THE INTELLIGENT BUILDING INDEX MANUAL

Version 5.0

Asian Institute of Intelligent Buildings (AIIB)

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Fifth Edition Preface

Intelligent Buildings have been developing for about 40 years since the 1980's. As a succession to Johnson Controls Intelligent Building Research Centre established in City University of Hong Kong in 1997, The Asian Institute of Intelligent Buildings (AIIB) was established in December 2000 by adopting the definition of Intelligent Buildings (IBs) proposed by the Research Centre, which is "*An Intelligent Building is designed and constructed based on an appropriate selection of QUALITY ENVIRONMENT MODULES to meet the user's requirements by mapping with the appropriate building facilities, termed Elements in the IBI Manual, to achieve long-term building value.*" [1] AIIB was founded by four founding Corporate Members and has been administered by the Council and the Executive Committees. Chapters in Asian cities have been established, including Singapore Chapter in 2004, Kuala Lumpur Chapter in 2010 and Taiwan under establishment. The four missions of AIIB are as follows:

i) to develop Asian definition and standards for intelligent buildings,
ii) to act as an independent certification authority for intelligent buildings through the use of The Intelligent Building Index (IBI),
iii) to educate and promote to the community benefits of intelligent buildings, and
iv) to work with international counterparts to bring Asia up to date on developments related to intelligent buildings.

With a view to missions (i) and (ii), AIIB has been developing her unique assessment scheme for intelligent buildings based on the official definition of IB, named IBI. Before we look at this new version of IBI, it is appropriate for us to have a quick review on history of development of building intelligence.

The development of building intelligence has been swift in the past four decades. There have been five generations of the development of building intelligence, viz. (1) Automated Building Model; (2) Responsive Building Model; (3) Effective Building Model, (4) Learning Model, and (5) Adoption Model as shown in Figure 1.

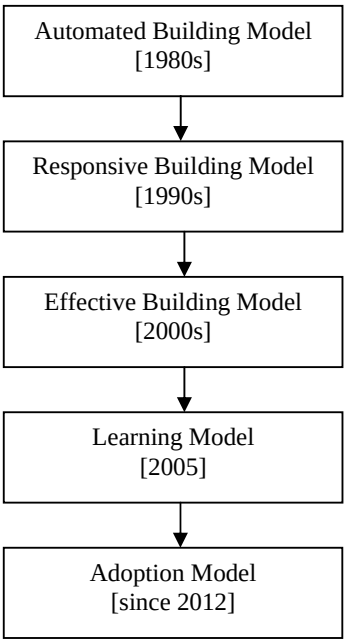

Figure 1 The 5 generations of building intelligence

In the first generation of building intelligence, it emphasized the achievement of building automation [2]. Then the second generation strengthened the responsiveness to the environmental changes of the systems [3]. Communication and integration systems were developed to enhance the responsiveness. But then in the late 1990s, the idea of intelligent building was changed from building intelligence to building users efficiency. It was claimed that "Intelligent buildings are not intelligent by themselves but they can furnish the occupants with more intelligence and enable them to work more efficiently." [1] Then in 2005 to 2009, papers on a novel learning model of building intelligence; intelligent building maintenance and intelligent facilities management

were published [4,5,6]. They argued on the importance of the learning skills of a building, such as artificial intelligence, which entitled it to be regarded as intelligent. Starting from 2012, re-visit of the sustainability elements of Version 4 began that it reverted the growing concerns of energy efficient; green living and work places of the Government and building occupants. Reviews and enhancements of the relevant modulus with latest Sustainability and Energy Codes were conducted while exchanging views and opinions amongst wide range of building professionals and academia [7, 8] in order to develop a modern intelligent building model which could be well adopted after the time. And this Version started to apply performance-based concept to facilitate the assessment of new forms living and business of the modern buildings while sometimes it is necessary for the assessment of could not be taken by usual mode.

The Intelligent Building Index (IBI) Manual was first launched by the AIIB in 2001 and has been updated almost every 4 years for perfection, i.e. Version 2.0 in 2001, Version 3.0 in 2005, Version 4.0 in 2009 and Version 5.0 in 2014. It is the first quantitative and comprehensive assessment tool for an IB, which has received and incorporated valuable comments from the building and construction industry, including government bodies, professional institutions, practitioners and academics. It has now been widely and deeply recognized in the region, and different types of buildings, including commercial buildings, hotels, buildings in educational institutions, and laboratories, in Hong Kong, in China Mainland and in Singapore, have been assessed by IBI in the past few years. It is time to update it to reflect the current advancements in technologies and global changes. This preface presents the fundamental conceptual changes in this new version, and a brief user guide is also provided in Chapter 1 of this manual.

Emphasizing a holistic approach towards intelligent building assessment, the IBI has introduced a multi-module assessment scheme and been weighted by a Cobb-Douglas Utility function, since the first launch of the manual in 2001 (version 2.0) [9]. IBI is unique in that it is the only assessment method in the world that incorporates all areas related to intelligent buildings and adopts such Cobb Douglas Utility function which can simulate the non-linear judgment criteria of human beings. So far, almost all existing assessment schemes in the world are working on a linear addition model which is computerized, not human in nature. Accordingly, non-applicability and failure of a particular feature by an IB can be clearly distinguished from each another while others can't. These concepts have been swiftly recognized in the industry, and the IBI has become a versatile assessment tool on the overall performance of an intelligent building, rather than a piecemeal or fragmented assessment on any individual aspect. Retaining this multi-module concept, the latest version has renamed some of the modules to reflect more accurately about their concerns. There are altogether 10 modules, or sub-indices if you like, and 373 numbers of elements, as shown in Table 1_2 of the User Guide.

Same as Version 4, this version also provides an electronic version of the IBI for assessment (a diskette with the worksheets is provided in the cover). It does not only allow more user friendly hands-on trials, but it also enables sensitivity analyses on the impact of a change of any individual elements on the overall score. Users can try to pre-assess their building intelligence by themselves first, and identify the strengths, weaknesses, opportunities and threats (SWOTs) of their buildings in terms of building intelligence. Certification can then be provided by the Asian Institute of Intelligent Buildings (AIIB) upon an approval process. In the assessment, users can simply select the type of building, and enter the scores on the individual elements, a combined score representing the overall score of the building is provided, an example is shown in Table 1. Starting from Version 5 of this guideline, performance-based approach is applied that proof of compliance dim-to-satisfy the Prescriptive Requirements of the Code will be accepted in the assessment. On the other hand, users can also exclude any modules or elements by setting them as Not-Applicable if the condition was considered not existing for the assessment construction.

In this example, you can easily realize one of the emphases of the IBI that the Cobb-Douglas function punishes heavily on un-balanced performance of a building. Although it achieves extremely high in CEI and HSI, and there are more than one half of the module scores above 50, yet the overall performance is scored at 43.89. Owners and building professionals can easily identify which modules and elements they shall invest on and focus at.

The module weights have been comprehensively reviewed in the previous version 3.0 [10], and they are normalized to become 100% total since in Version 4, as shown in the second column of Table 1. Table 1_3 in the user guide shows the distributions of the module weights among the 10 modules for different types of building, viz commercial, hospital, residential, hotel and educational institution.

The scoring system for all the elements is also standardized to the following scale. A standardized scoring scale helps benchmark performance and facilitates interpretations. Table 1_5 of the user guide shows the scoring standards and interpretations. Table 1_6 of the user guide, the elements are grouped into 14 trades (disciplines). Experts from the corresponding discipline can help provide evidence in the assessment of the relevant elements. As shown in Table 1_7 of the user guide codes the source of information. Furthermore, new sorting keys from three dimensions are provided for grouping relevant elements. Secondly, the elements are grouped into 3 stages of development, viz (1) design, (2) construction and installation, and (3) post-occupation stage (Table 1_8). It

enables provisional certification for pre-occupation assessment (design and/or construction and installation parts), and a full certification can be further issued upon the completion of another full scale post-occupation assessment (include design, construction and installation, operation, maintenance and management parts). A framework is provided for each module (Figures 2_1_B – 2_10_B), showing the hierarchy of the elements under these three major headings: Design, Construction/Installation, and Maintenance and Management. A framework provides an overall structure of the module which enhances better interpretation and understanding of the index. Thirdly, the elements are also categorized into the 4 dimensions of intelligence in accordance with the four generations of the development of building intelligence, viz. (1) Automated Building Model; (2) Responsive Building Model; (3) Effective Building Model, and (4) Learning Model, as shown in Table 1_9. Those best practices are also adopted in the Version 5 while it starts to adopt performance-based approach in the assessment.

Sub-Index (Module) Code	Module Weight (Y)	Score (M)	CD Weighted Score (I)
GRI	9.46%	10	1.2434
SPI	11.49%	20	1.4107
COI	10.14%	30	1.4116
WEI	12.16%	40	1.5662
CUI	8.11%	50	1.3733
ETI	11.49%	60	1.6005
SSI	8.78%	70	1.4523
MSI	9.46%	80	1.5136
CEI	8.11%	90	1.4403
HSI	10.81%	90	1.6266
Total Weight	100.00%	Type: Commercial Building	
Total Weighted Score (I)			43.8940

Table 1: Combined Score of the Intelligence Building Index (An Example)

Globally and locally, there are lots of statutory amendments, issuance of new international standards, and advancement of new technologies, in the past few years. This update has incorporated as far as possible many of these changes. For example, green building has attracted a lot of attention, such as the UK's Zero / Low-Carbon House (RIBA, 2007), ISO 50001 and BS EN 16001 are preparation for a new Energy Management Systems Standard. Locally, the Hong Kong Government has also announced a mandatory compliance of Building Energy Codes in his latest policy address 2008, the scorings of the corresponding elements in the IBI are revised accordingly.

Similarly, there have been many new updates in building codes and international standards. For example, the first international code on concrete repair: EN 1504 and the latest BS 9999:2008 on Fire Safety Design have been launched. Locally, we got the following new codes of practice on the Fire Safety in Building 2011, The design and construction of Buildings and Building Works for the Installation and safe use of Lifts and Escalators 2011, The Design and Construction of Lifts and Escalators 2012, Building Energy Codes 2012, Prevention of Legionnaires' Disease 2012 and etc.

Last but not least, this IBI version 5.0 collects and bridges differences opinions raised by the academic and professional participants. The Codes was reviewed and establishes by a special sub-committee forming by intelligent buildings professionals, Academic and Building Construction professionals, such as Government people, Architecture, Surveyors, and Engineers. As far as the rapid development in technologies and new variety needs of nowadays building users, contents of intelligent building developed to adopt new challenges that come with these needs. As to meet the changing built environment, performance-based approach is adopted in this Version. By the processes, Version 5 is developed to adopt and to be adopted by the building and construction industry as well as forming a development platform for the future.

Ir Dr. Charles C.K. Cheng (Chairman of Academic and Technical Research Executive Committee, AIIB)
and Ir Dr. Albert T.P. So (Chairman of Advisory Board, AIIB)
June 2014

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CONTENTS

CHAPTER 1 USER GUIDE

1.1 Organization of the Manual

This IBI Version 5.0 Manual is divided into two parts, namely, the User Guide, and the IBI Manual. The User Guide provides a brief introduction to the use of the manual and information on the codes and scoring standards.

Tables 1_1a and 1_1b show the tables and figures in this User Guide and the Manual. T stands for Table and F refers to Figures. The first numeric digit refers to the chapter number and the second digit refers to the sequence no. Chapter 1 is the User Guide and Chapter 2 is the Manual.

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Table 1_1a Tables of IBI v5

Revision No.: v5.0 r0 Date: 1 July 2014

No.	Descriptions	Module Index Name	Module Code
T1_1	Tables and Figures		
T1_2	The IBI Model – the Ten Modules		
T1_3	Module Weightings – Y		
T1_4	Cobb-Douglas Formula		
T1_5	Scoring Formula		
T1_6	Disciplines Codes		
T1_7	Codes on the Source of Information		
T1_8	Codes on the Stage of Development		
T1_9	Codes on the Dimension of Intelligence		
T1_10	Project Information Template		
T1_11	Combined Score Template (Modules 1 – 10)		
T1_12	Ranking of Building by the Combined Score		
T2_1	Module 1 Calculation Table	**Green**	**GRI**
T2_2	Module 2 Calculation Table	**Space**	**SPI**
T2_3	Module 3 Calculation Table	**Comfort**	**COI**
T2_4	Module 4 Calculation Table	**Working Efficiency**	**WEI**
T2_5	Module 5 Calculation Table	**Culture**	**CUI**
T2_6	Module 6 Calculation Table	**e-Services and Technology Provisions**	**ETI**
T2_7	Module 7 Calculation Table	**Safety and Structure**	**SSI**
T2_8	Module 8 Calculation Table	**Management Practice and Security**	**MSI**
T2_9	Module 9 Calculation Table	**Cost Effectiveness**	**CEI**
T2_10	Module 10 Calculation Table	**Health and Sanitation**	**HS I**

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Table 1_1b Figures of IBI v5

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No.	Descriptions	Module Index Name	Module Code
F1_3	Distribution of Module Weightings – Y		
F2_1	Module 1 Framework		
F2_2	Module 2 Framework		
F2_3	Module 3 Framework		
F2_4	Module 4 Framework		
F2_5	Module 5 Framework		
F2_6	Module 6 Framework		
F2_7	Module 7 Framework		
F2_8	Module 8 Framework		
F2_9	Module 9 Framework		
F2_10	Module 10 Framework		

1.2 IBI Model – the Ten Modules

The IBI is constructed in a three level hierarchy: a final IB index for a building can be obtained by aggregating in Cobb-Douglas function the scores of the 10 modules, which are composed of various numbers of elements in each module as shown in Table 1_2. There are 373 elements in total:

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Table 1_2 IBI Model – the Ten Modules of IBI v5

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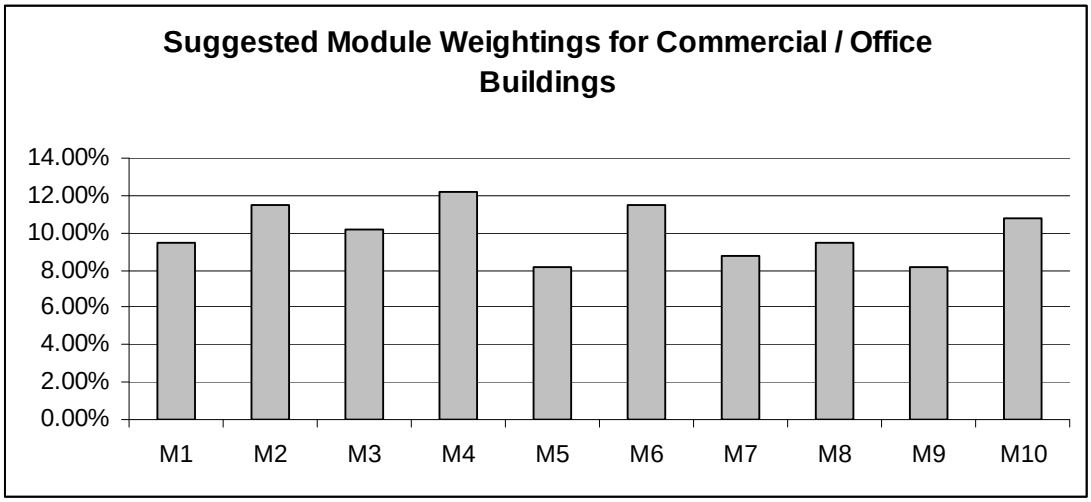
Module	Index Name	Index Code	No. of Elements
M1	Green	GRI	76
M2	Space	SPI	18
M3	Comfort	COI	52
M4	Working Efficiency	WEI	72
M5	Culture	CUI	15
M6	e-Services and Technology Provisions	ETI	39
M7	Safety and Structure	SSI	32
M8	Management Practice and Security	MSI	35
M9	Cost Effectiveness	CEI	3
M10	Health and Sanitation	HSI	31
	Total		373

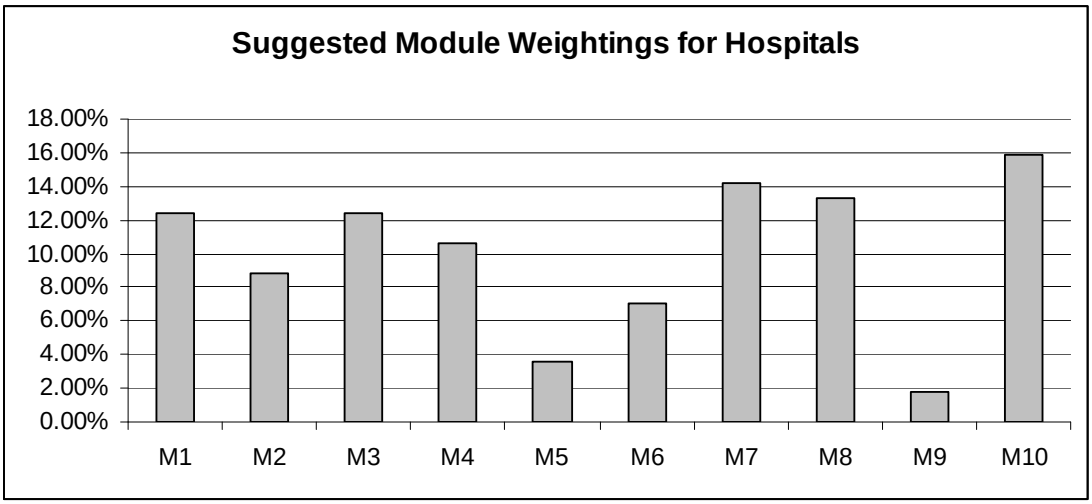
1.3 Module Weightings

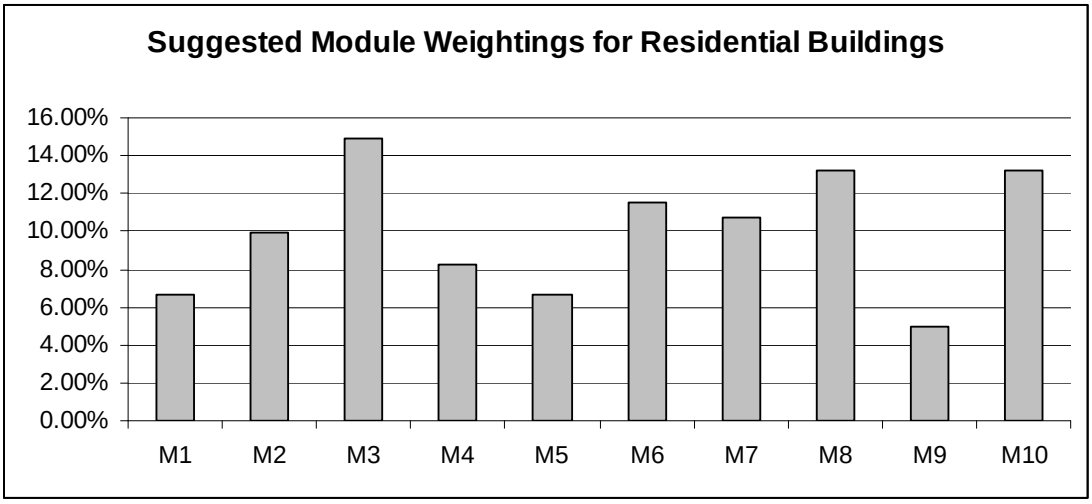
Panel A of Table 1_3 shows the recommended weightings of each module for different types of use of the building. These recommended weights (in highlighted boxes) are obtained from a large-scale market survey in 2004, but they can be revised by the auditor according to the actual situations. There are recommendations for weightings on four types of buildings, namely, (1) Commercial / Office, (2) Hospital, (3) Residential, (4) Hotels, and (5) Educational Institutions. For example, in Hotels, Comfort (COI) is of much higher weight (9) than Cost Effectiveness (CEI) (3).

