of the building facing the prevailing wind is the upper front area above the ground level of the building front.

b. Retaining walls for adjusting the height difference on-site may be excluded from the calculation of exposed areas.

c. Standard height (Hb) is expressed as [(Standard floor space ratio) / (Standard building coverage ratio)] x (Average floor height above the ground).

d. The floor height above the ground is the number of storeys of the subject building, excluding the basement.

e. When the prevailing wind direction is not perpendicular to the property line, base the evaluation on the orthogonal-oriented wind closest to the prevailing wind.

f. In cases where the site consists of several buildings, evaluate based on the overall exposed area of all buildings.

g. In cases where the site is irregularly shaped, determine the maximum site width according to the method shown in Figure 44.

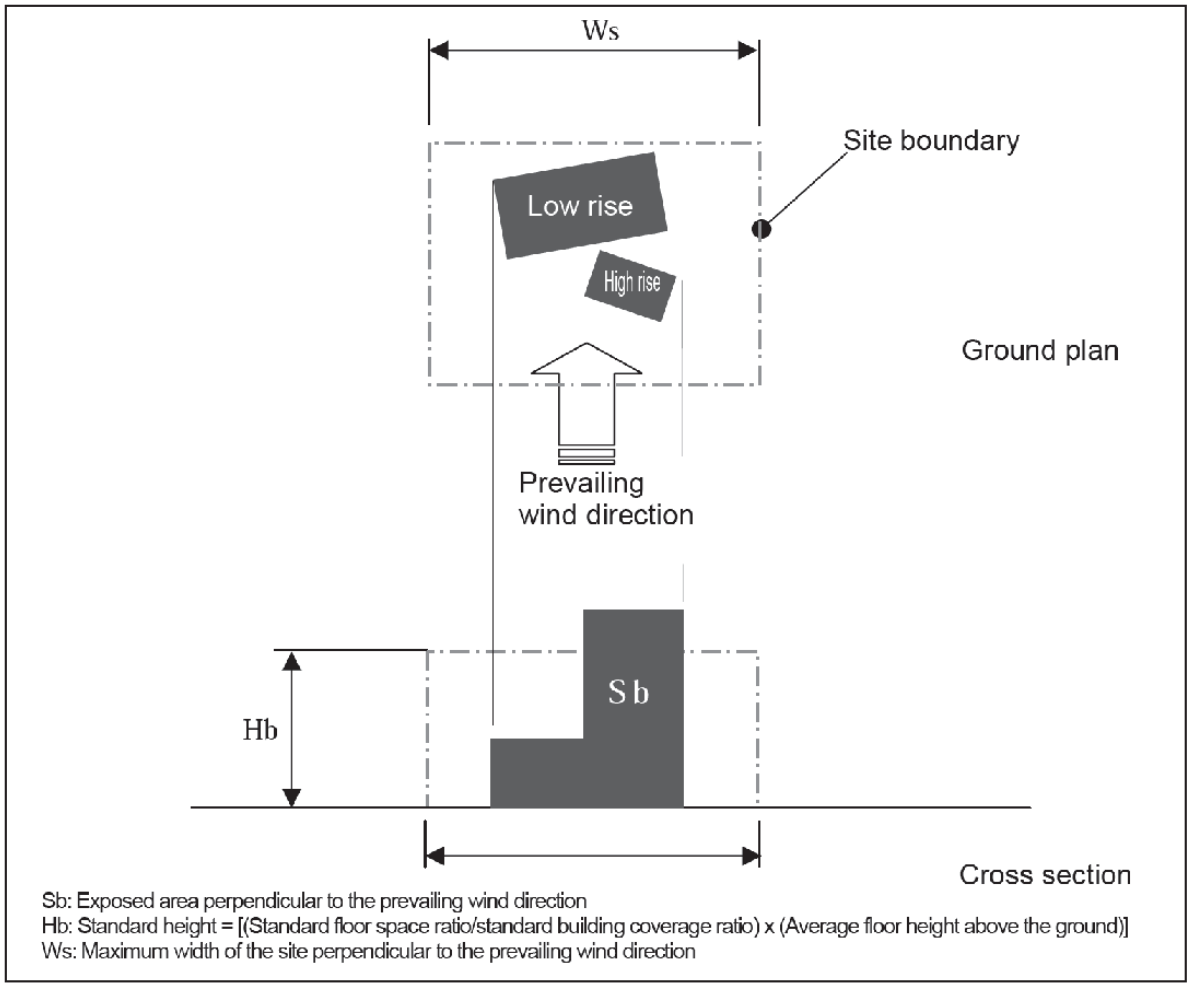


Figure 43: Percentage of the exposed area of the building that faces the prevailing wind

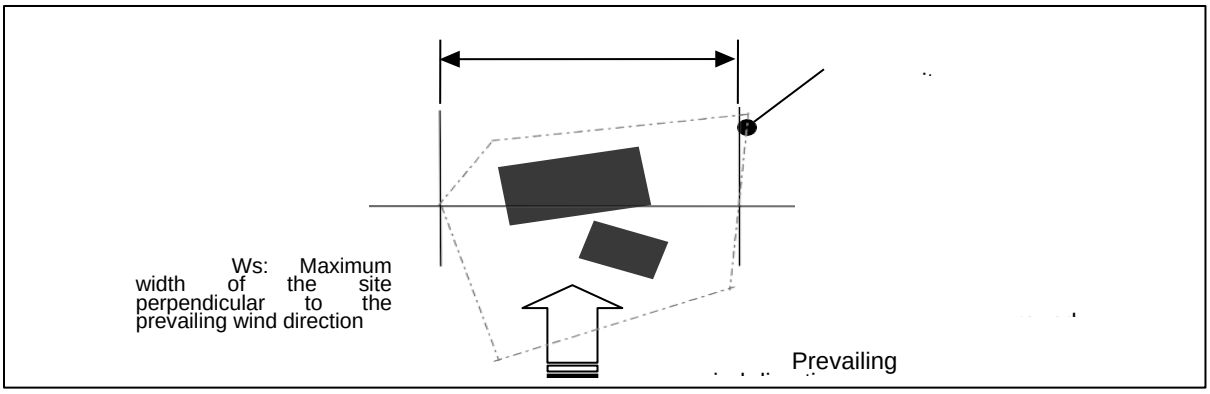


Figure 44: Ws of an irregularly-shaped site

i. When the subject building is located on a slope, the exposed area (Sb) above the average ground level is calculated.