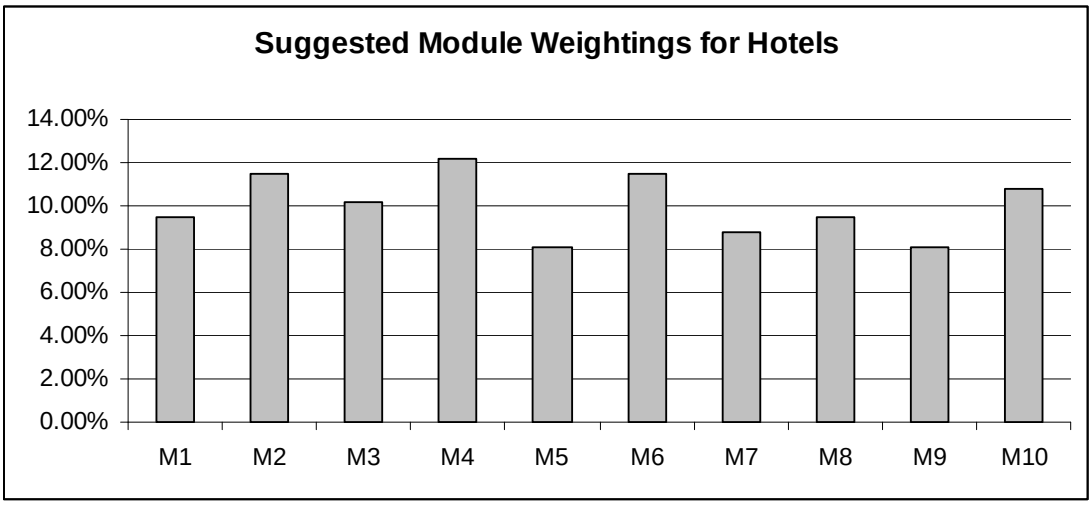
Panel B of this Table shows the normalized module weightings (Y) which normalized the total of weightings for all types of building to be 100%, so that their weightings are comparable for different building types. Figure 1_3 shows graphically the distribution of these module weightings.

It shall be noted that the assignment of weights is different for the same Quality Environment Module or Index for different types of buildings. *Therefore, two buildings can only be compared among themselves by using The IBI only if they are of the same type.* It is not fair and is unsuitable to compare an office building with a hospital even though they have got the same IBI. Of course, one is free to compare two buildings of the same type by referring to the individual index of the ten Quality Environment Modules so that a more detailed analysis can be carried out.









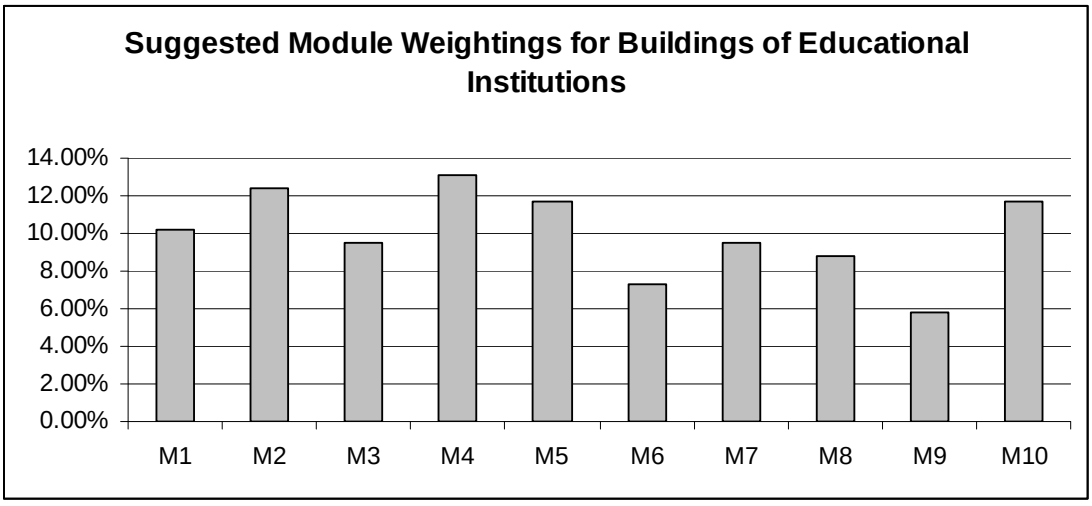


Figure 1_3 Distribution of Module Weightings (Y)

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Table 1_3 Module Weightings - Y

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The recommended weights below are applied since IBI v4 and they may be revised by the auditor according to the actual situations.

PANEL A: IBI v5 - Module Weightings (Y)

Module	GRI	SPI	COI	WEI	CUI	ETI	SSI	MSI	CEI	HS I		
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	TOTAL	Full Descriptions
Comm	9.46%	11.49%	10.14%	12.16%	8.11%	11.49%	8.78%	9.46%	8.11%	10.81%	100%	Commercial / Office
Hos	12.39%	8.85%	12.39%	10.62%	3.54%	7.08%	14.16%	13.27%	1.77%	15.93%	100%	Hospital
Res	11.30%	3.48%	15.65%	6.96%	12.17%	3.48%	12.17%	13.91%	5.22%	15.65%	100%	Residential
Hot	6.61%	9.92%	14.88%	8.26%	6.61%	11.57%	10.74%	13.22%	4.96%	13.22%	100%	Hotels
Edu	10.22%	12.41%	9.49%	13.14%	11.68%	7.30%	9.49%	8.76%	5.84%	11.68%	100%	Educational Institutions

1.4 Calculation of the IB Indices

Panel A of Table 1_4 shows the formula for the calculation of the combined index (I) by Cobb-Douglas function, while Panel B shows the formula for the calculation of the score of individual module (M).

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Table 1_4 Calculation of the IB Indices by Cobb-Douglas Function

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PANEL A: Formula for the Combined Score (I)

$$I = M_1^{\bar{W}_1} M_2^{\bar{W}_2} \cdots M_{10}^{\bar{W}_{10}}$$

where $0 < I \le 100$; $0 < M_i \le 100$; and $\bar{W}_i = \frac{W_i}{\sum_{all\ j} W_j}$,

I is the Combined Score,
M_i are the Score of Module i, and
W_i are the Weighting of Module i.

PANEL B: Formula for the Score of Individual Module (M)

$$M_m = x_1^{\bar{w}_1} x_2^{\bar{w}_2} x_3^{\bar{w}_3} \cdots$$

where $0 < M_m \le 100$; $0 < x_j \le 100$ and $\bar{w}_i = \frac{w_i}{\sum_{all\ j} w_j}$, for m= 1…10;

M_m is the Score of Module m,
x_j are the Score of Element j, and
w_j are the weighting of Element j.

1.5 Scoring Standards

Table 1_5 shows the scoring standards for individual element. The score shall be ranged from 0 to 100, as 0 is mathematically not definable by the Cobb-Douglas function. However, if the auditor would like to reflect the significant impacts of a few very dangerous elements in the overall score, it is possible to do so by giving a score very close to zero to these elements. For example, in an almost perfectly intelligent building, if the auditor found an extremely dangerous element x in the building, the auditor may give x a score of 0.000001 which would then significantly reflect the seriousness of the failure of just one item.

The proposed scoring standards divide the score into 8 categories, from 5 to 100. The scoring standards help auditors and owners interpret the results of the assessment, and analyze the SWOTs of the buildings. Both quality and the extent of provision of the element shall be assessed. Only when the assessed element achieves an excellent quality level as well as an extent of substantial provisions would it be scored at 90. If further excellence is found, bonus scores can be given up to 100. For a good quality element which does not supported by substantial enough provisions, it should not be scored at higher than 70. Score equal to 60 is a yardstick for an element provision just fulfills the latest Statutory requirements, which are often the minimum. In case the provision is much below the latest Statutory requirements, such as in old buildings; and the provisions may even result in illegality or hazard or very undesirable consequences, they shall be scored not higher than 5.

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Table 1_5 Scoring Standards

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IBI v5 Score	Scoring Standards
0	**NOT ALLOWED**
5	Below statutory requirements and results in illegality or hazard or very undesirable consequences
10	Worst conditions or designs, etc., or undesirable consequences
40	Fair to bad conditions or designs, etc.
50	Lack of recommended items but not statutorily required; or just fulfilling old code
60	Just fulfill the latest statutory requirements
70	Provide good but not substantial enough provisions
90	Excellent and substantial provisions
100	Excellent and substantial provisions PLUS BONUS SCORES

Scoring guidelines:

For each conversion formula, we are referring to the general and average performance everywhere inside the whole building. Unless specifically remarked, the assessor is recommended to take one point of measurement within a floor area of 5,000 m^2 on a random basis. For a building with total floor area smaller than 20,000 m^2, at least four points of measurement must be sampled randomly. The conversion formula is then applied to the average of values of all sampled points of this building. Since the points are chosen randomly, measurements related to all elements under all indices, unless specifically remarked, can be done at the same point in order to improve efficiency of the assessors. There are basically three types of formulae.

The first type is of the form: [a , b] to (x , y) where "a" and "b" are descriptions bearing clear meanings of the element, e.g. the existence of a certain system or the non-existence of a certain device etc. "x" and "y" are scores which are real numbers within the range between 0 and 100. The formula means that a score of x will be awarded to the element if the value of it is equal to "a" and a score of y will be awarded to the element if it is equal to "b". This type of formulae is of a discrete nature. Of course, there may be more than two values in each formula, depending on the nature of the element.

The second type is of the form: [a .. b] to (x .. y). This type of formulae is of a continuous nature. It means that the score is calculated based on a linear projection or mapping from the raw value of the element within the range from "a" to "b" to the range of score from "x" to "y" where "x" and "y" are scores within the range from 1 to 100. Technically speaking, the technique of interpolation is being used here.

The third type is of the form: [excellent , good , fair , worst] to (x1 , x2 , x3 , x4) or [good , fair , bad] to (x1 , x2 , x3) where the x's are real numbers within the range from 1 to 100. This type refers to element where the meaning is sometime quite vague or abstract in nature with a large range of grey levels. The human judgment of the assessor has to be relied on. Therefore, this type of formulae usually comes with an explanation or some guidelines to aid the assessor to arrive at the most reasonable decision. Normally, "excellent" means the best that can be achieved using current technologies while "worst" means nothing has been done related to this element. These two are not ambiguous. "good" means better than average while "fair" means poorer than average. Therefore, AIIB will provide training to assessors to make them qualified and professional enough to make an intelligent decision. It is believed, and actually our objective, that all authorized assessors will arrive at the same decision for the same element of the same building. We have already tried our best to minimize the frequency of appearance of this type of formulae but the world is very often not so clear cut.

In order to allow for innovative idea from the auditor and to prepare for the fast-growing technologies in the IB industry, at the end of each section on a specific index, i.e. Green Module, there is a clause entitled "Special feature(s) recommended by the auditor". The auditor is allowed to assign one additional tailor-made element which is appropriate to that particular building but not generally applicable to other buildings. The conversion formula can be determined by the auditor but he/she must put it in his/her report of assessment. Although the assignment of weight can also be determined by the auditor, it cannot exceed 5% of the sum of weights of all elements under this particular index. That means the total marks can be achieved by the elements other than this element will take maximum of 95% of the total marks. The remaining 5% at the maximum would be contributed by this particular element subject to the Auditor's judgment. For example, if the normalized total net score obtained by the other elements is 90% and the Auditor would like to give extra 30% out of 5 marks to the Module. The Score would be calculated as:

$$90 \times [1 + 0.05263 \times (30/100)] = 91.42\% \ (\mathbf{91\%})$$

The IBI Manual is open to the general public. Therefore, everybody is free to obtain an IBI for his/her own premises. However, this IBI will most likely not be endorsed by AIIB. Officially, there are two kinds of assessors approved by AIIB namely Authorized Auditors and Authorized Assessors. They have been trained by AIIB. Those who would like to have a certificate of The IBI issued by AIIB should employ Authorized Auditors to carry out the assessment exercise and then submit a detailed report to independent Authorized Assessors. Once the endorsement by Authorized Assessors is accepted by AIIB, a formal certificate will be issued indicating the rank of the building as well as the date when the certificate is issued. The IBI of a particular building is therefore time dependent and hence the certificate issued by AIIB always includes the date of award. Therefore the IBI should have reflected the general performance and characteristics of the building right from the design stage until the moment when its assessment is carried out.

1.6 Codes of the Disciplines

Table 1_6 shows the discipline codes in Versions 5.0. They are categorized into 14 categories in Version 5.0, and they help auditors and owners find the corresponding professions of the discipline to provide the information or to carry out the assessment.

INTELLIGENT BUILDING INDEX (AIIB - IBI v5)

Table 1_7 Codes of the Disciplines

Revision No.: v5.0 r0 Date: 1 July 2014

IBI v5	Descriptions	Remarks
AS	Acoustics	
AC	Air Conditioning and Mechanical Ventilation Engineering	
AR	Architectural	
CO	Communication, Networking and Computer	
EE	Electrical Engineering	
EP	Environmental Protection	
FS	Fire Services and Disasters Prevention Engineering	
GE	General	
LE	Lifts and Escalators Engineering	
LI	Lighting	
MA	Maintenance and Management	
QS	Quantity Surveying	
PD	Plumbing and Drainage Engineering	
SE	Structural Engineering or Building Surveying	

1.7 Codes on the Sources of Information

There are several keys or indexing on each element for ease of reference, including (1) sources of information; (2) disciplines; (3) Stages of Development, and (4) Dimension of Intelligence. Table 1_6 shows the codes on the sources of information. They are categorized into 6 categories, and they help auditors and owners find the required information to carry out the assessment.

Table 1_7 Codes on the Sources of Information

IBI v5	Sources of Information
RD	From reports and drawings
C	From client
V	From visit on site
T	From test on site
PJ	From professional judgment
LB	From log book

1.8 Codes on the Stages of Development

Table 1_8 shows the codes on the Stage of Development. They are divided into 3 stages, namely, Design Stage, Construction/Installation stage, and Post-occupation stage. They allow pre-construction assessment (i.e. assessment on design scheme only), pre-occupation assessment (i.e. assessment on construction and installations only), and a full assessment (i.e. assessment on both design, construction and installations, and post-occupation including management, maintenance and operations). Different assessment results can be certified on different stages of development.

INTELLIGENT BUILDING INDEX (AIIB - IBI v5)

Table 1_8 Codes on the Stages of Development

Revision No.: v5.0 r0 Date: 1 July 2014

IBI v5	Stage of Development	Accessible Aspects
D	Design stage	designs
I	Construction / Installation stage	designs, materials, specifications, workmanship, etc
P	Post-occupation stage	designs, materials, specifications, workmanship, operations, maintenance, repairs, management, etc

1.9 Codes on the Dimension of Intelligence

Table 1_9 shows the codes on the Dimension of Intelligence. There are 4 dimensions, namely, Automation, Responsiveness, Efficiency and Learning Capability. The dimension of intelligence does not necessarily indicate the dimension of intelligence, but just a different perspective of building intelligence. They allow auditors and owners to identify more clearly the strengths, weaknesses, opportunities and threats of the existing building intelligence. References are provided for detailed background information on the dimension of intelligence.

INTELLIGENT BUILDING INDEX (AIIB - IBI v5)

Table 1_9 Codes on the Dimension of Intelligence

Revision No.: v5.0 r0 Date: 1 July 2014

Dimension of Intelligence		References
Dimension 1	**Automation** – intelligence as building automation.	
Dimension 2	**Responsiveness** – intelligence as the responsiveness of the building facilities to the changes of the environment, including building control system, feedback system, and networking.	Harrison, A., Leo, E. and Read, J. (1998) (eds) *Intelligent Buildings in South East Asia*, E & FN Spon, London.
Dimension 3	**Efficiency** – intelligence as the performance of the building facilities to achieve higher efficiency and to fulfill user's requirements.	So, A.T.P., Wong, A.C.W. and Wong, K.C. (1999), A definition of intelligent buildings for Asia, *Facilities*, 17(12/13), 485-91.
Dimension 4	**Learning Capability** – intelligence as the learning capability of the building facilities to achieve higher efficiency and to fulfill user's requirements.	o Yiu, C.Y. and Yau, Y. (2006) A Learning Model of Intelligent Home, *Facilities*, 24(9/10), 365-375. o Yiu, C.Y. (2008) Intelligent Building Maintenance – a Novel Discipline, *Journal of Building Appraisal*, 3(4), 305-318. (free download at http://www.palgrave-journals.com/jba/journal/v3/n4/pdf/jba20089a.pdf) o Yiu, C.Y. (2009) Intelligent Facilities Management, *Joint Symposium* Nov. 25, 2009, CIBSE and ASHRAE.

1.10 Project Information Template

Table 1_10 provides a sample template for collecting general project information. Auditors and owners can design their own, but a good record of the assessment helps make comparisons and appraisals in the future.

INTELLIGENT BUILDING INDEX (AIIB - IBI r5)

Table 1_10 PROJECT INFORMATION TEMPLATE

Revision No. v5.0 r0 Date: 1 July 2014

	Descriptions	Notes (Examples)
1	Project Name	ABC
2	Project Ref.	IBI/v5/ABC2014
3	Building Name	123 Building
4	Building Ref.	123
5	Building Address	BA
6	General Building(s) Description	Commercial High Rise …
7	Building Age / Completion Date	Under Construction
8	Is the Building in Design (D) / Construction or Installation (I) / Post-occupation (P) Stage?	I
9	Date(s) of Inspection	Oct 2015
10	Name of Inspector(s)	EY
11	Desktop Study (Documents and Evidence Provided / Attached)	
12	Safety and Precautionary Measures Completed and Checked?	
13	Facilities for Access Ready and Checked?	
14	Equipment and Inspection Tools Ready and Calibrated?	
15	Any Constraints of the Inspection(s)	
16	Observations and Remarks	
17	Professional Inspector(s) Endorsement?	
18	Attached Building Plans	
19	Attached Calculation Sheets	
20	Attached Record Photos	
21	Any Follow-up Actions Required?	

1.11 Combined Scores Template

Table 1_11 provides a sample template for calculating the combined score of the IBI. Auditors and owners can design their own, and select which modules to be included. It provides an overall at-a-glance assessment result of the building intelligence.

INTELLIGENT BUILDING INDEX (AIIB - IBI r5)

Table 1_11 COMBINED SCORES - I for MODULES 1 - 10

Revision No. v5.0 r0 Date: 1 July 2014

Type of Building: Comm.

Module in r0	Index Name	Index Code	No. of Items	Module Weight (Y)	Applicable=1 (if na=0)	Appl x Wt	Total Item Weight (W)	Score (M)	CD Weighted Score (I)	Cf. IBI v3.0
1	**Green**	GRI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
2	**Space**	SPI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
3	**Comfort**	COI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
4	**Working Efficiency**	WEI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
5	**Culture**	CUI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
6	**e-Services and Technology Provisions**	ETI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
7	**Safety and Structure**	SSI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
8	**Management Practice and Security**	MSI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
9	**Cost Effectiveness**	CEI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
10	**Health and Sanitation**	HSI	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	Total Weights (Y)		**XXX**	**100.00%**			**XXX**			
	Total Weighted Score (I)								**XXX**	**XXX**

1.12 Ranking of Building Intelligence by IBI

The combined score of all modules is the Intelligent Building Index (IBI), which ranges from 1 to 100. In the certification of the building intelligence, five ranks from A to E (instead of showing the score) are to be shown. Table 1_11 provides the ranking schedule for mapping the combined score of the IBI to the rank of building intelligence. It is in line with the scoring standards above, as 60 is the threshold for fulfilling the statutory requirements. It is an upgrade from the requirements of IBI v3.0, where 80 can make an A, and 60 can make a B, as shown in Table below.

INTELLIGENT BUILDING INDEX (AIIB - IBI v5)

Table 1_12 Ranking of Building Intelligence by the Combined Score (I)

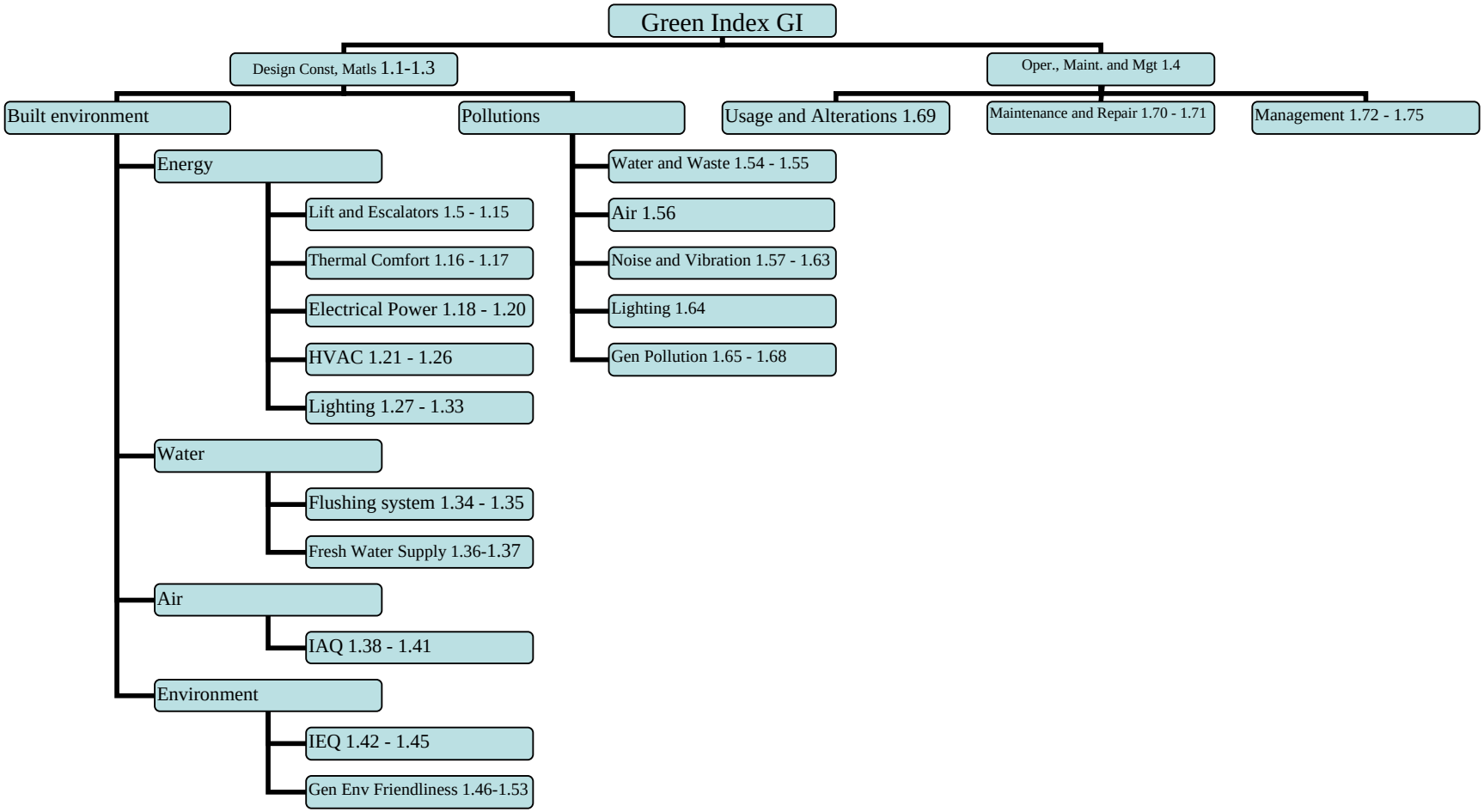
Revision No.: v5.0 r0 Date: 1 July 2014

IBI v5 Combined Normalized Score (I)	IBI v4 Combined Score (I)	Ranking	Description
90 – 100	90 – 100	A	Distinction Building
70 – 89.9	70 – 89.9	B	Credit Building
60 – 69.9	60 – 69.9	C	Fair Building
1 – 59.9	1 – 59.9	D	To be Improved

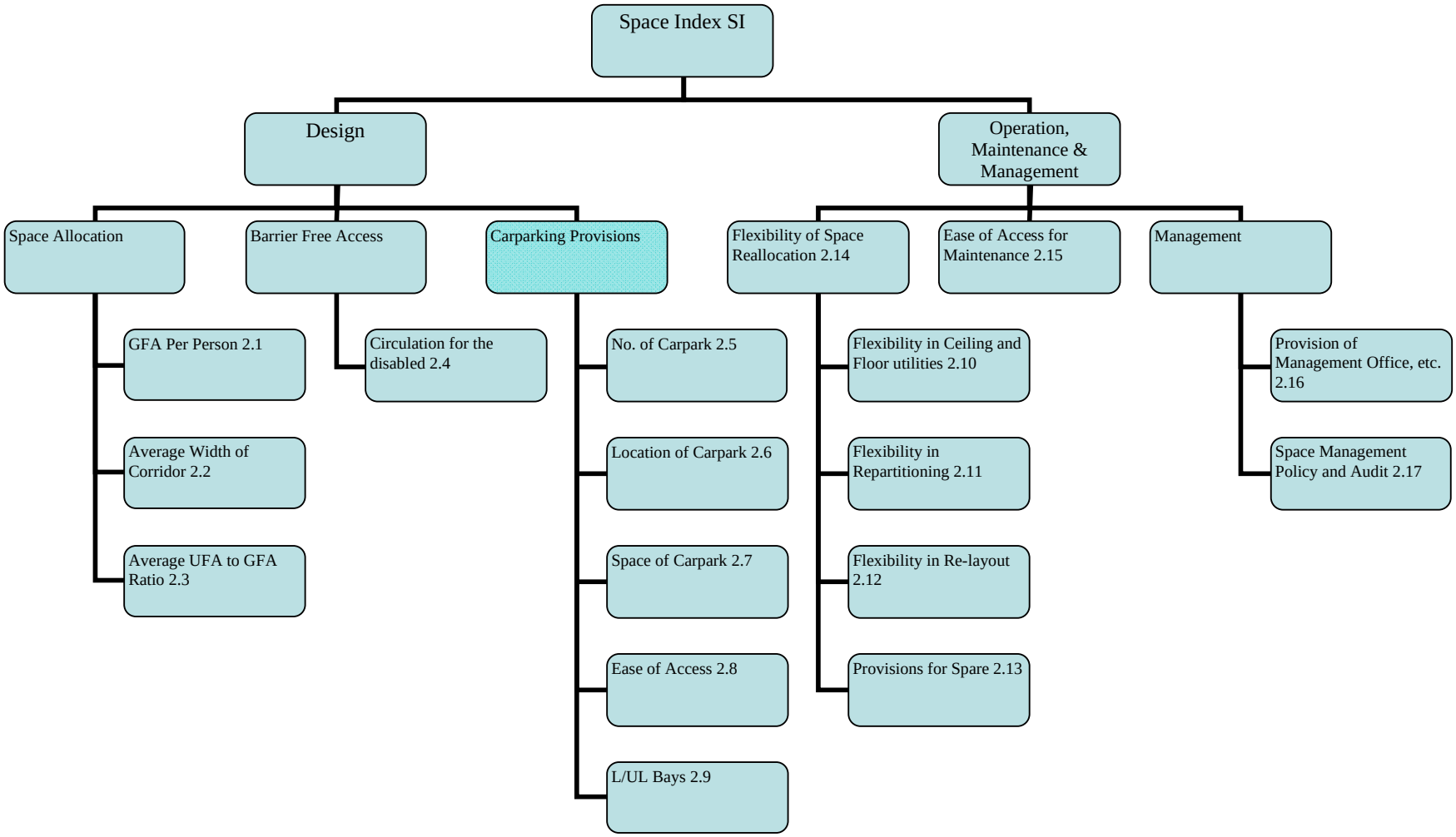
Note: Whenever a measurement is required for the purpose of assessing a score, 5 measurements should be taken at different spots randomly selected within the building. The average of these 5 values so obtained would then become the basis for assessing the score of an individual element.

CHAPTER 2 FRAMEWORKS OF MODULES

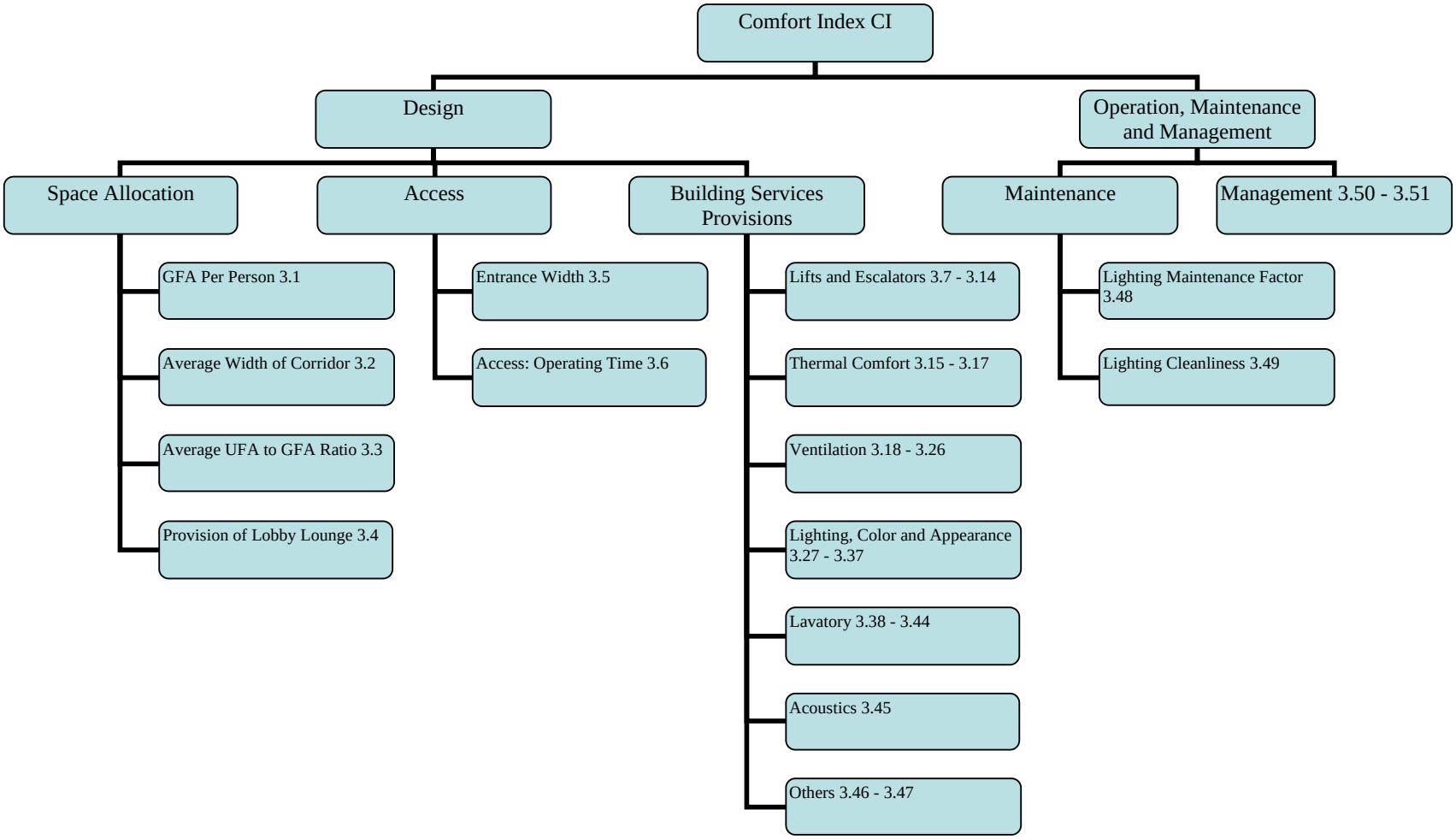
2.1 Figure 2-1 Framework of Module 1: Green Index



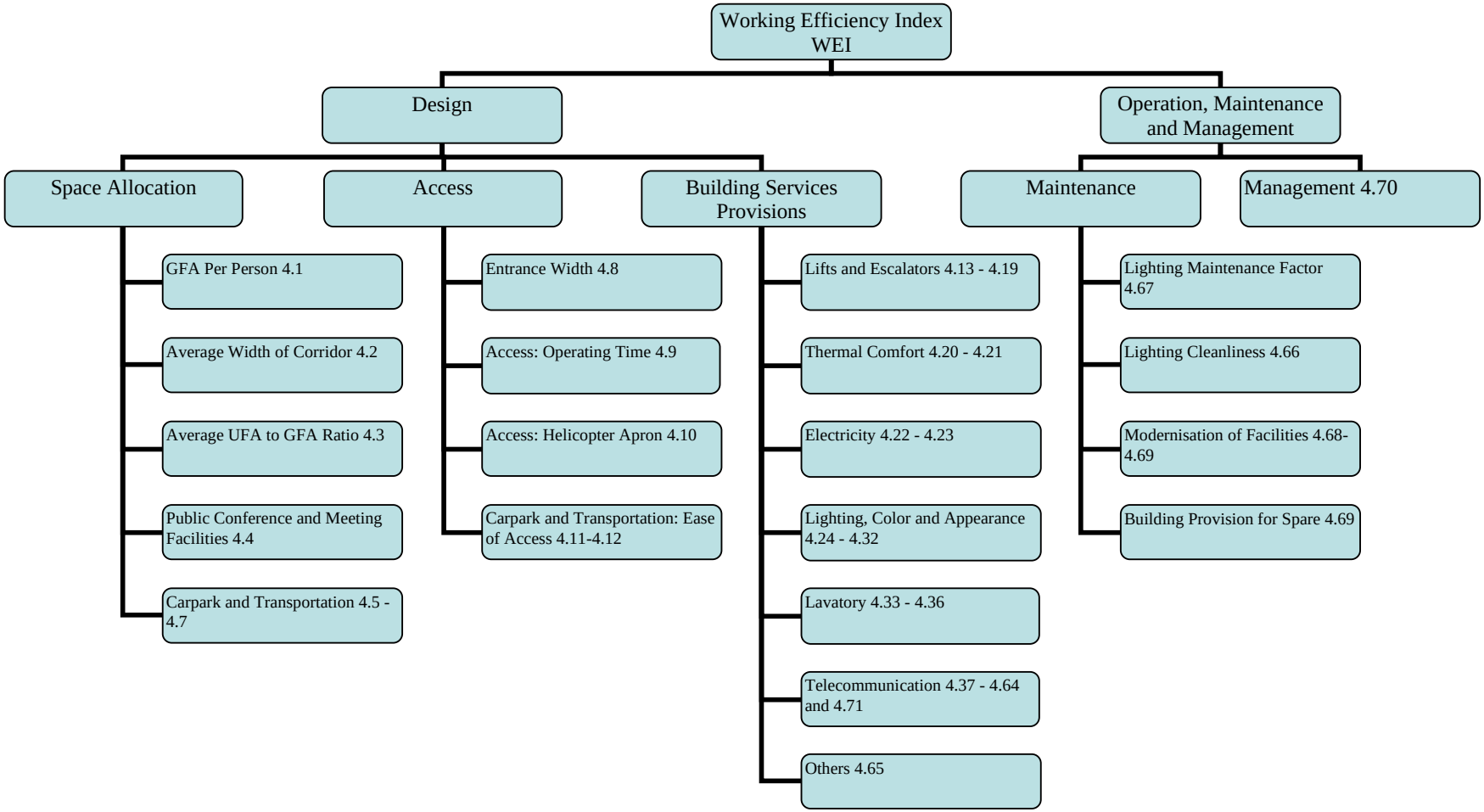
2.2 Figure 2-2 Framework of Module 2: Space Index



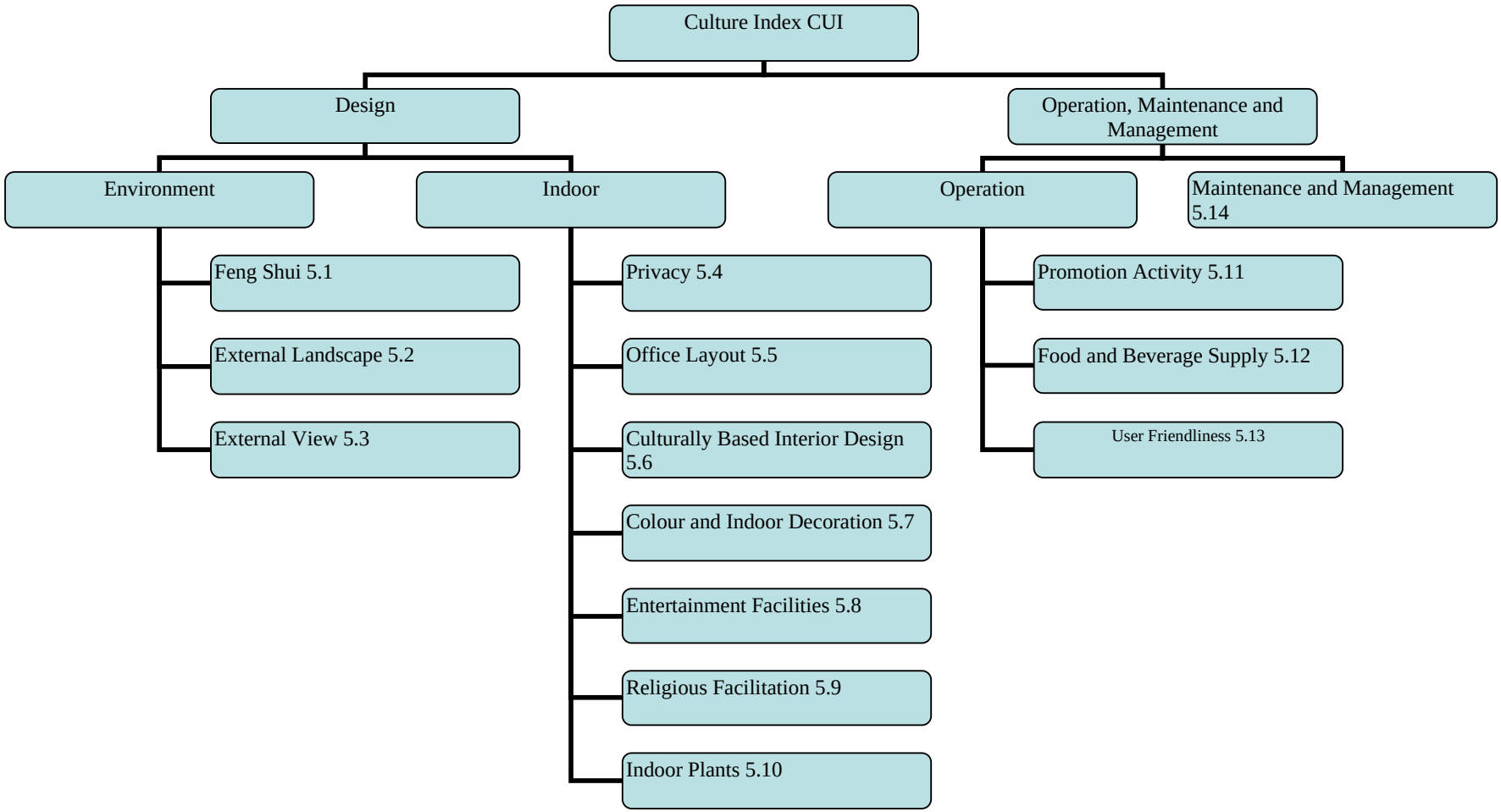
2.3 Figure 2-3 Framework of Module 3: Comfort Index