When multiple buildings are located on a slope, the exposed area (Sb) is calculated in the following procedure:

a. The height of individual buildings is the height from the average ground level of such buildings.

b. The exposed area Sb is calculated assuming that the site is a horizontal ground level (The average ground levels of the individual buildings are all at the same height) on which buildings having the height defined in Item [1] are located.

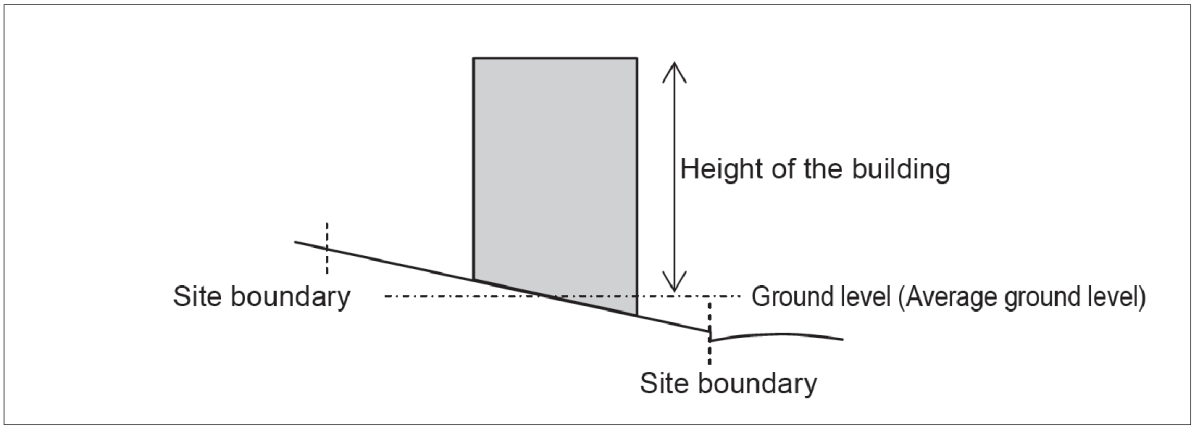


Figure 45: Calculation of the height of a building located on a slope

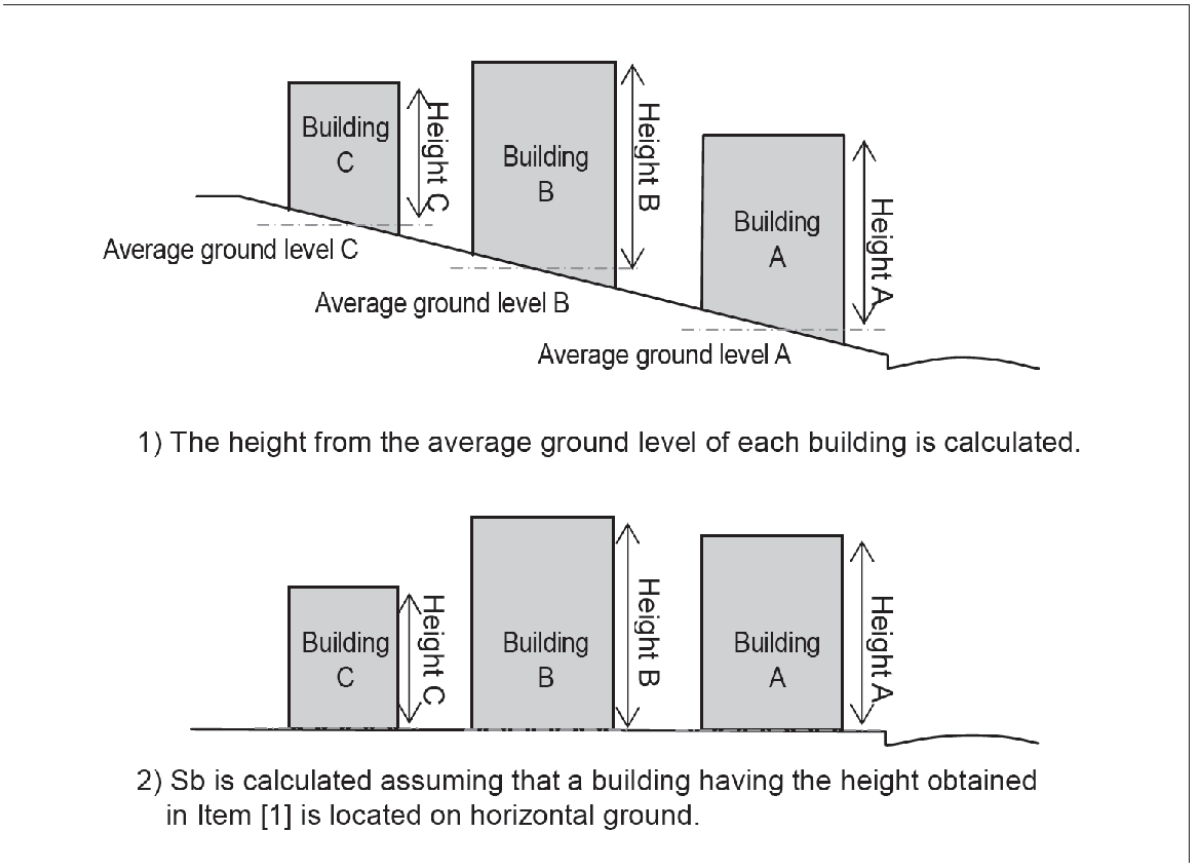


Figure 46: Calculation of the exposed area in cases when multiple buildings are located on a slope

For Item [3], in order to promote wind recovery in the area downwind from the building, the assessment is based on the ratio of open space to building footprint, which is the ratio of the setback distance from the site boundary in the direction of the prevailing wind relative to the building's span perpendicular to the prevailing wind, as well as the distance from the adjacent buildings (if relevant).

i. The site boundary that provides the maximum site width against the direction of the prevailing wind is determined in order to evaluate the setback distance in the direction of the prevailing wind.

ii. When the prevailing wind is not perpendicular to the property line, base the evaluation on the orthogonal-oriented wind closest to the prevailing wind instead.

iii. In cases where the site is irregularly shaped, determine the maximum site width Ws in the direction of the prevailing wind, according to Figure 44.

iv. In cases where the site consists of several units or buildings, aggregate the total plinth dimensions of all buildings against the maximum site width Ws.