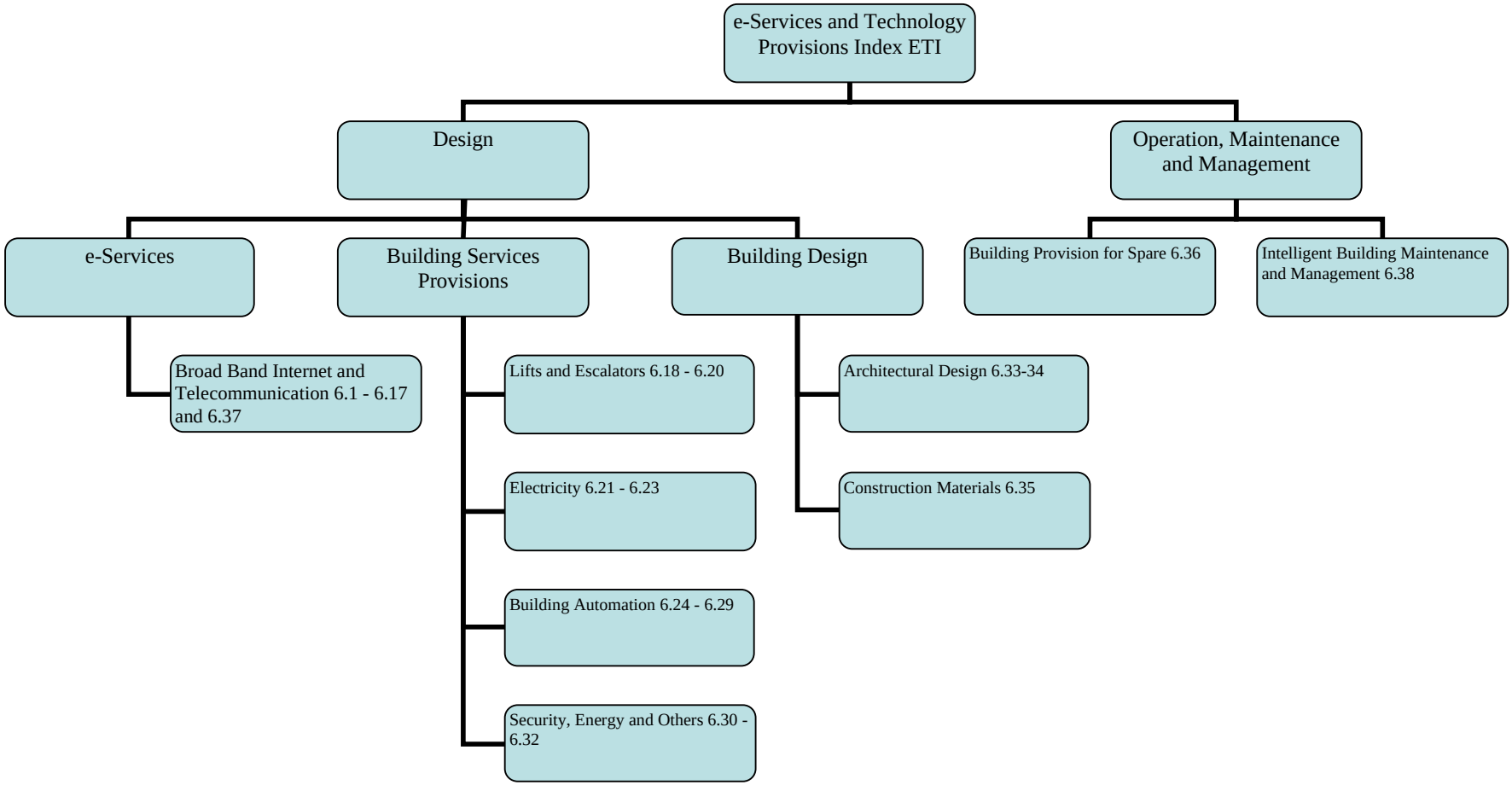
2.4 Figure 2-4 Framework of Module 4: Working Efficiency Index



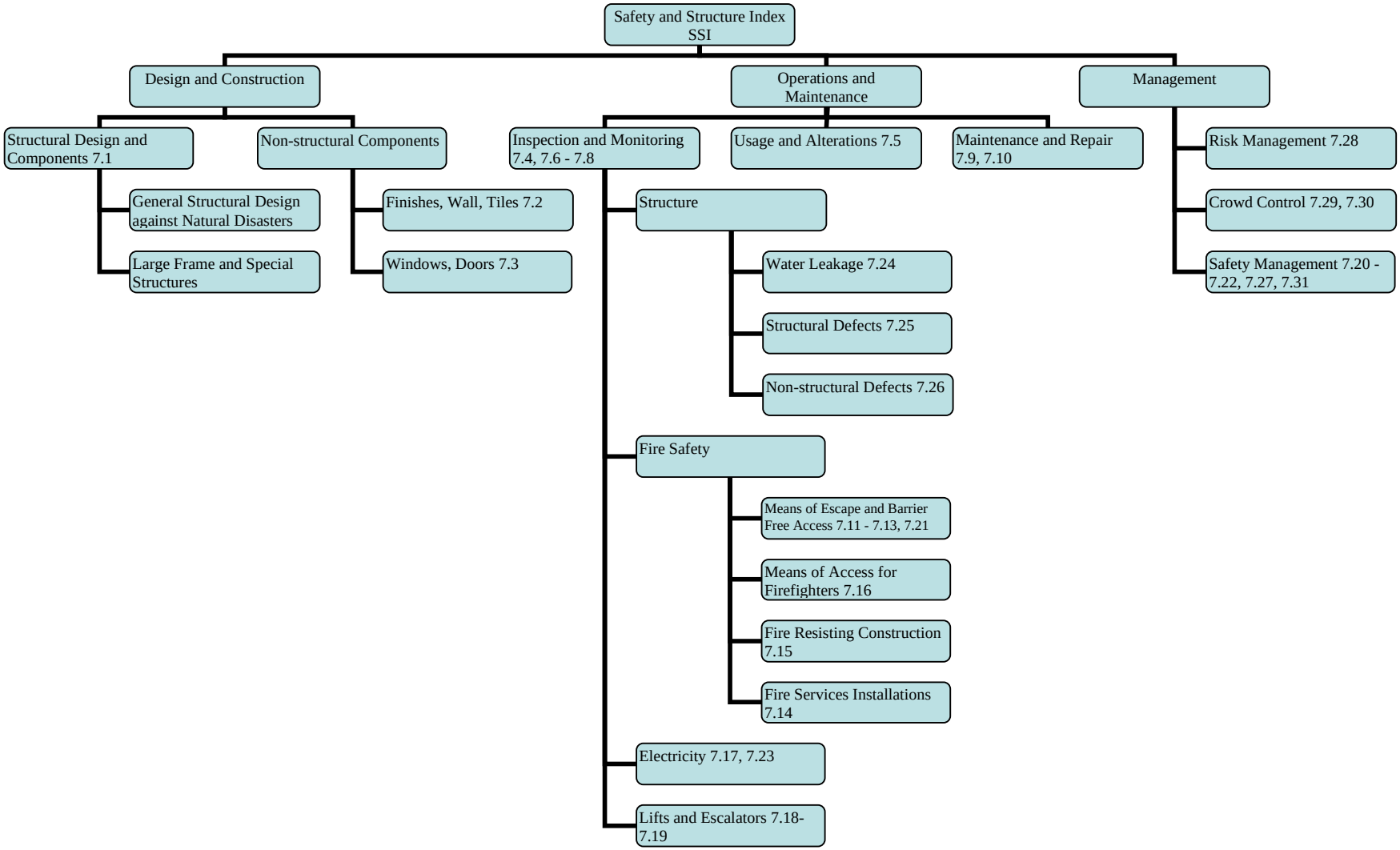
2.5 Figure 2-5 Framework of Module 5: Culture Index



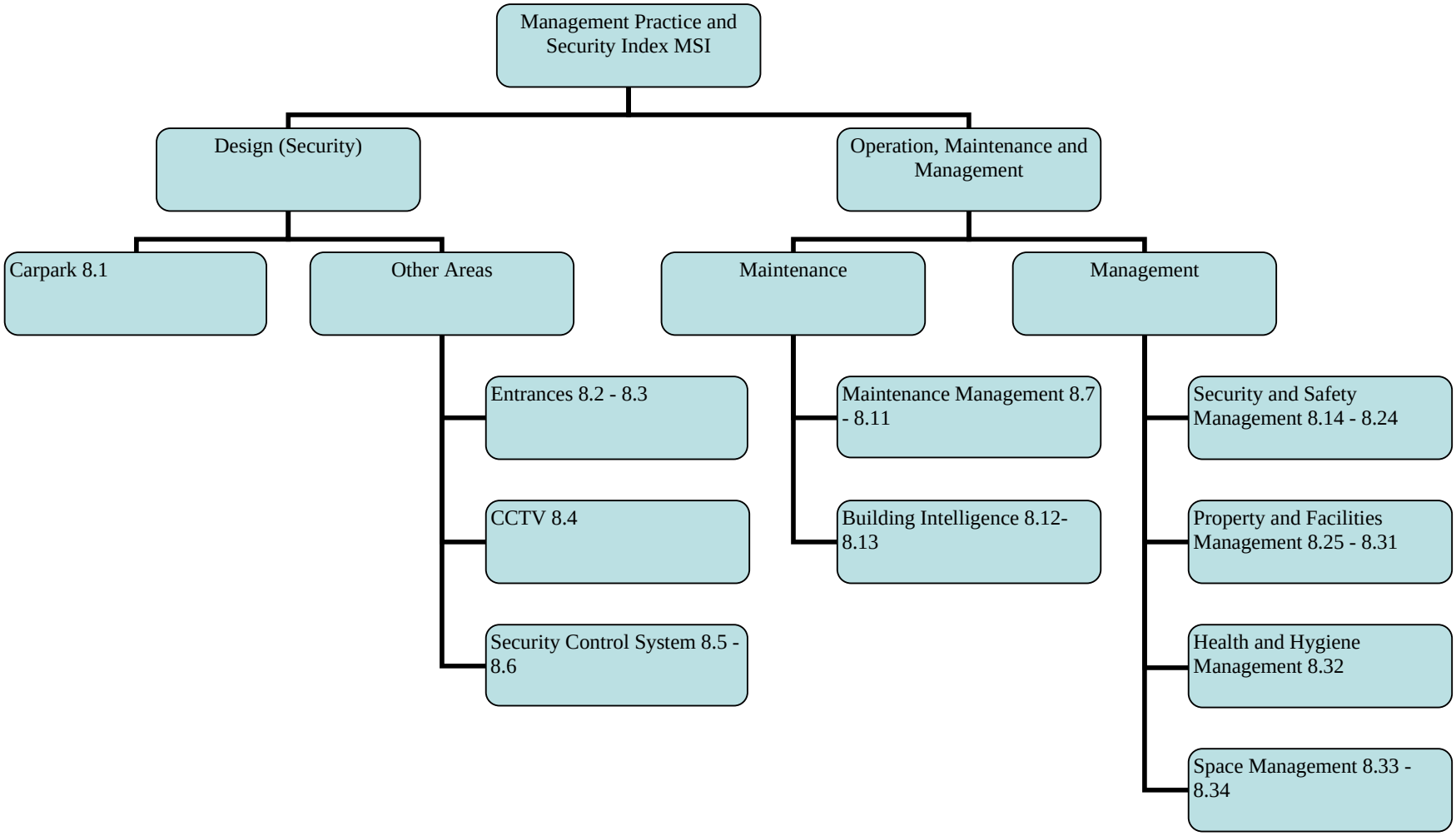
2.6 Figure 2-6 Framework of Module 6: e-Services and Technology Index



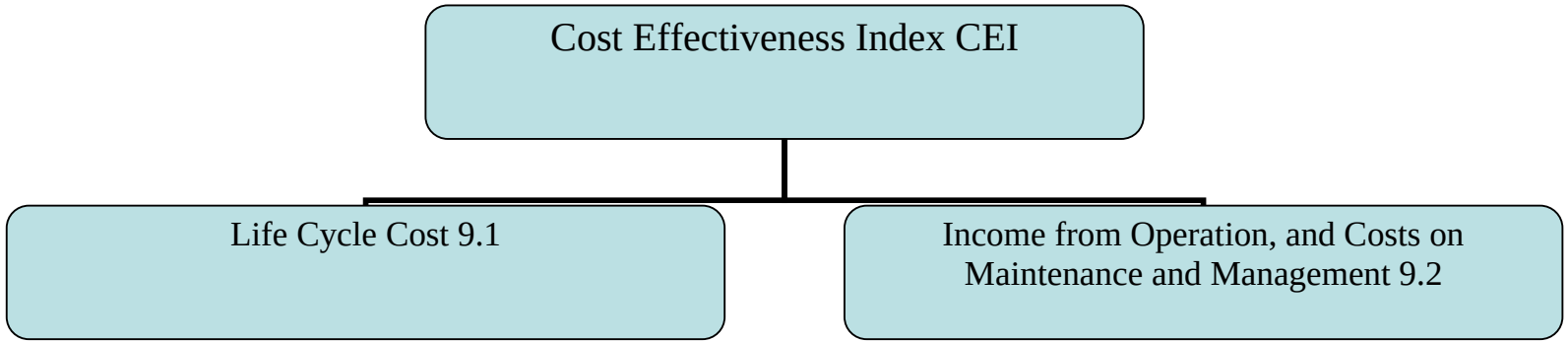
2.7 Figure 2-7 Framework of Module 7: Safety and Structure Index



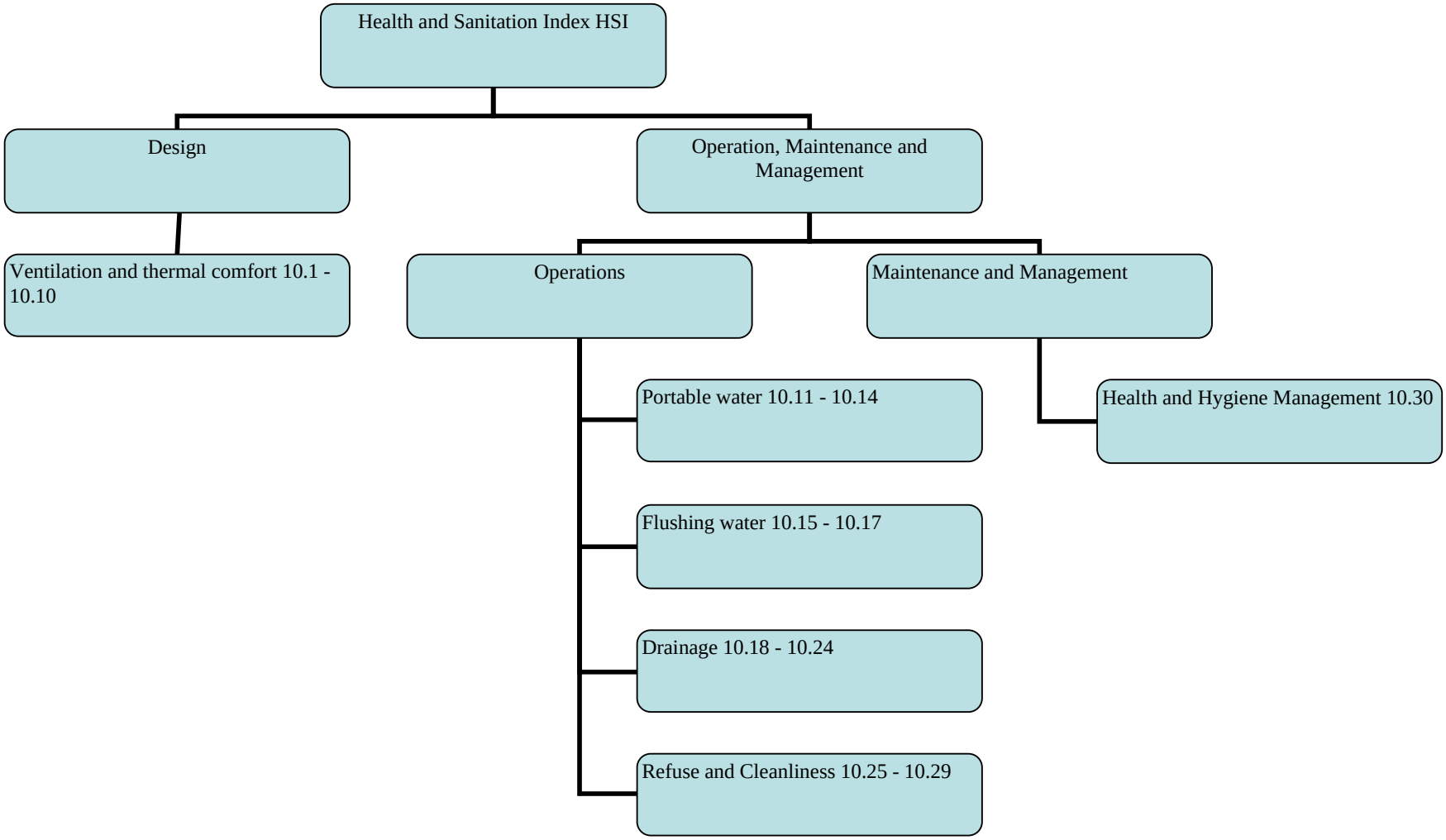
2.8 Figure 2-8 Framework of Module 8: Management Practice and Security Index



2.9 Figure 2-9 Framework of Module 9: Cost Effectiveness Index



2.10 Figure 2-10 Framework of Module 10: Health and Sanitation Index



INTELLIGENT BUILDING INDEX (IBI) MANUAL

Version 5.0 (r0)

Legends:

Each module is divided into two parts, namely (1) Marking Scheme and (2) Remarks and References. In the first part, a schedule of 5 columns is provided with the first column shows the item no in sequence, from 1 onwards. The second column is the heading of each element, and the third column shows the marking scheme. Column 4 is a description of the element, and column 5 is the recommended weighting for the element. Each row represents one element. The following is an example:

Item	Heading	Marking scheme	Descriptions	Weight
26	Lighting : Ease of control	[automatic control , timer control , manual control] to (80 , 60 , 30) Add 20 to lighting with dimming control	Ease of control is an important factor in energy saving. A poor lamp control scheme will hinder the implementation of any energy saving exercise within the building.	6

The second part is a schedule of 7 columns, with a sub-heading Remarks and References. The first column showing the same item no. as that in the Marking Scheme as the key. Column 2 shows the link, if any, to other element in other modules, they are also shaded for easy identification. The digit(s) before the underscore of the Link refers to the module no. and the digit(s) after the underscore of the Link refers to the element no. For example, 1_20 refers to the module no. 1 and the element no. 20. Column 3 shows the remarks and references for the element. Columns 4 to 7 are categorization keys as detailed in the user guide Table 1_ 6 to Table 1_9. Columns 4 to 7 show the discipline code, code of the source of information, code of the stage of development and code of the dimension of building intelligence, respectively. The following is an example:

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
26	1_36	0	LI	PJ/RD	D/P	3

CHAPTER 3 GREEN INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_1 GREEN INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Scientific Studies on Various Green Designs	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is left to the auditor to judge on the score of this item. Bonus scores for scientific studies on various green designs, including effects on the surrounding environment and buildings, such as sustainable features, light pollution, wall effect, wind and ventilation (AVA), etc.	9
2	Green building materials	[excellent , fair , bad] scores (90 , 60 , 30)	Extensive use of green building materials like low-emission coated glass, recycled rubber till, rubber soil, radon blocking paint etc. can be referred to whom giving marks to this item.	7
3	Existence of green features	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Balcony, Wider common corridors, Spacious lift lobbies, Communal sky garden, Communal podium garden, Acoustic fins, Sunshade and reflectors, Wing walls, wind catchers and funnels, Non-structural prefabricated external walls, utility platforms, mail delivery rooms with mailboxes, and noise barriers.	9
4	Green operations, maintenance and management	[yes , no] scores (90 , 50)	A proven green policy enforced, such as ISO 14000 certification or equivalent standards	7
5	Lifts and escalators energy consumption	Without passenger : [50 J/kg .. 500 J/kg] scores (90 .. 10) With passengers : [2 kJ/passenger/m .. 7 kJ/passenger/m] to (90 .. 10)	Two methods are available to find out the average power consumption. Without passenger, the car is first stopped at one floor below the middle floor of the service zone. It is then driven up three floors and back to the original floor. The total energy in J is divided by the net mass of the car to arrive at the figure for an empty car. During up-peak when all cars are closed to full load, total energy of the whole system during an interval of 5 minutes is divided by the total number of passengers handled by the system within the same time interval. This figure is further divided by the height of the zone of the lift group in m, arriving at the figure for a full-loaded car. Effective approach like Performance-based Overall Building Energy Efficiency Approach can be considered as an alternative.	2
6	Lifts and escalators handling capacity in percentage of total population	Ordinary lift: [15%..10%..5%..3%] scores (90..70..40..10) Sky lobby lift: [20%..15%..10%..5%] scores (90..70..40..10)	Handling capacity is the number of passengers handled by a lift system over a period of 5 minutes during up-peak and it is based on the assumption that lift cars are normally filled up to 80% of the rated load in terms of number of persons. Handling capacity is given by 240 * Contract capacity of car (in number of passengers) * Number of cars within a group / Up-peak Interval (in number of seconds).	1

		For a lift bank serving a sky lobby having a passenger handling capacity exceeding 20%, a score of 100 will always be given		
7	Lift and escalators maximum interval time	Assign a score of 80 for those that are complied with following Table Ref. 1_7 Add 2 each for any second shorter than the required maximum interval until 100. Deduct 2 each for any second longer than required maximum interval until 10	Interval time is the time required for the next car to arrive at the main terminal after the previous car has arrived the main terminal. It is an average value during the up-peak condition.	1
8	Lifts and escalators journey time	[40 s or below .. 120 s] scores (90 .. 10)	The journey time is an average value per passenger. It can be measured on site or evaluated by a simulation software package. It is the average time a passenger needs to take from the moment of entering the car to the moment of leaving the car.	1
9	Lifts and escalators waiting time	[30 s or below .. 90 s] scores (90 .. 10)	The waiting time is an average value per passenger and it can simply be taken as half the up-peak interval or it can be measured on site or evaluated by a simulation software package. It is the average time taken for a passenger to wait for the arrival of the appropriate car at the lift lobby.	1
10	Lifts and escalators Drive and controls systems	[ACVVVF , DCTL , ACVV or AC2 or DCWL , Hydraulic] to (90 , 70 , 40 , 10)	ACVVVF stands for Alternate Current Variable Voltage Variable Frequency and it is the most efficient drive from an energy conservation point of view. DCTL stands for Direct Current Thyristor Leonard. ACVV stands for Alternate Current Variable Voltage alone. DCWL stands for Direct Current Ward Leonard. Hydraulic is the most inefficient drive in lift systems.	2
11	Lifts and escalators maximum allowable electrical power of traction lifts	[compliance with Local Energy Codes, otherwise] scores (60 , 10)	Better than the Energy Codes can score higher.	2
12	Lifts and escalators total harmonics distortion (THD) of motor drive systems for lifts and escalators	[compliance with Local Energy Codes, otherwise] scores (60 , 10)	Better than the Energy Codes can score higher.	2
13	Lifts and	[0.85 or better , otherwise] scores	The figure can be measured by digital multi-function meter or digital power analyzer Or	2

	escalators total power factor of motor drive systems for lifts and escalators	(90 , 50)	Manufacturer's information will be a piece of alternative information which acceptable for this assessment.	
14	Lifts and escalators maximum allowable electrical power of escalators & passenger conveyors	[compliance with Local Energy Codes, otherwise] scores (60 , 10)	Better than the Energy Codes can score higher.	2
15	Lifts and escalators energy regeneration into the supply system	[presence of such feature , absence] scores (90 , 50)	The feature of energy regeneration of lift systems back into the power supply system is a very distinctive feature of energy conservation.	2
16	Thermal comfort	Absolute Predicted Mean Vote (PMV) = [0.3 or below .. 2.0 or above] scores (95 .. 10)	Thermal comfort is measured by PMV in accordance with ISO 7730 that Met = 1 and Clo = 0.8 will be applied for Hong Kong situation.	5
17	Overall Thermal Transfer Value	[OTTV <= 15 W/m^2 , OTTV <= 24 W/m^2 , OTTV >= 60 W/m^2] scores (90 , 60 , 10)	The suitable level of Overall Thermal Transfer Value (OTTV) and the methodology of OTTV calculations are specified in the Code of Practice for Overall Thermal Transfer Value in Buildings 1995 published by the Buildings Department of Hong Kong (BD). For our OTTV, the building tower is concerned and please refers to PNAP APP-67 issued by BD by details. Performance-based Overall Building Energy Efficiency Approach can be considered as an alternative.	8
18	Electricity demand provision	[Energy demand keep comply with the minimum designed load density/ 5% more than the load density/ 10% more/ 20% more scores (90 .. 80 .. 60 .. 10)	Electrical power load demand various with the characters of the building and its location. Local Energy Code or Commercial Codes such as CIBSE Codes can also be applied for this assessment.	7
19	Electric power quality	[fully compliance of Local Energy Codes, partial compliance with the Codes, completely not compliance] scores (60 , 50 , 10)	The compliance includes requirements such as transformer efficiency, circuit design, motor efficiency, motor sizing, power factor improvement, demand side management, total harmonics distortion, balancing of phases and metering/monitoring facilities etc.	8
20	Energy recycling system to provide heating	[use of waste heat , otherwise] scores (90 , 50)	Heating services in Hong Kong is not so important except for some special buildings like hospitals and hotels etc. N/A can be applied if no heating services were designed.	2

21	Provision of heat pump and heat wheel	Improvement in COP by x% is to be assessed. [x%=10% .. x%= -10%] to (90 .. 5)		3
22	Provision of heat recovery such as free cooling or heating	[exist , not exist] scores (90 , 50)	Heat recovery is a good practice in energy saving.	3
23	Coefficient of performance of air-conditioning installation	[2.5 or above .. 0.5 or below] scores (90 .. 10)	The total heat rejected by the chiller system of the building can be estimated from the flow rate of chilled water into and out of all chillers, the temperature difference and some physical constants. The overall electric power consumed includes consumptions of all chillers, cooling towers, pumps, air handling units, fan coil units and primary air units. It is difficult to get the measurements when the whole building is fully loaded. A 70% loading condition is considered satisfactory to conduct the Coefficient of performance measurement. BMS data can be accepted for this assessment.	9
24	Waste heat discharging method for the refrigeration plant	[district cooling/part of a tri-generation system, sea water, air cooling, fresh water cooling] scores (90 , 80 , 70 , 10)	Sea water cooling is considered as the most environmental friendly method of cooling while it is a very bad practice to use potable water for cooling purpose.	6
25	Cooling air distribution system	[all air system (VAV), air-water system, all water system, , other central system, split unit, Window unit] scores (90, 60, 50, 50, 40, 10)	Centralized air-conditioning systems are often more energy efficient than applying unitary equipment. Adopting variable air volume systems can save motor power as comparing with constant air volume system. Therefore, centralized types of air-conditioning system are often more preferable from an energy saving point of view.	5
26	Total energy consumption of the HVAC systems	[60 kWh/yr/m^2 or below .. 120 kWh/yr/m^2 .. 130 kWh/yr/m^2 .. 150 kWh/yr/m^2 or above] scores (90 .. 70 .. 40 .. 10)	The data can be obtained from an energy auditing exercise. Total energy consumption related to HVAC must be considered and such yearly value is divided by the GFA of the whole building. Performance-based Building Energy Efficiency Approach can be considered as an alternative.	9
27	Daylightings	Average daylight factors [3% or above .. 0%] scores (90 .. 10)	Normally, daylighting is measured in terms of daylight factor which is the ratio of the lux level at a particular location inside the building to the average lux level outside the building in open space. Here, the average indoor lux level is to be used. Hence, the auditor must take sampled values by turning off all artificial lightings and opening all internal shading devices. The Lighting Guide LG10: 1999 Daylighting and Window Design published by CIBSE can be referred to.	4
28	Permanent artificial lighting average power density	[Full compliance of Local Energy Codes, Not Compliance] scores (90 .. 10)	Better than the Energy Codes can score higher.	8
29	Permanent	[16 or less .. 22] scores (90 .. 50)	For the estimation of glare index, auditors are recommended to Linked to Technical	3

	artificial lighting average glare index		Memoranda TM 10: 1985 on The Calculation of Glare Indices and Lighting Guide LG7: 1993 on Lighting for Office. They are also applied by the present sustainability assessment Code: BEAM Plus, version 1.2 published in 2012.	
30	Permanent artificial lighting average lux level	[500 lux .. 1000 lux or higher] scores (90 .. 30) [500 lux .. 200 lux or lower] scores (90 ..10)	The desirable level of illumination of an indoor environment in lux, of course, depends on the application of the environment. Here, an office building is considered and it is the average lux level of the whole building that is under consideration. A value of 500 lux is considered appropriate for this kind of building. If other types of building was assessed, the Lux Level shall be adjusted by Local Energy Codes or Commercial Codes such as CIBSE Interior Lighting Codes	3
31	Average efficacy of all lamps	[50 lm/W or above .. 5 lm/W or below] scores (90 .. 10)	Efficacy is the ratio of the total lumen output of a lamp to the total electric power input to it. Very often, the consumption by the control gear, i.e. ballast of a fluorescent tube, is not considered. In our case, all energy consumptions must be included.	8
32	Average colour temperature	[corresponding to 555 K .. 450 K] scores (90 .. 10) [corresponding to 555 K .. 700 K] scores (90 .. 10)	The colour temperature is important to the comfort of sensation of occupants and it is important to the efficiency and health of occupants in the building.	2
33	Ease of lighting control	[automatic control , timer control , manual control] to (80 , 60 , 30) Add 20 to lighting with dimming control	Ease of control is an important factor in energy saving. A poor lamp control scheme will hinder the implementation of any energy saving exercise within the building.	5
34	Lavatory flushing system	Toilet: [ordinary system , full and half flushing system , recycled water system] scores (50 , 80 , 90)		5
35	Lavatory sanitary-wares flushing operation	Urinal: [continuous , press and release , electronic sensing] scores (10 , 50 , 90)		5
36	Lavatory fresh water supplies	[normal tap , press and release , electronic sensing] to (50 , 70 , 90)	The emphasis is how to prevent wasting of water when users forget to do anything after they have washed their hands.	5
37	Lavatory water systems functionality	[no failure .. 5 or more failures] scores (90 .. 10)	Randomly select five male and five female lavatories to test the water supplies system there. Potable water supply is considered an important feature of hygiene of the whole building.	3
38	Indoor air quality	[compliance with ASHRAE 62.1-2010 , compliance with statute, incompliance] scores (90 , 60 , 10)	ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality	9
39	Amount of fresh air changes per	[9.5 litres/s/occupant .. 15 litres/s/occupant] scores (90 .. 10)	Fresh air supply is important to the health of occupants and thus the intelligence of them inside an intelligent building. The main objectives of fresh air supply are to provide enough	7

<table>
<tr><td></td><td>second</td><td>[9.5 litres/s/occupant .. 1 litre/s/occupant] scores (90 .. 10)</td><td>oxygen and to remove odour from the indoor environment. Too much fresh air consumes unnecessary energy. Reference to ASHRAE Standard 62-2004
Recommended Air Change Rates proposed by Chartered Institute of Building Services Engineers Guide B is acceptable as an alternative assessment criteria:<table><tr><td>Space</td><td>Air change rates per hour</td></tr><tr><td>Offices</td><td>4- 6</td></tr><tr><td>Dinning hall, restaurants</td><td>10 - 15</td></tr><tr><td>Carpark</td><td>6 - 10</td></tr><tr><td>Libraries, museums and galleries</td><td>3 - 4</td></tr><tr><td>Boiler rooms</td><td>15-30</td></tr></table></td><td></td></tr>
<tr><td>40</td><td>Non-smoking building</td><td>[specially isolated and ventilated smoking areas , non-smoking , otherwise] scores (90 , 60 , 10)</td><td>A non-smoking building is always appreciated compared with a smoking building. However, a building with specially designed isolated areas for smoking should be awarded a higher score.</td><td>6</td></tr>
<tr><td>41</td><td>Special ventilation for some areas, e.g. carpark, kitchen, restaurant and toilet</td><td>[Fully automated demand control achieving 20 AC/h or more, .. , just comply with statutory requirements , .. , incompliance] scores (90 , 60 , 10)</td><td>The provision of air change shall not be less than statutory requirements, and if fully automated demand control can be provided, 90 score shall be considered. Variation to suit the environmental change such as step control or timer control shall gain bonus scores. These special areas are normally not air-conditioned. The ventilation rate is very important to the personnel working in these areas. For example, ventilation rate to the carpark is important to keep the carpark at a reasonable temperature, in particular, during peak summer and to maintain a low density of poisonous gas. It is important to the health of the occupants.
Notes: AC/h refers to “Air Change per hour”. If alternative natural ventilation is provided, scores higher than 90 may be given.
In US, International Energy Conservation Code: IECC 2012, Section R403.5 Mechanical Ventilation (Mandatory) published by International Code Council, Inc., Washington, DC:
The building shall be provided with ventilation that meets the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.
IECC 2012, Section R403.5.1 Whole-House Mechanical Ventilation System Fan Efficacy
Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.5.1.</td><td>3</td></tr>
<tr><td>42</td><td>Contamination of chilled and condensing water , virus, bacteria or other contaminants</td><td>[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)</td><td>The contamination refers to bacteria, virus and other contaminants. Regular water quality test report for monitoring is necessary.</td><td>7</td></tr>
</table>

43	Water leakage of MVAC systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is considered excellent if there is no leakage point at all. A good system refers to not more than 3 leakage points within the whole building. It is also based on the judgment of the auditor. There are two kinds of water leakage, namely condensate drain blockage and condensed water due to poor insulation.	5
44	Cleanliness of MVAC systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is a very subjective point and therefore the judgment of the auditor is relied on. Attention should be paid to the intersection of pipes, ducts and all louvers and diffusers.	7
45	Use of Water-cooled Chillers with fresh water or sea water cooling	[exist , not exist] scores (90 , 50)	This item is comparing water-cooled chillers against air-cooled chillers. Refer also item 1.26 above.	6
46	Provision of consumables in Lavatory	[none , non-recycled paper , recycled paper , rolling towel , dryer] scores (10 , 20 , 40 , 50 , 90)	The emphasis is how to prevent wasting of materials, in particular, toilet consumables.	3
47	Recycle of wastes produced by the building	[yes , no] scores (90 , 50)	This is a matter of existence of such facility or not.	6
48	Substantial use of non-exhaustible material for construction	[yes , no] scores (90 , 10)	This is a very subjective issue and the judgment of the auditor is relied on.	5
49	Plans to lower the life cycle usage of energy	[exist , not exist] scores (90 , 30)	The existence of any new plan to conserve energy or reduce energy use without downgrading the services to the occupants on a continuous basis is the key issue of this clause. The display of energy usage, efficiency and performance in public areas, etc.	8
50	Use of natural ventilation	[exist , not exist] scores (90 , 60)	The intention to introduce natural ventilation as far as possible is the key issue of this clause. Of course, during summer when the outdoor temperature is far above the desirable indoor temperature, natural ventilation is not feasible. However, during winter, when the outdoor temperature is below the desirable indoor temperature, some means can be conducted to introduce natural ventilation. Enthalpy control in HVAC is one possible method to maximize fresh air supply during winter. The existence of such control algorithm is the main theme of this clause.	4
51	Substantial use of renewable energy	[substantial use, minimal use, nil] scores (90, 70, 50)	Renewable energy sources such as solar energy, wind energy, tidal energy are the key issues of this clause.	5
52	Plantation and landscape gardening	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Optimal plantation inside the building and landscape gardening around the building, with a landscape consultant's advice, are excellent practices.	8
53	Image of environmental	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is the overall opinion of the auditor. Therefore, the judgment of the auditor is relied on. The auditor should look at various design features by the architect whether environmental	6

	friendliness		friendliness was taken care of during the design stage. Also, whether the building management has put environmental friendliness at a top priority is to be addressed.	
54	Drainage	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is an overall assessment on the drainage system of the whole building. Although the judgment of the auditor is relied on for this issue, the following points must be taken into consideration by the auditor. o Number of junctions sufficient strength and capacity o Use of suitable materials o Sufficient gradient o Adequately supported (if underground) o Readily accessible o Protected against differential movement o Watertight between joints o Without obstruction o Number of manhole and inspection chambers o Position of manhole and inspection chambers	7
55	Waste disposal	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is an overall assessment on the waste disposal system of the whole building. Although the judgment of the auditor is relied on for this issue, the following points must be taken into consideration by the auditor. o Efficiency of sewage disposal o Provision of refuse chamber o Effects on other activities in the buildings o Management of the sewage disposal o Recycle of waste o Proper collection of waste o Cleanliness o Special procedure for dangerous waste (radioactive waste) o Number of dustbins o Size of dustbins	7
56	Outdoor air pollution	[air pollutants exhausted from the building , otherwise] to (10 , 90)	This part refers to any gas generated inside a building that is exhausted out of the building.	6
57	Lift in-car noise level	[50 dBA or lower ..60 dBA .. 65 dBA or higher] scores (90 .. 50.. 10)	In-car noise can be measured by the EVA-625 recorder with a microphone placed 1 m above the car floor at the middle of the car when the empty car is traveling upward from the bottom floor to the top floor of the zone. During the noise measurement, lift car ventilation fan or air-conditioner should be switched on.	2
58	Lift lobby noise	[50 dBA or lower ..60 dBA .. 65	Only lifts' operation is taken into account of the lobby noise and it can be measured by using	2

	level	dBA or higher] scores (90 .. 50.. 10)	a standard sound level meter at the lobby. The point of measurement should be specified, e.g. 1 m above the finished floor level and 1 m away from the landing doors. Ambient noise should be excluded from the measured values.	
59	Lift machine room noise level	[audible at the nearest common area/occupied area , otherwise] scores (10 , 90)	It is not a very serious problem if the noise level inside the machine room is higher. Hence, there are only two scores for it. If it is audible from any common area, it will score 10. Otherwise, it will score 100.	2
60	Lifts and escalators vibration	Horizontal vibration: [0.15 m/s2 or higher .. 0.08 m/s2 .. 0.04 m/s2] scores (10 .. 50 .. 90) Vertical vibration: [9.8 m/s2 .. 9.88 m/s2 .. 9.95 m/s2 or higher] scores (90 .. 50 .. 10) The above limits apply to lifts with speeds up to 4 m/s. Lifts having speeds above this value will be subject to increased vibration limits. For lift speeds in the range 4-7 m/s, a multiplier of 1.5 may be used for all acceleration level limits.	The same machine, EVA-625, used in item 1.61 can be used to measure the vibration levels	1
61	Noise level of MVAC systems	[NC 45 or below .. NC 50 .. NC 65] scores (90 .. 70 .. 10)	Acoustics is a very important factor related to the satisfaction of an air conditioning system.	6
62	Outdoor noise pollution	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Statutory compliance is a minimum (full compliance shall score 60, incompliance shall score 10). Optimal noise mitigation measures, with an acoustic consultant's advice, are excellent practices.	6
63	Indoor noise pollution	Average noise level at [55 dB(A) or below .. 70 dB(A) or above] scores (90 .. 10)	Five locations inside the building are randomly chosen to perform the test. The average noise level in dB(A) is used.	6
64	Sunlight pollution by curtain wall	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Curtain wall is not a preferable means of construction except from an aesthetic point of view. Curtain wall will increase the OTTV of a building and it will reflect sunlight to affect the drivers on the road. Here, we are looking at the fact whether the curtain wall, if existing, will affect the drivers or not. It is quite subjective and therefore the judgment of the auditor is relied on.	7
65	Pollution related to fuel consumption by heating	[no pollution , otherwise] scores (90 , 10)	The score is based on human judgment of the auditor.	2
66	Condition of AC pipe insulation	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The score is based on human judgment of the auditor. Insulation materials contained CFC/HCFC should not be encouraged.	7