Consider ground surface coverage to reduce thermal impact beyond site

Evaluate thermal impact reduction measures, namely the use of ground covering materials with a high evaporative cooling capacity or solar reflectance. Both types of ground covering measures are included in this assessment.

i. Base evaluation on the percentage of ground covered with appropriate materials. Obtain the percentage using the formula below:

<Percentage of ground covered with appropriate materials>
= <Percentage of ground covered with evaporative materials> +
<Percentage of ground covered with highly reflective material>

ii. Each percentage is obtained using the corresponding formula below:

a. Percentage of ground covered with evaporative materials.

Evaluate effectiveness of thermal impact reduction based on ground area with a high evaporative cooling capacity. The assessment is based on the total value of evaporative cooling effects for applicable areas (i.e. covered with lawn, grass or shrubs, water area, area with mid/high trees and water retention area) in lawn area equivalent.

<Percentage of ground covered with evaporative materials>
= <percentage of green-covered area> + 2.0 x <percentage of water-covered area>
+ 3.0 x <percentage of horizontal projected area of medium and tall trees>
+ <percentage of water retention area>

Obtain each of the above percentages using the following formulas:

<Percentage of green-covered area> = <Green area>/<Site area> x 100 (%)

<Percentage of water-covered area> = <Water surface area>/<Site area> x 100 (%)

<Percentage of horizontal projection area of mid-height/tall tree> = <Horizontal projection area of mid-height/tall tree>/<Site area> x 100 (%)

<Water retention area> = <Area with water-retentive materials>/<Site area> x 100 (%)

"Calculation of Tree Canopy Size and Green Area" to determine sizes of green area and horizontal projection area of mid-height/tall trees.

Materials with a high-water retention capability are those referred to "High Water Retention Materials" or equivalent materials.

Areas covered with water-permeable materials are considered as without evaporative cooling effects and are thus excluded from the total water-retentive area.

b. Percentage of ground covered with solar reflective materials

Evaluate effectiveness of solar energy reflected outward based on the percentage of ground covered with materials with high solar reflectance capability.

<Percentage of ground covered with high solar reflectance materials>
= <Area covered with high solar reflectance materials>/<Site area> x 100 (%)

Evaluate effectiveness of thermal impact reduction based on the use of ground covering materials with high solar reflectance.

Materials with high solar reflectance are coating materials water-proofing sheets, or equivalent materials.

Ground covering materials with high solar reflectance used in areas accessible by people and cars (sidewalk, roadway, parkade, parks, rooftop, etc.) have lower reflectance values than those used in inaccessible areas of rooftop (approximately 25-35% lower) in order to minimise solar reflection impacts on people (heat and light).

Consider the building cladding materials to reduce thermal impact beyond site.

Evaluate thermal impact reduction measures, namely use of effective exterior materials, in individual areas (i.e. roof and walls). For Item [1], evaluate roof area covered with evaporative cooling materials (e.g. rooftop greenery) or with materials with a high solar reflectance. Percentage of ground covered with solar reflective materials.

i. Obtain the percentage area of such materials with respect to the total roof area, using the formula below:

<Percentage of roof area with applicable materials>
= <Percentage of roof area covered with evaporative materials> +
<Percentage of roof area covered with materials with high solar reflectance>

a. Percentage of roof area covered with evaporative materials

- Evaluate effectiveness of thermal impact reduction based on the use of rooftop greenery.
- Obtain the percentage roof area with evaporative materials using the formula below
- "Calculation of Tree Canopy Size and Green Area" to determine sizes of green area on the roof and horizontal projection area of mid-height/tall trees.

<Percentage of roof covered with evaporative materials>
= <percentage of green-covered area> + 2.0 x <percentage of water-covered area> + 3.0 x <percentage of horizontal projected area of medium and tall trees> + <percentage of water retention area>

- Obtain percentages of green-covered area, water-covered area, horizontal projected area of medium-height and tall trees and water retention area on the rooftop, using the formulas below.

<Percentage of green-covered area> =<Green area>/<Total roof area> x 100 (%)

<Percentage of water-covered area> =<Water surface area>/<Total roof area> x 100 (%)

<Percentage of horizontal projected area of medium-height/tall trees> = <Horizontal projected area of medium-height/tall trees>/<Total roof area> x 100 (%)

<Percentage of water retention area> = <Water retention area>/<Total roof area> x 100 (%)

b. Roof area with high solar reflectance materials

Evaluate the effectiveness of thermal impact reduction based on the use of roof covering materials with high solar reflectance.

<Percentage of roof area covered with high solar reflectance materials>
= <Roof area covered with high solar reflectance materials>/<Total roof area> x 100 (%)

Materials with a high solar reflectance are coating materials (JPMS27), water-proofing sheets (KRKS-001), or equivalent materials, as listed in "High Solar Reflectance Materials."

A high rate of long-wave radiation promotes radiative cooling during the night, thus contributing to A/C load reduction in the evening. For Item [2], evaluate effectiveness of thermal impact reduction based on the use of green or water-retentive materials for exterior walls.

Obtain the percentage of applicable areas for the total exterior wall area (including window areas).

Percentage of the applicable exterior wall area is calculated using the formula below, as described in IV-2. Appropriate Exterior Wall Materials under "Q3.3.2 Improvement of the Thermal Environment on Site.

" Refer to "Calculation of Tree Canopy Size and Green Area" to determine the size of green-covered areas on the exterior walls.