67	Refrigerant of AC system	[environmental friendly , otherwise] scores (90 , 10)	For new installations, all conventional refrigerants that are not environmental friendly are forbidden to be used.	4
68	Pollution produced	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Pollution is in terms of the use of reusable construction materials, categorisation of garbage, reduction in the emission of carbon dioxide, the employment of virtual wiring so that partitioning will not generate wasted electric wires. This is a very subjective issue and therefore the judgment of the auditor is relied on.	7
69	Modernization of Major Facilities	[System in place, .., no] to (90 , .., 50)	A sinking fund and maintenance fund available for modernization of major facilities. It is important to identify whether a system is in place to monitor the performance of major facilities for the consideration of modernization.	1
70	Access for erection and maintenance of MVAC systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Adequate amount of space for convenience, safety and effective maintenance and erection of equipment is very important to the overall performance of the HVAC system. This is based on the judgment of the auditor.	1
71	Light fitting maintenance factor	[90% or above .. 50%] scores (90 .. 50)	The maintenance factor refers to ratio of the total lumen output of a lamp together with the fitting due to aging and dirt to the total lumen output of it when new. One lamp is randomly chosen from every floor throughout the building and the test is carried out.	2
72	Management Plans for Waste Minimization and Materials Recycling	[yes , no] scores (90 , 50)	Evidence of management plan and achievements in waste minimization and materials reuse and recycling.	6
73	Energy Management / Energy Savings Measures / Energy Audit / Carbon Audit	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	For example, the Danish Board of Technology suggests the following: Passive house Standard: 17.5kWh/sm/year + 550kWh/heated area; Low energy class 1: 35kWh/sm/year + 1100kWh/heated area. Other international standards such as The Passive house Standard or the AECB Carbon Lite Standards, can be referred to. Other international energy management standards such as BS EN 16001 / ISO 50001 Energy Management Systems, ANSI/ASHRAE/IESNA Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings can also be referred to.	9
74	Green Transportation Means	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	such as the provision of electricity-powered means of transportation, or ease of access to main public transport terminals to discourage the use of private car, etc	6
75	Water Management / Water Savings Measures / Audit	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Achieving all the following four may be considered excellence: (1) active leakage control; (2) water conservation measures; (3) seawater for flushing; and (4) water reclamation. The award of government certificate on water savings can be referred.	6
76	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1		The auditor is recommended to consider the adoption of green design concepts by the various elements of applicant such as Lobby Space, Corridors width, Fresh air, Natural light, Sky Garden, Acoustic fins, Wind catchers, Security, Lighting optimization, Optimal and flexible air-conditioning, Machine noise, Logistics, Virtual wiring, Sustainability, Maintainability. International and Local Green and/or Standards/Guidelines, such as HKBEAM, BEAM Plus, CGBC and Joint Practice Notes in Hong Kong can be referred to.	EP	RD/PJ	D	3
2		International and Local Green Codes such as LEEDS of US; HKBEAM/BEAM Plus of HK; CGBC of China/HK can be referred to.	EP	RD/PJ	I	3
3		The Government of HK pays high attention to these green features. In early 2001 and 2002, the Buildings Department of HKSAR initiated the promotion of green and innovative buildings in Hong Kong, which was a major step forward with the releasing of 2 Joint Practice Notes on green features for new building developments. Jointly prepared by the Buildings Department, the Lands Department and the Planning Department of HKSAR, the Practice Notes for professional persons sets out the incentives to be provided by the Government to encourage the design and construction of such buildings. Such green features could be excluded from gross floor area (GFA) and/or site coverage (SC). Cumulative GFA exemption must not exceed 8% of total permitted GFA, subject to an overall cap of 10% on total GFA concessions. In 2011, the GFA concession for balconies and utility platforms was reduced from the original level of 100% to "up to 50%" of the area of such features, and the maximum thickness of non-structural prefabricated external walls eligible for GFA concessions was reduced from 300mm to 150mm.	AR	RD/C	D	3
4			EP	RD	P	3
5		Depending on the method of measurement	LE	RD/T/LB	D/P	3
6			LE	RD	D	3
7		Table Ref 1_7 extracted from COP for energy efficiency of lift and escalator installations 2007 issued by HK EMSD for reference	LE	RD	D/P	3
8			LE	RD	D/P	3
9			LE	RD	D/P	3
10			LE	RD	D	3
11		Maximum allowable values indicated in Table Ref 1_11 is extracted from the Building Energy Code of Hong Kong [2012] for reference.	LE	T/LB	D	3
12		Table Ref 1_12 is extracted from the Building Energy Code of Hong Kong [2012] for reference.	LE	RD	D	3
13			LE	RD/T	D	3
14		Tables Ref 1_14.a to f are extracted from the Building Energy Codes of Hong Kong [2012] for reference.	LE	RD	D	3
15			LE	RD/C	D	3
16			AR	RD/T	D/P	3
17		The OTTV of this guideline refers to PNAP APP-67 of Hong Kong Buildings Department that applies to a	AR	RD	D/P	3

		building tower. Performance-based Overall Building Energy Efficiency Approach can be considered as an alternative.				
18		Table Ref 1_18 extracted from CIBSE Code: Design electrical load demand for reference	EE	RD	D	3
19		In Hong Kong, Building Energy Codes 2012 published by EMSD is referred.	EE	RD	D	3
20			AC	RD/PJ	D	3
21			AC	RD	D	3
22			AC	RD	D	3
23			AC	RD/C	D	3
24			AC	RD/C	D	3
25			AC	RD/C	D	3
26		Auditors are recommended to refer to the Code of Practice for Energy Efficiency of Lighting Installations published by EMSD in 2007 [1998], Building Energy Code 2007 and Guidelines on Energy Audit 2007, published by Electrical & Mechanical Services Department (EMSD), Hong Kong.	AC	RD/LB	D/P	3
27			LI	RD/T	D/P	3
28		Table Ref 1_28 extracted from the Building Energy Codes of Hong Kong 2012 for reference	LI	RD	D	3
29			LI	RD/T	D/P	3
30			LI	RD/T	D/P	3
31			LI	RD/T	D/P	3
32			LI	RD/T	D/P	3
33			LI	RD/PJ	D/P	3
34			PD	RD/C/V	D	3
35			PD	RD/C/V	D	1
36			PD	RD/C/V	D	1
37			PD	T	P	3
38		Refer ASHRAE62.1 and reference: Chow, T.T., & Lam, J.C. (1992). Thermal comfort and energy conservation in commercial buildings in Hong Kong. Architectural Science Review, 35(2), 67-72.	AC	RD/T	D/P	3
39			AC	RD/C	D/P	3
40			AC	C/PJ	D/P	3
41			AC	RD/C/V	D/P	3
42			AC	PJ/LB	P	3
43			AC	V/PJ	P	3
44			AC	V/PJ	P	3
45		Water-cooled chiller has a benefit of higher COP as compared with air cooled one. In Hong Kong, use of fresh water cooling Chillers was promoted in 2000. In 2013, district cooling to the new Kai Tak Re-development was provided by sea-water-cooled chillers.	AC	RD	D	3
46			PD	C/V	D/P	3

47			EP	RD	D/P	3
48			EP	RD/C	D/I	3
49		The display of energy usage has been statutorily required in some countries. Life cycle cost analysis is also a popular assessment required by variety of Green / Sustainability Codes	EP	RD/C	D/P	3
50			EP	RD	D	3
51			EP	RD	D	3
52			EP	V/PJ	D/P	3
53			EP	V/PJ	D/I/P	3
54			PD	RD/PJ	D/I/P	3
55			EP	RD/PJ	D/I/P	3
56		Zero carbon for new homes law in the UK (2016) can be one of the considerations	EP	RD	D/P	3
57			LE	T/LB	P	3
58			LE	T/LB	P	3
59			LE	T/LB	P	3
60			LE	T/LB	P	3
61			AR	T/LB	P	3
62			EP	T/LB	P	3
63			EP	T/LB	P	3
64			EP	RD/PJ	D	3
65			AR	RD/PJ	D	3
66			AC	V/PJ	P	3
67			AC	RD/C	D	3
68			AR	RD/PJ	P	3
69			GE	C/PJ	P	3
70			GE	V/PJ	P	3
71			LI	RD/LB	P	3
72		In Hong Kong, refer PNAP 98, 243, and 245	MA	RD/C	P	3
73		Mandatory Energy Efficient scheme has been launched to Hong Kong in 9/2012. Building energy efficient assessment can be done by Registered Energy Assessor (EMSD HK).	MA	T/LB	P	3
74			EP	V	D/P	3
75		In Hong Kong, WSD's TWM leaflet at http://www.wsd.gov.hk/en/html/pdf/TWMe.pdf shows the details and the pilot scheme of water reclamation system. In Singapore, the NEWater Scheme on water reclamation was launched in 2001. The Water Efficiency Labeling Scheme is to be launched by WSD in 2009 in Hong Kong.	MA	RD/C	D/P	3
76			GE	PJ	D/I/P	1/2/3/4

Ref1_7 Recommended Interval of a Lift Bank

Zone type:	Maximum interval of a lift bank (s)
Office zone	30
Hotels	40
Institutional zone	45
Commercial zone (Shopping Complex)	30
Industrial zone	55
Composite zone	The smallest value of maximum intervals that apply to different zone types of a composite zone.

Ref 1_11 Maximum Allowable Electrical Power (kW) of Traction Lifts

Source: Building Energy Codes of Hong Kong 2012, Maximum Electrical Power (kW) of traction drive lift at rated load of various ranges of rated speed, Table 8.4.1, pp 39.

Rated Load L (kg)	Rated Speed Vc (m/s)				
	Vc < 1	1 ≤ Vc < 1.5	1.5 ≤ Vc < 2	2 ≤ Vc < 2.5	2.5 ≤ Vc < 3
L < 750	6.7	9.5	11.4	15.2	17.1
750 ≤ L < 1000	9.5	11.4	16.2	20	22.8
1000 ≤ L < 1350	11.4	16.2	20.9	25.7	30.4
1350 ≤ L < 1600	14.3	19	25.7	30.4	36.1
1600 ≤ L < 2000	16.2	23.8	30.4	37.1	43.7
2000 ≤ L < 3000	23.8	35.2	44.7	56.1	66.5
3000 ≤ L < 4000	31.4	45.6	59.9	74.1	87.4
4000 ≤ L < 5000	39.9	57	74.1	92.2	109.3
L ≥ 5000	0.0079L + 0.475	0.0112L + 0.95	0.0148L + 0.48	0.018L + 1.9	0.0217L+ 0.475
	3 ≤ Vc < 3.5	3.5 ≤ Vc < 4	4 ≤ Vc < 5	5 ≤ Vc < 6	6 ≤ Vc < 7
L < 750	20	21.9	23.8	28.5	32.3
750 ≤ L < 1000	25.7	29.5	30.4	37.1	43.7
1000 ≤ L < 1350	34.2	38	42.8	49.4	57
1350 ≤ L < 1600	40.9	46.6	49.4	58.9	68.4
1600 ≤ L < 2000	50.4	57	61.8	71.3	83.6

$2000 \leq L < 3000$	75.1	85.5	90.3	109.3	125.4
$3000 \leq L < 4000$	98.8	114	123.5	142.5	166.3
$4000 \leq L < 5000$	123.5	142.5	152	180.5	209
	$7 \leq Vc < 8$	$8 \leq Vc < 9$	$Vc \geq 9$		
$L < 750$	37.1	42.8	$4.643Vc + 0.0013Vc^3$		
$750 \leq L < 1000$	49.4	57	$6.192Vc + 0.002\ Vc^3$		
$1000 \leq L < 1350$	66.5	76	$8.357Vc + 0.002Vc^3$		
$1350 \leq L < 1600$	78.9	90.3	$9.905Vc + 0.0025\ Vc^3$		
$1600 \leq L < 2000$	99.8	114	$12.381Vc + 0.0013Vc^3$		
$2000 \leq L < 3000$	147.3	166.3	$18.572Vc + 0.0029Vc^3$		
$3000 \leq L < 4000$	194.8	223.3	$24.762Vc + 0.0036Vc^3$		
$4000 \leq L < 5000$	242.3	275.5	$30.953Vc + 0.0046Vc^3$		

Ref 1_12 Maximum allowable THD for Lift and Escalator Motor Drive Systems

Source: Building Energy Codes of Hong Kong 2012, Maximum Total Harmonic Distortion of Motor Drive for lift, Table 8.6.1, pp 44.

Circuit Fundamental Current of Motor Drive, I (A), Moving Up with Rated Load at Rated Speed	Maximum Total Harmonic Distortion (%) in Each Phase
I < 40A	40%
40A ≤ I < 80A	35%
80A ≤ I < 400A	22.5%
400A ≤ I < 800A	15%

Source: Building Energy Codes of Hong Kong 2012, Maximum Total Harmonic Distortion of Motor Drive for escalator and passenger conveyor, Table 8.6.2, pp 45.

Circuit Fundamental Current of Motor Drive, I (A), with No Load at Rated Speed	Maximum Total Harmonic Distortion (%) in Each Phase	
I < 40A	35%, for electrical supply direct from building's feeder circuit	40%, for electrical supply not direct from building's feeder circuit
40A ≤ I < 80A	35%	
80A ≤ I < 400A	22.5%	

Ref 1_14a Maximum electrical power of escalator at designated width and rise for ranges of rated speed operating under no load

Source: Building Energy Codes of Hong Kong 2012, Maximum electrical power of escalator at designated width and rise for ranges of rated speed operating under no load, Table 8.4.3, pp 41

Nominal Width W (mm)	Rise R (m)	Electrical Power (W) at Rated Speed Vr (m/s)					
		Non-Public Service Escalator			Public Service Escalator		
		Vr < 0.5	0.5 ≤ Vr < 0.6	0.6 ≤ Vr < 0.75	Vr < 0.5	0.5 ≤ Vr < 0.6	0.6 ≤ Vr < 0.75
600	R < 3.5	1283	1473	1853	Not Applicable		
	3.5 ≤ R < 5	1520	1805	2233			
	5 ≤ R < 6.5	1758	2138	2613			
	R ≥ 6.5	209R + 432	247R + 530	302R + 652			
800	R < 3.5	1425	1615	1948	1995	2375	2945
	3.5 ≤ R < 5	1710	1995	2423	2375	2850	3515
	5 ≤ R < 6.5	1995	2375	2898	2755	3278	4085
	6.5 ≤ R < 8	2328	2755	3373	3135	3705	4608
	R ≥ 8	230R + 588	253.6R + 694	312.5R + 853	291.6R + 795	347.7R + 952	433R + 1183
1000	R < 3.5	1520	1805	2185	2138	2518	3135
	3.5 ≤ R < 5	1900	2185	2708	2518	3230	3705
	5 ≤ R < 6.5	2214	2660	3230	2898	3468	4275
	6.5 ≤ R < 8	2613	3040	3753	3278	3895	4893
	R > 8	268R + 653	349.6R + 771	346.7R + 997	305.6R + 837	346.7R + 1109	456.9R +1251

1000	Rise R (m)	Heavy Duty Escalator @		
		Vr = 0.5	0.5 < Vr ≤ 0.65	0.65 < Vr ≤ 0.75
	R ≤ 5	3822	4127	4328
	5 < R ≤ 6.5	4746	5074	5292
	6.5 < R ≤ 10	7034	7454	7742

$10 < R \leq 13$	8994	9502	9840
$13 < R \leq 16$	10864	11425	11801
$16 < R \leq 17.5$	11797	12388	12780
$17.5 < R \leq 20$	13355	13991	14425
$R > 20$	622.9R + 896	641.3R + 1165	654R + 1345

Remark:

@ escalator with the following characteristics can be regarded as heavy duty escalator :

- designed to operate continuously for a period of not less than 20 hours per day, seven days per week, with an alternating passenger load of 100% brake load for one hour and 50% brake load for the following hour;
- not less than 4 no. of flat steps at each landing;
- maximum calculated or measured deflection of supporting structure of escalator not exceeding 1/1500 of the distance between supports;
- brake load given by multiplying the number of visible steps by 120 kg; and
- diameter of chain wheel not less than 100 mm.