<Percentage of exterior wall area with applicable materials>= (<Green-covered exterior wall area> + <Exterior wall areas with water-retentive materials>)/<Total exterior wall area> x 100 (%)

Reduce atmospheric emission of heat from building equipment

For Item [1], evaluate reduction of atmospheric thermal emissions from building service systems based on effective energy use. Effective measures include the following:

i. Building thermal load control

Sun shielding structures (e.g. mid/tall trees, eaves, louvers); control of waste heat from A/C system via insulation reinforcement

ii. Improved efficiency in the building service system

Use of an energy-efficient system (e.g. A/C, lighting, ventilation, elevators)

iii. Natural energy utilisation (optimal use of natural energy potential of the surrounding areas)

Use of natural airflow and daylight

iv. Untapped energy utilisation (optimal use of urban waste heat from surrounding areas)

Use of waste heat from garbage incineration facility

Use of seawater, river water, groundwater, etc.

v. Introduction of high-efficiency infrastructure Regional heating/cooling systems For overall evaluation of the measures above, apply the score results obtained in the "LR1 Energy" assessment. Award 1 point for a score of 3.0 or higher but lower than 4.0, 2 points for a score of 4.0 or higher but lower than 4.5, and 3 points for a score of 4.5 or higher.

For Item [2], evaluate reduction of atmospheric thermal emissions from A/C external units (i.e. sensible heat emissions) that directly affect air temperature.

vi. Standard-level measures refer to methods such as maintaining waste heat temperature as low as possible (e.g. effective positioning of A/C exterior units away from intake vents to avoid recirculation of diffused air).

vii. Advanced-level measures refer to methods that control/reduce sensible heat emission by approximately 80% or more, such as latent heat conversion (e.g. water misting, evaporative cooling, use of river water and sewage water as a heat sink, and waste heat recovery.)

viii. Award 3 points for residential buildings.

ix. In apartments, establish appropriate points based on points from non-residential and residential sections (i.e. 3 points) using the building's gross floor area ratio.

Use simulations or other means to confirm effects in mitigating deterioration of the heat environment

i. Award 1 point if a desktop study (desktop prediction) has been made on the form and layout of the building relative to the wind direction, and the study found that thermal impact beyond the site is being thoroughly reduced.

ii. Award 2 points if numerical simulation of fluid flow, or other methods, were used on the current situation and the planned building, considering topography of the site area, the building and surrounding green space, to predict impact, and the study found that thermal impact beyond the site is being thoroughly reduced. Append documents and diagrams so that the above effects can be confirmed by a third party.

LR3.2.3 Load on Local Infrastructure

LR3.2.3.1 Reduction of Rain Water Discharge Loads

Exclude from assessment if the region concerned has no administrative guidelines for rain water flow suppression. Table 156 shows CASBEE Iskandar Building LR3.2.3.1 Reduction of Rain Water Discharge Loads Scoring System.

Table 156: CASBEE Iskandar Building LR3.2.3.1 Reduction of Rain Water Discharge Loads Scoring System

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt <If there are administrative guidelines>	Note
Level 1	(No corresponding level)	N.A.
Level 2	(No corresponding level)	
Level 3	Rain water flow suppression measures are implemented at the instructed scale.	
Level 4	The instructed scale is satisfied, and other rain water treatment measures have been implemented.	
Level 5	(No corresponding level)	

Under this item, evaluate groundwater permeation measures and temporary storage measures, in order to evaluate performance in limiting rain water runoff flow. The assessment of rain flow control measures follows the scale of measures specified in administrative instructions concerning the methods and sizes of countermeasures, which have been set by local authorities with reference to the state of urbanisation in the area, and conditions in rivers and sewers. Areas which do not have administrative instructions should be excluded from assessment.

If administrative instructions exist in the region concerning rain water flow suppression measures, award Level 3 if the specified scale of measures has been met, and Level 4 if he specified scale has been met and further measures have also been implemented (If rain water percolation and similar measures were implemented voluntarily).

LR3.2.3.2 Sewage Load Suppression

Table 157: CASBEE Iskandar Building LR3.2.3.2 Sewage Load Suppression Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The Malaysia Sewarage Industry Guidelines (MSIG) set by Suruhanjaya Perkhidmatan Air Negara (SPAN), whichever is the most stringent, is satisfied.
Level 4	Discharge standards are satisfied, and further special measures have been used for better control of sewage loads (additional effort from owner)
Level 5	(No corresponding level)

Award level 3 if the discharge standards are satisfied. Award level 4 if the discharge standards are satisfied and special measures or targets have been adopted for more advanced efforts.

LR3.2.3.3 Traffic Load Control

Table 158: CASBEE Iskandar Building LR3.2.3.3 Traffic Load Control Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	0 points in the table of the efforts to be evaluated.
Level 2	1 point in the table of the efforts to be evaluated.
Level 3	2 points in the table of the efforts to be evaluated.
Level 4	3 points in the table of the efforts to be evaluated.

Level 5	4 points or more in the table of the efforts to be evaluated.

Table 159: CASBEE Iskandar Building LR3.2.3.3 Traffic Load Control Scoring System – Efforts to Be Evaluated

Assessment Item	Description
I. Efforts related to use of bicycles (use of alternative means of transport)	1) Provision of an appropriate number of cycle parking spaces (including motorcycle spaces) for building users, and consideration for the convenience of cycle park users (ease of entry and egress, placement in a convenient location, etc.).
	2) Other (state content)
II Efforts to provide car parking space	1) Provision of an appropriate number of car parking spaces (as a measure to avoid parking on roads, and congestion of nearby roads).
	2) Provision of parking facilities for unloading goods vehicles (residential buildings are not applicable).
	3) Consideration of the position, form and number of parking lot approach roads (entry and exit) (to contribute to relieving congestion of local roads).
	4) Other (state content)

Evaluate the content of efforts made to control traffic loads (congestion etc.) caused by automobile traffic generated by the building's operation.

Effort 1-

Efforts related to use of bicycles (use of alternative means of transport)

Under (1), evaluate measures to encourage use of bicycles, as a means of restricting the use of cars by building users.

Under (2) evaluate efforts other than those for bicycles, such as creation of new circulating bus routes.

Effort 2-

Efforts to provide car parking space.

Under (1), evaluate the provision of appropriate numbers of parking spaces, to avoid building users parking on roads outside the site.

Under (2), evaluate the provision of appropriate numbers of car parking spaces for service vehicles involved in the operation of the building (maintenance and service vehicles, delivery and pickup vehicles, package delivery vehicles, garbage collection vehicles, etc.) to avoid parking outside the site for service visits.

Under (3) evaluate efforts to facilitate smooth vehicle movement in and out of the building parking lots, avoiding vehicle congestion around the entrances and exits.

LR3.2.3.4 Waste Treatment Loads

Table 160: CASBEE Iskandar Building LR3.2.3.4 Waste Treatment Loads- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	1 point or less in the table of the efforts to be evaluated.
Level 2	2 points in the table of the efforts to be evaluated.
Level 3	3 points in the table of the efforts to be evaluated.
Level 4	4 points in the table of the efforts to be evaluated.
Level 5	5 points or more in the table of the efforts to be evaluated.

Table 161: CASBEE Iskandar Building LR3.2.3.4 Waste Treatment Load – Efforts to Be Evaluated

Assessment Item	Description
I. Estimation of types and quantities of waste	1) The types and quantities of waste generated on the site (interior and exterior) on a day-to-day basis have been estimated to assist in planning measures to reduce the waste processing load.
II. Provision of space and equipment to encourage separate collection	2) Interior and exterior stock space has been planned that will allow sorted collection of many varieties of waste.
	3) Interior and exterior waste sorting and collection containers and boxes have been planned.
	4) Planned collection of valuable materials has been planned (group collections, etc.).
III. Installation of equipment for waste reduction,	5) Measures are planned to reduce, compact and compost organic garbage (home processing and composting etc. of organic waste).

compaction or composting	6) Reduction and compaction of bottles, cans etc. are planned

Evaluate efforts to reduce the generation of waste when the building is in operation, and to sort, reduce and compact that waste.

Effort 1-

Estimation of types and quantities of waste

(1) It is important to keep track of the actual garbage output situation and manage it in order to reduce the amount of waste output from inside the building. Evaluate whether the types and quantities of waste produced on a day-to-day basis have been investigated and identified.

Effort 2-

Provision of space and equipment to encourage separate collection

(2) Various types and quantities of waste are generated inside the building. Evaluate provision of adequate space for proper sorting and stocking under (2), provision of containers, boxes, racks etc. for sorting and stocking under (3), and planning for regular planned collections for valuable materials under (4).

Effort 3-

Installation of equipment for waste reduction, compaction or composting

(3) For organic waste generated in the course of building operation, evaluate planning for reduction, compaction and composting by disposers composters and similar equipment.

(4) For bottles ,cans, and other non-organic wastes, evaluate planning for equipment to reduce and compact waste.

LR3.3 Consideration of Surrounding Environment

LR3.3.1 Noise, Vibration & Odour

LR3.3.1.1 Noise

Table 162: CASBEE Iskandar Building LR3.3.1.1 Noise Pollution Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct. Apt	Note
Level 1	Noise level exceeds the current regulation standard*1 specified under the Environmental Noise Limits and Control (DOE)	Designated facilities regulated within the designated area under the Guidelines for Environmental Noise Limits and Control by DOE. All other buildings are considered as level 3
Level 2	(No corresponding level)	
Level 3	Noise level is at or below the current regulation standard*1 specified under the Environmental Noise Limits and Control (DOE)	
Level 4	(No corresponding level)	
Level 5	Noise level is significantly below*2 the current regulation standard*1 specified under the Environmental Noise Limits and Control (DOE)	

*1 Take the current values of the regulation standard, and evaluate facilities accordingly, even if they were installed before the current values came into effect (evaluate for day and night).

*2 Level 5 applies to noise level at or below [current standard value -10 dBA] throughout the day.

The assessment item in this section covers buildings that have designated facilities subject to the regulation within the designated area(s). All other buildings shall be uniformly rated as Level 3. If, however, more active measures have been used in buildings other than the above, they may be evaluated according to their level. When using CASBEE for Building (New Construction), it is sufficient to evaluate according to the design specification. However, a condition of assessment is that the standards must be satisfied for all the measurement times, namely day (7am - 10pm), and night (10pm - 7am).

When rating as Level 5, evidence indicating that the level of noise is substantially below the current regulation standard (less than 10 dB) must be provided for the third-party inspection.

Table 163: DOE noise requirements according to zones.

	Type 1 zones		Type 2 zones	
	Day	Night	Day	Night
Level 1	Not adequate for level 3	Not adequate for level 3	Not adequate for level 3	Not adequate for level 3
Level 3	Not exceeding 60 dBA	Not exceeding 55 dBA	Not exceeding 65 dBA	Not exceeding 60 dBA
Level 5	Not exceeding 50 dBA	Not exceeding 45 dBA	Not exceeding 55 dBA	Not exceeding 50 dBA
	Type 3 zones		Type 4 zones	
	Day	Night	Day	Night
Level 1	Not adequate for Level 3	Not adequate for Level 3	Not adequate for Level 3	Not adequate for Level 3
Level 3	Not exceeding 70 dBA	Not exceeding 65 dBA	Not exceeding 75 dBA	Not exceeding 75 dBA
Level 5	Not exceeding 60 dBA	Not exceeding 55 dBA	Not exceeding 65 dBA	Not exceeding 65 dBA