Ref 1_14b Maximum electrical power of passenger conveyor at designated width and length at inclination up to 6° from horizontal for various ranges of rated speed operating under no load

Source: Building Energy Codes of Hong Kong 2012, Maximum electrical power of passenger conveyor at designated width and length at inclination up to 6° from horizontal for various ranges of rated speed operating under no load, Table 8.4.4, pp 42

Nominal Width (mm)	Length L (m)	Electrical Power (W) at Rated Speed Vr (m/s)							
		Non-Public Service Passenger Conveyor				Public Service Passenger Conveyor			
		Vr < 0.5	0.5 ≤ Vr < 0.6	0.6 ≤ Vr < 0.75	0.75 ≤ Vr < 0.90	Vr < 0.5	0.5 ≤ Vr < 0.6	0.6 ≤ Vr < 0.75	0.75 ≤ Vr < 0.90
800	L < 8	1093	1378	1805	2138	1283	1663	1900	2233
	8 ≤ L < 12	1568	1995	2612	3088	1568	1995	2612	3088
	12 ≤ L < 16	2043	2613	3325	4085	2043	2613	3325	4085
	16 ≤ L < 20	2518	3705	4180	5035	2518	3705	4180	5035
	L ≥ 20	120.6L + 96	176.7L + 141	200.4L + 160	240.3L + 192	120.6L + 96	176.7L + 141	200.4L + 160	240.3L + 192
1000	L < 8	1235	1568	1805	2138	1378	1758	1995	2328
	8 ≤ L < 12	1995	2565	2898	3468	1995	2565	2898	3468
	12 ≤ L < 16	2660	3373	3800	4560	2660	3373	3800	4560
	16 ≤ L < 20	3278	4180	4703	5653	3278	4180	4703	5653
	L ≥ 20	155.8L + 124	198.5L + 159	225L + 180	270.7L + 216	155.8L + 124	198.5L + 159	225L + 180	270.7L + 216
1400 & above	L < 8	1544	1960	2256	2673	1723	2198	2494	2910
	8 ≤ L < 12	2494	3206	3623	4335	2494	3206	3623	4335
	12 ≤ L < 16	3325	4216	4750	5700	3325	4216	4750	5700
	16 ≤ L < 20	4098	5225	5879	7066	4098	5225	5879	7066

	$L \geq 20$	195L + 155	248L + 199	281L + 225	338L + 270	195L + 155	248L + 199	281L + 225	338L + 270

Remark:

The maximum allowable electrical power for a passenger conveyor with Nominal Width above 1000 mm and below 1400 mm is given by interpolation of the control value for equipment at Nominal Width
1000 mm and the control value for equipment at Nominal Width 1400 mm.

Ref 1_18 Minimum design electrical power load demand reference

Sources: CIBSE

Type of Building	Minimum Capacity (W/m^2)
Office	60
School	30
Residential Building	30
Hospital	25
Hotel	25
Church	15

Ref 1_28 Lighting power density for various types of space

Source: Building Energy Codes of Hong Kong 2012, Lighting Power Density for various types of space, Table 5.4, pp 14-15

Type of Space	Maximum Allowable LPD (W/m^2)
Atrium / Foyer with headroom over 5m	20
Bar / Lounge	15
Banquet Room / Function Room / Ball Room	23
Canteen	13
Car Park	6
Classroom / Lecture Theatre / Training Room	15
Clinic	15
Conference / Seminar Room	16
Corridor	10
Dormitory / Quarters / Barrack	10
Entrance Lobby	15
Exhibition Hall / Gallery	20
Guest room in Hotel or Guesthouse	15
Gymnasium / Exercise Room	15
Kitchen	15
Laboratory	15
Library - Reading Area, Stack Area or Audio Visual Centre	15
Lift Car	13
Lift Lobby	12
Loading & Unloading Area	11

Multi-functional Space	See below
LPD of each combination of function-specific luminaires should not exceed the maximum allowable value corresponding to the type of space illuminated by that combination of luminaires, detailed as follows: LPD_{F1} not to exceed LPD_{S1} , LPD_{F2} not to exceed LPD_{S2} ,……., LPD_{Fn} not to exceed LPD_{Sn} where LPD_{F1} , LPD_{F2} .,...., LPD_{Fn} respectively refers to the lighting power density corresponding to function F1, F2, ..., Fn, and LPD_{S1} , LPD_{S2} .,...., LPD_{Sn} respectively refers to the maximum allowable value of lighting power density corresponding to the classified Space S1, S2,....., Sn based on the respective function F1, F2, ..., Fn.	
Office	15
Patient Ward / Day Care	15
Plant Room / Machine Room / Switch Room	12
Public Circulation Area	15
Railway Station ● Concourse / Platform / Entrance / Adit / Staircase, with headroom not exceeding 5 m ● Concourse / Platform / Entrance / Adit / Staircase, with headroom over 5 m	 15 20
Restaurant	20
Retail	20
Seating Area inside Theatre / Cinema / Auditorium / Concert Hall / Arena	12
Sports Arena, Indoor, for recreational purpose	17
Staircase	8
Storeroom / Cleaner	11
Toilet / Washroom / Shower Room	13
Workshop	14

CHAPTER 4 SPACE INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_2 SPACE INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Area per person	[8-12 m^2/person .. 16 m^2/person or above] scores (90 .. 10) [8-12 m^2/person .. 4 m^2/person or below] scores (90 .. 10)	It is believed that a normal office building should accommodate one person per eight to twelve square meters of area. If the building is too densely populated or too sparsely populated, it is either a non-comfortable condition or a waste of space. This value is estimated by dividing the estimated total number of occupants of the building by the total GFA of it. The auditor shall consider purpose of the design and the applicability of the figures on the actual situations, such as mobile offices, etc.	8
2	Average width of corridor	[2 m or above .. 1 m] scores (90 .. 50)	To provide an efficient environment for people to move around the building, the corridors, at least the common ones, must be as wide as possible. Width of corridors basically filled the Statuary requirement shall be scored at least 60.	7
3	Average usable area in percentage of total GFA	[80% .. 90% or above] scores (90 .. 50) [80% .. 50% or below] scores (90 .. 50)	A building must provide as much space as possible for the real purpose of the building, i.e. working or entertainment etc. The usable area is more important than the GFA. This clause seems to be a little bit in conflict with Item 2 of the Space Index but the design must take care of both issues. The total usable area of the whole building is to be evaluated and this sum is divided by the total GFA of the whole building. Here, the usable area refers to the utilization of space for the purpose of the building thus excluding all areas used for common corridors, lift lobbies and hoistways, plant rooms etc. Lean structure can improve the score of this item.	6
4	Circulation for the disabled	[full compliance with the statutory requirements, compliance with old code, otherwise] scores (60 , 50 , 10)	Design guide for the disabled or for barrier free access shall be referred to. For example, BS 8300:2010.	5
5	Number of carpark space	[full compliance with the guidelines (Item 5 of References) , partial compliance by at least 50% or compliance with more than 1.5 times that of recommendation of the guidelines, otherwise] scores	Whether carpark is adequate is a very important feature of an intelligent building, in particular, when the building is at the sub-urban area. Even though the building is at the city centre, the provision of adequate carparks is also critical to the efficiency of the building.	7

		(90 , 50 , 10)		
6	Location of carpark	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The location of carpark inside an intelligent building is also critical. The design of the carpark spaces must suit the convenience of the occupants. The distance to the most remote carpark space inside the carpark from the carpark lifts must be considered. It is a subjective issue and the decision of the auditor is relied on.	7
7	Carpark spacing	[full compliance of the following table (Item 7 of References) , otherwise] to (90 , 50)	Item 7 of Remarks and Reference of Chapter 4 gives a guideline related to the recommended size of a carpark. If more number and spacious disabled carparks are provided, and/or with intelligent provisions, bonus marks can be scored. Intelligent provisions include information or indication of the availability and location of empty carparks, etc.	7
8	Ease of access to main public transport terminals	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Main transport terminals refer to public bus terminals, underground terminals and ferry terminals etc. It is difficult to say whether it is easy to get to the nearby public transport terminal or not. The judgment of the auditor is relied on.	3
9	Number of loading and unloading areas for taxis, cargo vehicles and private cars	[full compliance , otherwise] scores (90 , 50)	Item 5 of Remarks and References of Chapter 4 is referred to. This is also a kind of indication whether the building is easily accessible by public transportation means.	5
10	Flexibility for installing new false ceilings and floor utilities for a totally different use	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is one of the most important features of an intelligent building. Design must offer full flexibility for the occupants to re-install new false ceilings and floor utilities at any area inside the building with ease. Since it is rather subjective, the judgment of the auditor is relied on. Some guidelines are listed here. If the re-installation of a 1,000 m^2 floor space can be completed within 7 days then it is classified as excellent. If it takes 30 days or more, it is a worst design.	9
11	Flexibility for re-partitioning	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Re-partitioning for a different use inside an intelligent building is very common and the design must fit this purpose with ease. It is a subjective judgment but the following guidelines are helpful. The cost of re-partitioning per GFA can be estimated. The works include walls, partitions, air-conditioning, electrical services, lighting, communication, fire services and LAN etc. If it is required to re-partition wet wall and do 100% re-ducting and re-wiring, that is the worst design. If the works just involve re-partitioning modular dry walls and no re-ducting is required, i.e. the wiring configuration just needs to be re-programmed, that is excellent.	9
12	Flexibility of internal re-arrangement of personnel	[10 minutes or shorter .. 1 hour .. 2 hours .. 0.5 day .. 1 day .. 1.5 day .. 2 days or longer] scores (90 .. 80 .. 70 .. 50 .. 30 .. 20 .. 10)	Other than re-partition and re-installation of false ceilings and floor utilities, it is often for people inside an office to change their seats due to deployment, secondment or promotion. Such change must be facilitated inside an intelligent building. The average time to swap 2 officers on a random basis can be estimated and the score can be given accordingly.	9
13	Building provisions	[excellent , good , fair , worst]	Considerations should include spare riser space, spare plant space, spare conduits,	8

	for spare, equipment, and facilities	scores (90 , 70 , 40 , 10)	adequate floor loading, headroom, raised floor, false ceiling etc.	
14	Interfloor lock-out slab panels	[exist .. not exist] scores (90…50)	the provision of “knock-out slab” for future construction of inter-floor staircase” shall be introduced	4
15	Ease of access for future plant maintenance and replacement, and maintainability of installations	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The assessment is based on provision of sufficient space and proper access for general maintenance of equipment, the adequate storage of spare parts and supply of tools and the chance of occurrence of accidents to workers and general public etc. It is left to the auditor to make the final judgment.	4
16	Provisions of space for management	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Spaces such as building management office, building control room, maintenance workshop, staff common room, shroff office, etc. They shall be included in the design stage.	7
17	Maintenance and Management Policy and Facilities Audit for this Module	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	7
18	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1			AR	RD	D	3
2			AR	RD	D	3
3		In Hong Kong, refer to BD's UFA definition.	AR	RD	D	3
4		In Hong Kong, PNAP APP-41 (2012) and Design Manual for Barrier Free Access (2008) published by BD are the major design guidelines. The 2008 design manual mainly focus on: o Dimension of the circulation area o Provision of ramp o Disabled friendly lifts	AR	RD	D	3
5		In Hong Kong, recommendations from the Hong Kong Planning Standards and Guidelines published by the Planning Department can be referred to. Table 11 of Hong Kong Planning Standards and Guidelines published by Planning Department (2005), 2011 Revision, will be used. http://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/ch8/ch8_tbl_11.htm	AR	RD	D	3
6			AR	PJ	D	3
7		Table 11 of the Hong Kong Planning Standards and Guidelines published by Planning Department (2005) gives a guideline related to the recommended size of a carpark in Hong Kong. http://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/ch8/ch8_tbl_11.htm	AR	RD	D	3
8			AR	RD	D	3
9			AR	RD	D	3
10			AR	RD	D	3
11			AR	RD/C/V	D/P	3
12			AR	RD/C/T	D/P	3
13			AR	RD	D	3
14			AR	RD	D/I	3
15			AR	RD/V	D/P	3
16			AR	RD/V	D/P	3
17			MA	RD/LB	P	3
18	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 5 COMFORT INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_3 COMFORT INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Area per person	[8-12 m^2/person .. 16 m^2/person or above] scores (90 .. 10) [8-12 m^2/person .. 4 m^2/person or below] scores (90 .. 10)	It is believed that a normal office building should accommodate one person per eight to twelve square meters of area. If the building is too densely populated or too sparsely populated, it is either a non-comfortable condition or a waste of space. This value is estimated by dividing the estimated total number of occupants of the building by the total GFA of it. The auditor shall consider purpose of the design and the applicability of the figures on the actual situations, such as mobile offices, etc.	8
2	Average width of corridor	[2 m or above .. 1 m] scores (90 .. 50)	To provide an efficient environment for people to move around the building, the corridors, at least the common ones, must be as wide as possible. Width of corridors basically filled the Statuary requirement shall be scored at least 60.	3
3	Average usable area in percentage of total GFA	[80% .. 90% or above] scores (90 .. 50) [80% .. 50% or below] scores (90 .. 50)	A building must provide as much space as possible for the real purpose of the building, i.e. working or entertainment etc. The usable area is more important than the GFA. This clause seems to be a little bit in conflict with Item 2 of the Space Index but the design must take care of both issues. The total usable area of the whole building is to be evaluated and this sum is divided by the total GFA of the whole building. Here, the usable area refers to the utilization of space for the purpose of the building thus excluding all areas used for common corridors, lift lobbies and hoistways, plant rooms etc. Lean structure can improve the score of this item.	3
4	Provision of a lobby lounge on every floor	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The lobby lounges should include seats, vending machines and specially ventilated smoking rooms.	7
5	Access entrance width	[10 persons or above .. 1 person or below] scores (90 .. 10)	This clause refers to the main entrance of the building. The number of occupants that can enter the building at the same time is used to give the score for this clause. An intelligent building should allow a large group of people to enter or exit at the same time as a means of ease of entrance and exit.	4
6	Operating time of the building	[24 hrs * 7 days .. 10 hrs * 5 days or less] scores (90 .. 50)	If the building is always open to the occupants that will offer so much convenience. Of course, a good security or access system must be available. Here, the total number of hours per week is used to assess this clause.	4
7	Lifts and escalators vibration	Horizontal vibration: [0.15 m/s2 or higher .. 0.08 m/s2 .. 0.04 m/s2] scores (10 .. 50 .. 90)	The same machine, EVA-625, used in item 1.61 can be used to measure the vibration levels	9

		Vertical vibration: [9.8 m/s2 .. 9.88 m/s2 .. 9.95 m/s2 or higher] scores (90 .. 50 .. 10) The above limits apply to lifts with speeds up to 4 m/s. Lifts having speeds above this value will be subject to increased vibration limits. For lift speeds in the range 4-7 m/s, a multiplier of 1.5 may be used for all acceleration level limits.		
8	Lifts and escalators acceleration and deceleration	[0.8 m/s^2 or below .. 5 m/s^2 or above] scores (90 .. 5)	A typical trip of a lift car from the ground floor to the top floor of a building usually consists of five steps, i.e. standstill, acceleration, rated speed operation, deceleration and standstill. Common occupants should feel comfortable if both the acceleration and deceleration are being kept below a value about one sixth of the gravitational acceleration, i.e. 9.8 m/s^2.	9
9	Lifts and escalators average illumination	[5 lux .. 100 lux] scores (10 .. 90) [300 lux .. 100 lux] scores (30 .. 90)	The measurement of illumination should be at floor level inside the car. If glare or non-uniformity exists, the auditor can deduct at most 30 marks from the score.	8
10	Lifts and escalators ventilation rate	[20 AC/hr or above .. 10 AC/hr or below] scores (90 .. 10)	Good ventilation inside the lift car is important to ensure health and comfort of the passengers, in particular, when the lift car is in a halt. Normally, the hoistway is well ventilated by openings to the machine room at the top while the machine room is located above the roof so that fresh air can freely move in and out through big louvres. When the lift cars are traveling up and down, the piston effect can bring fresh air into the hoistway. Fresh air from gaps at landing doors of all floors can also move in and out of the hoistway. Ventilation into the lift car is normally by a fan locating at the ceiling of the car. Temperature and moisture inside the lift cars shall be considered.	8
11	Lift in-car noise level	[50 dBA or lower ..60 dBA .. 65 dBA or higher] scores (90 .. 50.. 10)	In-car noise can be measured by the EVA-625 recorder with a microphone placed 1 m above the car floor at the middle of the car when the empty car is traveling upward from the bottom floor to the top floor of the zone. During the noise measurement, lift car ventilation fan or air-conditioner should be switched on.	7
12	Lift lobby noise level	[50 dBA or lower ..60 dBA .. 65 dBA or higher] scores (90 .. 50.. 10)	Only lifts' operation is taken into account of the lobby noise and it can be measured by using a standard sound level meter at the lobby. The point of measurement should be specified, e.g. 1 m above the finished floor level and 1 m away from the landing doors. Ambient noise should be excluded from the measured values.	7
13	Lift machine room noise	[audible at the nearest	It is not a very serious problem if the noise level inside the machine room is higher. Hence,	7

<table>
<tr><td></td><td>level</td><td>common area/occupied area , otherwise] scores (10 , 90)</td><td>there are only two scores for it. If it is audible from any common area, it will score 10. Otherwise, it will score 100.</td><td></td></tr>
<tr><td>14</td><td>Lifts and escalators waiting time</td><td>[30 s or below .. 90 s] scores (90 .. 10)</td><td>The waiting time is an average value per passenger and it can simply be taken as half the up-peak interval or it can be measured on site or evaluated by a simulation software package. It is the average time taken for a passenger to wait for the arrival of the appropriate car at the lift lobby.</td><td>3</td></tr>
<tr><td>15</td><td>Thermal comfort</td><td>Absolute Predicted Mean Vote (PMV) = [0.3 or below .. 2.0 or above] scores (95 .. 10)</td><td>Thermal comfort is measured by PMV in accordance with ISO 7730 that Met = 1 and Clo = 0.8 will be applied for Hong Kong situation.</td><td>9</td></tr>
<tr><td>16</td><td>Thermal comfort : Indoor air quality</td><td>[compliance with ASHRAE 62.1-2010, compliance with statute, incompliance] scores (90 , 60 , 10)</td><td>ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality</td><td>8</td></tr>
<tr><td>17</td><td>Overall Thermal Transfer Value</td><td>[OTTV <= 15 W/m^2 , OTTV <= 24 W/m^2 , OTTV >= 60 W/m^2] scores (90 , 60 , 10)</td><td>The suitable level of Overall Thermal Transfer Value (OTTV) and the methodology of OTTV calculations are specified in the Code of Practice for Overall Thermal Transfer Value in Buildings 1995 published by the Buildings Department of Hong Kong (BD). For our OTTV, the building tower is concerned and please refers to PNAP APP-67 issued by BD by details. Performance-based Overall Building Energy Efficiency Approach can be considered as an alternative.</td><td>5</td></tr>
<tr><td>18</td><td>Amount of fresh air changes per second</td><td>[9.5 litres/s/occupant .. 15 litres/s/occupant] scores (90 .. 10)
[9.5 litres/s/occupant .. 1 litre/s/occupant] scores (90 .. 10)</td><td>Fresh air supply is important to the health of occupants and thus the intelligence of them inside an intelligent building. The main objectives of fresh air supply are to provide enough oxygen and to remove odour from the indoor environment. Too much fresh air consumes unnecessary energy. Reference to ASHRAE Standard 62-2004
Recommended Air Change Rates proposed by Chartered Institute of Building Services Engineers Guide B is acceptable as an alternative assessment criteria:
<table>
<tr><td>Space</td><td>Air change rates per hour</td></tr>
<tr><td>Offices</td><td>4- 6</td></tr>
<tr><td>Dinning hall, restaurants</td><td>10 - 15</td></tr>
<tr><td>Carpark</td><td>6 - 10</td></tr>
<tr><td>Libraries, museums and galleries</td><td>3 - 4</td></tr>
<tr><td>Boiler rooms</td><td>15-30</td></tr>
</table></td><td>8</td></tr>
<tr><td>19</td><td>Noise level of MVAC systems</td><td>[NC 45 or below .. NC 50 .. NC 65] scores (90 .. 70 .. 10)</td><td>Acoustics is a very important factor related to the satisfaction of an air conditioning system.</td><td>7</td></tr>
<tr><td>20</td><td>Frequency of breakdown of major HVAC</td><td>[Predictive / Preventive Maintenance Scheme,</td><td>Frequent breakdown of the HVAC systems can seriously affect human comfort. Here, the average mean time between failures (MTBF) of each piece of major equipment, say chiller,</td><td>5</td></tr>
</table>