Table 164: Examples of noise prevention measures

Content							**Acoustical insulation effect**
Physical methods	Technical measures against sound sources	The source of the sound must be removed	Prevention of direct pressure variation	Prevention of vortices, flow disturbances, explosions etc.			Estimate on the basis of experience and experiments etc.
			Reduction of object vibration	Reduction of agitative force		Eliminate impact, collision, friction and imbalance. Put in balance.	II
				Vibration isolation		Place anti-vibration devices between the vibrating body and the stationary body to put the vibration transfer rate below 1.	II
				Damping processes		Paint or affix damping materials to raise the loss coefficient to 5% or more. Use anti-vibration steel plates.	Estimate on the basis of experiments normally at around 10 dB.
	Transmission reduction	Reduction of the transmission of sound that has been generated	Reduction of sound transmission	Sound absorption treatment		Apply sound absorbent material to locations struck by sound to give the necessary absorption rate.	Determined bydesign
				Acoustic isolation	Sealed type	Surround the sound source with materials having the necessary transmission losses (covers, hoods, structures).	II
					Partial	Erect barriers (walls, building) sound reduction index of at least 10 dB from the source volume.	II 25 dB is the limit.
					Open type	Attach mufflers along the sound route with the necessary sound reduction index.	Determined by design
			Use of phenomena which reduce sound transmission	Distance attenuation		Move the sound source as far as possible away from the problem point.	0-6 dB double distance
				Attenuation by directionality		Do not orient directions of strong sound radiation towards the problem point.	Normally around 10 dB
				Attenuation by absorption in air		Effective with long distances and high-frequency sources.	0.6 dB/100 m (at 1 kHz). Around 5 dB/100 m (at 8 kHz)
				Attenuation by air temperature and wind		Place the sound source downwind.	Differs with wind speed and air temperature distribution
				Attenuation by absorption in		Make the ground surface sound absorbent.	0.7 dB/10 m for grass 30 cm high (at 1 kHz)
				Attenuation by trees		A row of trees will have no effect.	Around 10 dB/50 m for trees with high leaf density
Sensory methods	Masking			Generate a noise to mask the offending noise. Effective against low noise levels.			
Psychological methods	Greetings, compensation etc.			Consider psychology in dealing with the situations of the offended and offending parties.			

LR3.3.1.2 Vibration

The assessment is carried out regarding buildings that have designated facilities regulated within the designated area(s) under the Environmental Vibration Limits and Control requirement sets by the Department of Environment. All other buildings are excluded from this assessment. Table 165 shows CASBEE Iskandar Building LR3.3.1.2 Vibration Scoring System.

Table 165: CASBEE Iskandar Building LR3.3.1.2 Vibration Scoring System- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	Vibration level exceeds the current regulation standard*1 specified under the Environmental Vibration Limits and Control requirements set by the Department of Environment.	The assessment is carried out regarding buildings that have designated facilities regulated within the designated area under the Environmental Vibration Limits and Control requirements. All other buildings are excluded from this assessment.
Level 2	(No corresponding level)	
Level 3	Vibration level is at or below the current regulation standard*1 specified under the Environmental Vibration Limits and Control requirements set by the Department of Environment.	
Level 4	(No corresponding level)	
Level 5	Vibration level is significantly below*2 the current regulation standard*1 specified under the Environmental Vibration Limits and Control requirements set by the Department of Environment.	

*1 Take the current values of the regulation standard, and evaluate facilities accordingly, even if they were installed before the current values came into effect (evaluate for both day and night).
*2 For level 5, vibration should be limited to below [current standard value -5 dB] (for both day and night).

For this item, evaluate the impact of vibration generated within the site on adjacent sites and the surrounding area. The assessment item in this section covers buildings that have designated facilities subject to the regulation within the designated area. All other buildings are excluded from the assessment. When using CASBEE for Building (New Construction), it is sufficient to evaluate

according to the design specification. However, a condition of assessment is that the standards must be satisfied for all the measurement times, namely day (8am - 7pm), and night (7pm - 8am). When rating as Level 5, evidence indicating that the level of vibration is substantially below the current regulation standard (less than 5 dB) must be provided for the third-party inspection. Table 166 shows the Standard Values from the Environmental Vibration Limits and Control Requirements.

Table 166: Standard Values from the Environmental Vibration Limits and Control Requirements

	Type 1 zones		Type 1 zones	
	Day	Night	Day	Night
Level 1	Not adequate for Level 3	Not adequate for Level 3	Not adequate for Level 3	Not adequate for Level 3
Level 3	Not exceeding 60 dB	Not exceeding 55 dB	Not exceeding 65 dB	Not exceeding 60 dB
Level 5	Not exceeding 55 dB	Not exceeding 50 dB	Not exceeding 60 dB	Not exceeding 55 dB

LR3.3.1.3 Odour

Evaluate buildings within the regulated areas as specified under the Environmental Quality Act 1974 (Act 127) and buildings in which designated malodorous substances are handled. Buildings in which such substances are not handled are excluded from this assessment. Table 167 shows CASBEE Iskandar Building LR3.3.1.3 Odour.

Table 167: CASBEE Iskandar Building LR3.3.1.3 Odour- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt	Note
Level 1	Odour level is below the allowable limit for odour index, and for the concentrations of currently designated malodorous substances under the Environmental Quality Act 1974 (Act 127)	Evaluate buildings within the regulated areas as specified under the Environmental Quality Act 1974 and buildings in which designated malodorous substances are handled. Buildings in which such substances are not handled are excluded from this assessment and N/A shall be selected.
Level 2	(No corresponding level)	
Level 3	Odour level satisfies the allowable limit for odour index, and for the concentrations of currently designated malodorous substances under the Environmental Quality Act 1974 (Act 127).	
Level 4	(No corresponding level)	
Level 5	(No corresponding level)	

For this item, as no specific limit is specified under the Environmental Quality Act 1974 (Act 127), it is suggested to evaluate at Level 3.

LR3.3.2 Wind/Sand Damage & Daylight Obstruction

LR3.3.2.1 Wind/Sand Damage & Daylight Obstruction

Table 168: CASBEE Iskandar Building LR3.3.2.1 Wind/Sand Damage & Daylight Obstruction

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	No preliminary study or was performed about the creation of strong wind spots*1 and no countermeasures*2 were taken against wind hazard.
Level 2	A preliminary study has been performed and measures taken to avoid or reduce wind hazard, but there has been no assessment. Alternatively, wind strength grade has been evaluated on the basis of a desktop forecast*3, and wind strength has been worsened in some areas, or there are measurement points at which the wind environment rank for the sight has been lowered.
Level 3	A preliminary study has been performed and measures taken to avoid or reduce wind hazard*4. Then, the wind strength grade has been evaluated on the basis of a desktop forecast*3, and the results show that wind strength has not worsened. Alternatively, rank assessment has been performed on the basis of wind environment assessment indices*5, and the results indicate that a wind environment with suitable rank for the location has been achieved.
Level 4	A preliminary study or prevention planning has been performed and measures taken to avoid or reduce wind hazard, followed by a rank assessment*5 has been performed on the basis of wind environment assessment indices. Results indicate that the wind environment in some parts is better than usual for the location.
Level 5	A preliminary study or prevention planning has been performed and measures taken to avoid or reduce wind hazard, followed by a rank assessment*5 has been performed on the basis of wind environment assessment indices. Results indicate that the wind environment is better than usual for the location.

*1 Preliminary study

*2 Wind hazard reduction measures

*3 Desktop forecast

*4 Prevention plan and reduction and avoidance countermeasures

*5 Rank assessment on the basis of wind environment assessment indices

LR3.3.2.2 Sand and Dust

Table 169: CASBEE Iskandar Building LR3.3.2.2 Sand and Dust- Entire Building

Score	Sch (Primary/Secondary)
Level 1	(0 points)
Level 2	Insufficient level of measures for schoolyard dust control are established. (1 point)
Level 3	Standard level of measures for schoolyard dust control are established. (2 points)
Level 4	More than sufficient level of measures for schoolyard dust control are established. (3 points)
Level 5	A high level of measures for schoolyard dust control are established. (4 points or higher)

Table 170: CASBEE Iskandar Building LR3.3.2.2 Sand and Dust – Assessment Item

Assessment Item	Description
I. Measures to control airborne dispersion of dust from schoolyard	(1) Dust shield trees or nets surrounding the school perimeter
	(2) Structures surrounding the school perimeter
II Dust-proofing measures for schoolyard surface	(1) Sprinkler system.
	(2) Dust-proof paving
	(3) Dust-proof paving/lawn covering

LR3.3.2.3 Restriction of Daylight Obstruction

Evaluate Level 3 if there are no shade regulations in place.

Table 171: CASBEE Iskandar Building LR3.3.2.3 Restriction of Daylight Obstruction- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Shade regulations are satisfied, or there are no shade regulations applicable to the site.
Level 4	Avoidance of daylight obstruction is proven through simulations.
Level 5	(No corresponding level)

LR3.3.3 Light Pollution

LR3.3.3.1 Outdoor Illumination and Light that Spills from Interiors

Table 172: CASBEE Iskandar Building LR3.3.3.1 Outdoor Illumination and Light that Spills from Interiors- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	0 points in the table of the efforts to be evaluated.
Level 2	1 point in the table of the efforts to be evaluated.
Level 3	2 points in the table of the efforts to be evaluated.
Level 4	3 points in the table of the efforts to be evaluated.

Level 5	4 points in the table of the efforts to be evaluated.

In the absence of a mandate based on law, regulation of administrative instruction, or of demands from the local area, building which apply no particular measures should be awarded Level 3. Table 173 shows CASBEE Iskandar Building LR3.3.3.1 Outdoor Illumination and Light that Spills from Interiors – Efforts to Be Evaluated.

Table 173: CASBEE Iskandar Building LR3.3.3.1 Outdoor Illumination and Light that Spills from Interiors – Efforts to Be Evaluated

Assessment Item
1) Outdoor illumination and light that spills from interiors
Only some of the checklist points of the CIE91.1.160/ ISO/ CIE8995-3:2018 (universal guideline) or equivalent (eg: Light Pollution Countermeasure Guidelines) are satisfied. (1 point) A majority of the checklist points of the CIE91.1.160/ ISO/ CIE8995-3:2018 (universal guideline) or equivalent (eg: Light Pollution Countermeasure Guidelines) are satisfied. (2 points)
2) Countermeasures against light pollution from billboard lighting
Billboard lighting satisfies some of the considerations in "Considerations for Billboard Illumination" as referred to local government act, JKR & KKR guideline (Tatacara Iklan latest version) (1 point) A majority of the considerations in "Considerations for Billboard Illumination" as referred to local government act, JKR & KKR guideline (Tatacara Iklan latest version) are satisfied, or there is no billboard lighting. (2 points)

Evaluating light pollution caused by buildings includes exterior lighting at night, light spill from the interior, lighting for advertising displays, and glare reflecting from the building. For this item, the basic approach should be to use the level of compliance with the CIE91.1.160/ ISO/ CIE8995-3:2018 (universal guideline) or equivalent (eg: Light Pollution Countermeasure Guidelines).

If a Local Illumination Environment Plan has been adopted by a local authority, the level of compliance with that plan may also be used as the judgement standard.

Effort 1-

Outdoor illumination and light that spills from interiors

The efforts may be evaluated using the CIE91.1.160/ ISO/ CIE8995-3:2018 (universal guideline) or equivalent (eg: Light Pollution Countermeasure Guidelines), or a Local Illumination Environment Plan (or equivalent). For ease of reference, the following is extracted from the Light Pollution Countermeasure Guidelines.

Table 174: Checklist for a good lighting environment" in the Light Pollution Countermeasure Guidelines

Check item	Approach and examples of measures
0. Was the examination system appropriate? - Did any lighting specialist participate in the examination system?	---Add a person with specialist knowledge of light and illumination to the examination system. ---If it is difficult to put such a person into the examination system, get the expert's advice as an advisor.
Is energy used effectively? Are illumination levels set appropriately for purposes? Is the brightness too high or too low, relative to the JIS brightness standard or other lighting-related standards? Is the illuminated range appropriate? Is it wider than necessary? Does the chosen light source have high overall efficiency? Was the installation of lighting equipment with high coefficient of utilisation, or of equipment for increasing coefficient of utilisation, considered?	Set brightness to match the purpose of the lighting, with reference to the JIS brightness standard or other lighting-related standards. If brightness is too high, change to a lower-wattage light source. Reconsider the illuminated range. Reference 2) Choose overall efficiency higher than that in the Guide to outdoor lighting equipment. Reconsider the lighting patterns and installation positions of the lighting equipment.
2. Have measures been devised to diminish the impact on human activities? Has lighting equipment been chosen that leaks little light upwards or towards the surroundings?	- Select lighting equipment which satisfies upward light output ratio in the "Guide to outdoor lighting

Also, have measures been considered to reduce light leakage? Is reference 2), upward light output ratio in the "Guide to outdoor lighting equipment" satisfied. Have glare and extreme contrast been restricted? Have target values been considered for restriction of luminosity and luminance from lighting equipment in directions that cause problems? Could light that is excessive in brightness, brilliance, hue or other changes over time causes discomfort or impede daily activities? Have target values for luminance of illuminated surfaces or the brightness of windows due to leaked light been considered?	equipment" Reference 2). Alternatively, consider installation of the following. - Reconsider the selection of lighting equipment and the direction of light projection. If necessary, use louvers and hoods, etc. for shading. - Reconsider the settings for brightness (luminance) and operation methods. Lower the set brightness (luminance) if necessary. Alternatively, use louvers and hoods, etc. to shade lighting equipment.
3. Have measures been devised to diminish the impact on flora and fauna (ecosystems)? - Was harmony with the surroundings considered? Does the lighting plan involve lighting that is far brighter than the surrounding environment? Has a survey been conducted of flora and fauna that should be protected in the environment surrounding the lighting equipment? Have measures been considered to avoid impact on flora and fauna that should be protected?	Reconsider the set brightness. If brightness is too high, change to a lower-wattage light source. Reinvestigate impact on the surrounding environment, and reconsider whether lighting equipment should be installed, and the appropriateness of the set brightness, the lighting equipment used, the operating methods and other aspects.
4. Have operation and management methods been considered? Is there an operating plan with specifications for each time bracket, tailored to the surrounding?	Consider adjustable brightness, or turning off some or all lights, at night.

Environment? Have periodic cleaning and lamp replacement been considered?	Consider performing periodic inspection, cleaning and lamp replacement.
5. Has care been taken over application to district development? - Was there overall coordination? -Was lighting design considered that incorporated public, semi-public and private spaces? - Were the targets of measures selected appropriately? - Were safety and peace of mind considered?	Have a district development coordinator check impact on cooling loads, scenic appearance, and other aspects. Lighting design should address lighting of plots on both sides of roads, and spaces that face the street. Consideration of parking lots, used car lots and outdoor golf driving ranges, which can be expected to have a strong impact. Consideration of lighting that is suitable for crime prevention, etc.

Table 175: Guide to outdoor lighting equipment" in the Light Pollution Countermeasure Guidelines

Regulations	Assessment	Content
Overall efficiency	Evaluate for overall efficiency. Lamp output/(lamp power + power losses in the lighting circuit)	If lamp input power is 200W or more, we recommend at least 60 [lm/W], and at least 50 lm/W for lamps below 200W.
Overall efficiency	Coefficient of utilisation = effective used output/total lamp output = (lit area x average brightness)/total lamp output	Coefficient of utilisation is the proportion of the light generated by the lamp which reaches areas or objects which require illumination.

Upward light output ratio	Evaluate according to ULOR (upward light output/lamp output).	Lighting environment I*: 0%
		Lighting environment II*: 0-5%
		Lighting environment III*: 0-15%
		Lighting environment IV*: 0-20%
Glare and impact on human activities	"Standard for Exterior Public Illumination for Pedestrians"	
	Following the points under "Glare restriction" in the Basically, follow existing JIS and technical guidance.	
Impact on flora and fauna	Improve the light distribution characteristics and mounting of lighting equipment, or place light screens, etc. in the environment to limit, as far as possible, the artificial light shining into the natural environment.	

Table 176: "4 types of lighting environment" in the Light Pollution Countermeasure Guidelines

(1) Lighting environment I	These are natural parks or rural communities, in which the density of installation of outdoor lighting equipment is relatively low. Such areas are basically dark.
(2) Lighting environment II	These are residential areas in villages or suburbs, with the main lighting behind street lamps and anti-crime lamps, etc., with low brightness in surrounding areas.
(3) Lighting environment III	These are urban residential areas, with road and street lighting and some distribution of objects such as billboards, with moderate brightness in surrounding areas.

(4) Lighting environment IV	These are busy urban districts and the centers of major cities, with a high density of outdoor illumination and billboards, and with high brightness in surrounding areas.

Effort 2-

Light pollution from billboard lighting

Evaluate lighting used on all outdoor advertising (spotlights, neon lights and other lighting of advertising surfaces) and outdoor advertising activities (moving signs, vending machines, searchlights, etc.). Evaluate according to the proportion of the considerations that have been implemented among those listed in considerations for Billboard Illumination guidelines, with reference to the Local Government Act, JKR, and KKR guidelines (latest version of "Tatacara Iklan".

LR3.3.3.2 Measures for Reflected Solar Glare from Building Walls

Table 177: CASBEE Iskandar Building LR3.3.3.2 Measures for Reflected Solar Glare from Building Walls- Entire Building

Score	Off, Sch, Rtl, Rst, Hal, Hsp, Htl, Fct, Apt
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Not adequate for Level 4.
Level 4	Measures for reducing reflected glare from building walls (including glass surfaces) are taken.
Level 5	In addition to efforts required for Level 4, further advanced measures such as confirming a significant reduction effect due to simulation practice are taken.

For this item, as the countermeasures for light pollution caused by buildings, evaluate measures to mitigate the glare cast on the surrounding area by reflection of daylight from walls. Glare caused by reflection of daylight from buildings can cause unanticipated impact, particularly in office buildings with large areas of glass. Therefore, this is a matter that must be considered with great care.

Major measures against reflected glare evaluated as Level 4 are as follows:

Table 178: Major measures against reflected glare evaluated as Level 4

Measure	Method	Content
Counter measures on building walls	Reduced reflectance	Application of anti-reflection film on the inner side of the reflecting surface, or a coating applied to the glass, can cut reflectance.
	Diffuse reflection	Measures such as surface treatments and tempered glass can make the reflection more diffuse.
	Adjusted reflection angle	The angle at which the glass is mounted can be adjusted to reduce the impact of reflections.

Glass may become prone to thermal cracking due to higher solar absorbance rate. Glass with surface treatment is limited by wind pressure strength consideration.

Measures evaluated as Level 5 include, in addition to implementing those rated as Level 4, performing a simulation in order to ensure a significant reduction of glare or elimination of almost all glare due to the measures.