	equipment	Reactive / Corrective Maintenance Scheme, No Maintenance] scores (90, 60 , 10)	fan, pump, air handling unit, primary air unit, cooling tower etc., inside the HVAC system is used to evaluate the frequency of breakdown.	
21	Special ventilation for some areas, e.g. carpark, kitchen, restaurant and toilet	[Fully automated demand control achieving 20 AC/h or more, .. , just comply with statutory requirements , .. , incompliance] scores (90 , 60 , 10)	The provision of air change shall not be less than statutory requirements, and if fully automated demand control can be provided, 90 score shall be considered. Variation to suit the environmental change such as step control or timer control shall gain bonus scores. These special areas are normally not air-conditioned. The ventilation rate is very important to the personnel working in these areas. For example, ventilation rate to the carpark is important to keep the carpark at a reasonable temperature, in particular, during peak summer and to maintain a low density of poisonous gas. It is important to the health of the occupants. Notes: AC/h refers to "Air Change per hour". If alternative natural ventilation is provided, scores higher than 90 may be given.	5
22	Odour and freshness of indoor air	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is based on the auditor's olfactory and common senses.	2
23	Contamination of chilled and condensing water, virus, bacteria or other contaminants	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The contamination refers to bacteria, virus and other contaminants. Regular water quality test report for monitoring is necessary.	4
24	Access for erection and maintenance of MVAC systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Adequate amount of space for convenience, safety and effective maintenance and erection of equipment is very important to the overall performance of the HVAC system. This is based on the judgment of the auditor.	1
25	Water leakage of MVAC systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is considered excellent if there is no leakage point at all. A good system refers to not more than 3 leakage points within the whole building. It is also based on the judgment of the auditor. There are two kinds of water leakage, namely condensate drain blockage and condensed water due to poor insulation.	6
26	Cleanliness of MVAC systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is a very subjective point and therefore the judgment of the auditor is relied on. Attention should be paid to the intersection of pipes, ducts and all louvers and diffusers.	8
27	Daylightings	Average daylight factors [3% or above .. 0%] scores (90 .. 10)	Normally, daylighting is measured in terms of daylight factor which is the ratio of the lux level at a particular location inside the building to the average lux level outside the building in open space. Here, the average indoor lux level is to be used. Hence, the auditor must take sampled values by turning off all artificial lightings and opening all internal shading devices. The Lighting Guide LG10: 1999 Daylighting and Window Design published by CIBSE can be referred to.	5
28	Permanent artificial lighting average power density	[Full compliance of Local Energy Codes, Not Compliance] scores (90 .. 10)	Better than the Energy Codes can score higher.	1
29	Average colour	[corresponding to 555 K ..	The colour temperature is important to the comfort of sensation of occupants and it is	7

	temperature	450 K] scores (90 .. 10) [corresponding to 555 K .. 700 K] scores (90 .. 10)	important to the efficiency and health of occupants in the building.	
30	Lighting colour rendering	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Colour rendering is the appearance of an object in terms of its colour as sensed by the human occupants. For office spaces, all natural colours of objects within the building should be preserved as far as possible. It is rather subjective and thus, the judgement of the auditor is relied on.	4
31	Noise from luminaries	[audible , otherwise] scores (5 , 90)	Sometimes, noise is generated from the light fittings. That is strictly forbidden in an intelligent building. It is totally unacceptable if the noise is just audible from anywhere inside the building.	7
32	Ease of lighting control	[automatic control , timer control , manual control] to (80 , 60 , 30) Add 20 to lighting with dimming control	Ease of control is an important factor in energy saving. A poor lamp control scheme will hinder the implementation of any energy saving exercise within the building.	6
33	Lighting glare	[16 or less .. 22] scores (90 .. 50)	For the estimation of glare index, auditors are recommended to Linked to Technical Memoranda TM 10: 1985 on The Calculation of Glare Indices and Lighting Guide LG7: 1993 on Lighting for Office. They are also applied by the present sustainability assessment Code: BEAM Plus, version 1.2 published in 2012.	8
34	Suitability of lighting task	[full compliance with the CIBSE guide .. average deviation by more than 50%] scores (90 .. 10)	For the level of illumination, the requirements deviate significantly from room to room and from task to task, hence compliance with CIBSE lighting guide being a strong recommendation. Here, the lux level at individual room is measured and compared with that listed in the Code for Interior Lighting: 1994 published by CIBSE. The building will get a score of 10 if the average deviation from the handbook is more than 50%.	8
35	Window shape and position	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The position and shape of each window is considered by the auditor from an architectural point of view.	3
36	Colour and indoor decoration	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Human beings are very colour sensitive. Colour of an indoor environment can seriously affect the mood of the occupants. However, different colours are suitable for different areas for different purposes. The availability of a colour design scheme and the consideration of colour comfort in the design can have bonus scores. It is left to the auditor to make the final judgment.	5
37	General appearance of facilities	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Including the appearance of air-conditioning system, lighting system, etc. Consider the effects of the appearance on comfort.	7
38	Number of lavatory and provision of appliances	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Item 38 of Remarks and References of Chapter 3 gives the guidelines on the minimum design of lavatories (compliance scores 60, incompliance scores 10). It is a subjective matter and the judgment from the auditor is relied on. Normally inside a lavatory, there must be at least one closet cubicle for the disabled. For more information on the required provisions of disabled toilets, international or local design guides shall be referred to. The auditor can	3

			consider upgrading the score if there is provision of executive toilets and showers facilities.	
39	Location of lavatory	[30 m or below .. 90 m or above] scores (90 .. 10)	Lavatories must be located to suit the convenience of occupants as far as possible. The estimation here is based on the distance that an occupant needs to walk in order to reach the nearby lavatory from anywhere inside the building.	7
40	Cleanliness of lavatory	[very clean , normal , very dirty] scores (90 , 50 , 10)	It is subjective and the decision of the auditor is relied on. In particular, the existence of bad odour is a sign of "very dirty".	6
41	Goodness of lavatory provisions and appliances	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is subjective and the decision of the auditor is relied on. The auditor can look at this clause based on the refilling speed, the flow rate of the flushing system and of course, whether the system is automatic or not. Automatic flushing system shall get bonus score.	4
42	Goodness of Fresh water supplies system	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is subjective and the decision of the auditor is relied on. The auditor can look at this clause based on the flow rate of the potable water supply system, the cleanliness of water and of course, whether the system is automatic or not.	5
43	Provision of consumables in Lavatory	[none , non-recycled paper , recycled paper , rolling towel , dryer] scores (10 , 20 , 40 , 50 , 90)	The emphasis is how to prevent wasting of materials, in particular, toilet consumables.	7
44	Repair of water system	[all fine , 1-5 failures , otherwise] scores (90, 50 , 10)	Even though facilities have been provided, water supply (both fresh and flush) is a key dominating factor to ensure the lavatory is fully functional. Five male and five female lavatories are randomly selected within the building where the water supply at each tap or toilet there is checked. Failure with water supply from one tap is considered one failure.	5
45	Indoor ambient noise level	[LAeq = 45 dB(A) or below .. LAeq = 60 dB(A) or above] scores (90 .. 10)	The overall sound level is measured as an equivalent continuous sound level by LAeq. LAeq means steady state A-weighted sound level over a specified time interval. Normally, a period of eight hours can be used to assess the loudness of an acoustic environment. Once again, ten areas within the building are chosen on a random basis to carry out the measurement while the average value is used for this clause.	5
46	Entertainment facilities	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	In some countries, like Japan, entertainment facilities within an office building are necessary because the officers tend to stay in the building from very early in the morning till very late in the evening. However, this practice is not common in the western countries. In Hong Kong, it is getting more and more popular. Entertainment facilities include restaurants, cafes, health clubs, lounges, sky gardens, podium gardens, roof gardens, vending machines, pantries etc, for informal gathering meals and relaxation. It is left to the auditor to make the final judgment because it is quite subjective whether the facilities are appropriate and sufficient.	7
47	Provision of automatic devices facilitating users of the building	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Such as sensors for automatic door opening and closing at entrances and exits.	7
48	Light fitting maintenance factor	[90% or above .. 50%] scores (90 .. 50)	The maintenance factor refers to ratio of the total lumen output of a lamp together with the fitting due to aging and dirt to the total lumen output of it when new. One lamp is randomly chosen from every floor throughout the building and the test is carried out.	4

49	Lighting cleanliness	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is a sense of feeling as perceived by the auditor regarding the general cleanliness of all light fittings. That is important from a comfort point of view.	5
50	Signage / Building Directory / Directional Signs / Maps	Computerised / Interactive Signage, .. Hardware, .. No] scores [90, 60, 0]	Signages for disabled and signages for evacuation are of special importance. Other signages for the ease of locating oneself, locating the place looking for, and locating help or information, shall be adequately and efficiently provided. Automatic, interactive and intelligence design of signages may score bonus.	5
51	Maintenance and Management Policy and Facilities Audit for this Module	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	7
52	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1	2_01		AR	RD	D	3
2	2_02		AR	RD	D	3
3	2_03	In Hong Kong, refer to BD's UFA definition.	AR	RD	D	3
4			AR	RD/C	D	3
5			AR	RD/T	D	3
6			GE	C	D/P	3
7	1_60		LE	T/LB	P	3
8			LE	RD	D	3
9			LE	T	D	3
10			LE	RD	D	3
11	1_57		LE	T/LB	P	3
12	1_58		LE	T/LB	P	3
13	1_59		LE	T/LB	P	3
14	1_09		LE	RD	D/P	3
15	1_16		AR	RD/T	D/P	3
16	1_38	Refer ASHRAE62.1 and reference: Chow, T.T., & Lam, J.C. (1992). Thermal comfort and energy conservation in commercial buildings in Hong Kong. Architectural Science Review, 35(2), 67-72.	AC	RD/T	D/P	3
17	1_17	The OTTV of this guideline refers to PNAP APP-67 of Hong Kong Buildings Department that applies to a building tower. Performance-based Overall Building Energy Efficiency Approach can be considered as an alternative.	AR	RD	D/P	3
18	1_39		AC	RD/C	D/P	3
19	1_61		AR	T/LB	P	3
20			AR	LB	P	3
21	1_41		AC	RD/C/V	D/P	3
22			AR	V	P	3
23	1_42		AC	PJ/LB	P	3
24	1_70		GE	V/PJ	P	3
25	1_43		AC	V/PJ	P	3
26	1_44		AC	V/PJ	P	3
27	1_27		LI	RD/T	D/P	3
28	1_28	Table Ref 1_28 extracted from the Building Energy Codes of Hong Kong 2012 for reference	LI	RD	D	3
29	1_32		LI	RD/T	D/P	3
30			LI	PJ	D	3

31			LI	PJ	D/P	3
32	1_33		LI	RD/PJ	D/P	3
33	1_28	Table Ref 1_28 extracted from the Building Energy Codes of Hong Kong 2012 for reference	LI	RD	D	3
34			LI	RD	D/P	3
35			AR	PJ	D	3
36		The paper “Indoor lighting design incorporating human psychology”, by So A. T. P. and Leung L. M., published in Architectural Science Review, Vol. 41, No. 3, 1998, pp 113 – 124, is a relevant reference.	AR	C/PJ	D/I/P	3
37			AR	V	D/I/P	3
38		In Hong Kong, PNAP 297 (http://www.bd.gov.hk/english/documents/pnap/Pnap297.pdf) or Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations for the required provisions of sanitary fitments; and the Design Guide for Barrier Free Access 2008 for the required provisions of disabled toilets.	PD	V/PJ	D	3
39			PD	V/PJ	D	3
40			PD	V/PJ	P	3
41			PD	V/PJ	D	1
42			PD	V/PJ	D	1
43	1_46		PD	C/V	D/P	3
44			PD	LB	P	3
45			AS	T	D/P	3
46			GE	C/PJ	D/P	3
47			GE	V/PJ	D	1
48	1_71		LI	RD/LB	P	3
49			LI	PJ	P	3
50			GE	V	D	2
51	2_17		MA	RD/LB	P	3
52	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 6 WORKING EFFICIENCY INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_4 WORKING EFFICIENCY INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Area per person	[8-12 m^2/person .. 16 m^2/person or above] scores (90 .. 10) [8-12 m^2/person .. 4 m^2/person or below] scores (90 .. 10)	It is believed that a normal office building should accommodate one person per eight to twelve square meters of area. If the building is too densely populated or too sparsely populated, it is either a non-comfortable condition or a waste of space. This value is estimated by dividing the estimated total number of occupants of the building by the total GFA of it. The auditor shall consider purpose of the design and the applicability of the figures on the actual situations, such as mobile offices, etc.	8
2	Average width of corridor	[2 m or above .. 1 m] scores (90 .. 50)	To provide an efficient environment for people to move around the building, the corridors, at least the common ones, must be as wide as possible. Width of corridors basically filled the Statuary requirement shall be scored at least 60.	7
3	Average usable area in percentage of total GFA	[80% .. 90% or above] scores (90 .. 50) [80% .. 50% or below] scores (90 .. 50)	A building must provide as much space as possible for the real purpose of the building, i.e. working or entertainment etc. The usable area is more important than the GFA. This clause seems to be a little bit in conflict with Item 2 of the Space Index but the design must take care of both issues. The total usable area of the whole building is to be evaluated and this sum is divided by the total GFA of the whole building. Here, the usable area refers to the utilization of space for the purpose of the building thus excluding all areas used for common corridors, lift lobbies and hoistways, plant rooms etc. Lean structure can improve the score of this item.	6
4	Existence of public conference and meeting facilities	[good , fair , bad] scores (90, 70, 50)	It is a trend that in some modern buildings that a conference floor is provided so that tenants can make use (rent or other arrangement) of it for meetings, seminars or conferences. In this floor, all sorts of equipment for meetings are available so that tenants do not need to assign lots of space within their flats for such purposes.	2
5	Number of carpark space	[full compliance with the guidelines (Item 5 of References) , partial compliance by at least 50% or compliance with more than 1.5 times that of	Whether carpark is adequate is a very important feature of an intelligent building, in particular, when the building is at the sub-urban area. Even though the building is at the city centre, the provision of adequate carparks is also critical to the efficiency of the building.	2

		recommendation of the guidelines, otherwise] scores (90 , 50 , 10)		
6	Location of carpark	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The location of carpark inside an intelligent building is also critical. The design of the carpark spaces must suit the convenience of the occupants. The distance to the most remote carpark space inside the carpark from the carpark lifts must be considered. It is a subjective issue and the decision of the auditor is relied on.	2
7	Number of loading and unloading areas for taxis, cargo vehicles and private cars	[full compliance , otherwise] scores (90 , 50)	Item 5 of Remarks and References of Chapter 4 is referred to. This is also a kind of indication whether the building is easily accessible by public transportation means.	4
8	Ease of access for future plant maintenance and replacement, and maintainability of installations	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The assessment is based on provision of sufficient space and proper access for general maintenance of equipment, the adequate storage of spare parts and supply of tools and the chance of occurrence of accidents to workers and general public etc. It is left to the auditor to make the final judgment.	8
9	Access entrance width	[10 persons or above .. 1 person or below] scores (90 .. 10)	This clause refers to the main entrance of the building. The number of occupants that can enter the building at the same time is used to give the score for this clause. An intelligent building should allow a large group of people to enter or exit at the same time as a means of ease of entrance and exit.	3
10	Operating time of the building	[24 hrs * 7 days .. 10 hrs * 5 days or less] scores (90 .. 50)	If the building is always open to the occupants that will offer so much convenience. Of course, a good security or access system must be available. Here, the total number of hours per week is used to assess this clause.	6
11	Helicopter apron provision	[exist , NA] scores (90 , NA)	The provision of a helicopter apron on the roof of the building certainly helps the personnel of the top management of companies and improves the overall security level when some important guests get to and leave the building. In case it is required by statute, compliance shall only score 60, and incompliance shall score 10. However, some external conditions may render the provision of a helicopter in-applicable.	2
12	Ease of access to main public transport terminals	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Main transport terminals refer to public bus terminals, underground terminals and ferry terminals etc. It is difficult to say whether it is easy to get to the nearby public transport terminal or not. The judgment of the auditor is relied on.	5
13	Existence of AI based supervisory vertical transportation system control	[yes , no] scores (90 , 50)	Vertical transportation systems within an intelligent building is one of the most important building services systems related to working efficiency of human occupants because people need to go to work, to move round the building for works and to leave the building after works. A modern elevator system can ensure fast circulation of the population by using new group supervisory control systems. These systems very often can learn the traffic patterns of the general population by possessing some artificial intelligence (AI) based control algorithms and switch itself to modes that optimally fits the requirements on	5

			a real-time basis to shorten the waiting time and journey time and increase the overall handling capacity. Numerical figures are assessed in the following clauses. In this clause, only the existence of AI based algorithms is considered.	
14	Lift and escalators : Provision of in-car information display system	[yes , no] scores (90 , 50)	Information is important to modern business. Passengers take tens of seconds to arrive at their destination floors and they basically have nothing to do when they are riding inside a car. The provision of in-car information display can allow the passengers to get the most up-dated information such as weather reports, important news and real-time economic figures etc.	2
15	Lifts and escalators handling capacity in percentage of total population	Ordinary lift: [15%..10%..5%..3%] scores (90..70..40..10) Sky lobby lift: [20%..15%..10%..5%] scores (90..70..40..10) For a lift bank serving a sky lobby having a passenger handling capacity exceeding 20%, a score of 100 will always be given	Handling capacity is the number of passengers handled by a lift system over a period of 5 minutes during up-peak and it is based on the assumption that lift cars are normally filled up to 80% of the rated load in terms of number of persons. Handling capacity is given by 240 * Contract capacity of car (in number of passengers) * Number of cars within a group / Up-peak Interval (in number of seconds).	5
16	Lifts and escalators journey time	[40 s or below .. 120 s] scores (90 .. 10)	The journey time is an average value per passenger. It can be measured on site or evaluated by a simulation software package. It is the average time a passenger needs to take from the moment of entering the car to the moment of leaving the car.	4
17	Lifts and escalators waiting time	[30 s or below .. 90 s] scores (90 .. 10)	The waiting time is an average value per passenger and it can simply be taken as half the up-peak interval or it can be measured on site or evaluated by a simulation software package. It is the average time taken for a passenger to wait for the arrival of the appropriate car at the lift lobby.	5
18	Lift and escalators location	[maximum distance from anywhere to the nearest lift group at a typical floor = 30 m or below .. 90 m or above] scores (90 .. 10) Add 10 scores if cargo/goods lifts are provided for the transportation of goods and equipment between floors.	Even if the hardware and software of the elevator system are satisfactory, the service is not favourable if every time when an occupant wants to take a lift, he or she needs to walk a long distance to get there. The lifts should be distributed around the building as uniform as possible, i.e. preferably, there are lifts everywhere if the floor area is large. Here, the maximum distance from anywhere inside the building to the nearest lift group is used to evaluate this clause.	5
19	Lift and escalators servicing and repair	[2 times of out-of-service/month or less .. 10 times or more/month] scores	A good elevator system should keep its frequency of out-of-service as low as possible. Only monthly or half-monthly shutdown due to routine maintenance is acceptable. Here, the number of out-of-services due to routine maintenance, repair or other kinds of ad hoc	4

		(90 .. 10)	servicing per month is a good indicator of the overall condition of the lift system. Data can be collected from the maintenance logbook normally kept inside the machine room. Here, any lift group within the whole building is treated as an element of the elevator system or a whole. If maintenance services and spare parts are provided by the manufacturer of the lift and escalators can earn bonus scores.	
20	Thermal comfort	Absolute Predicted Mean Vote (PMV) = [0.3 or below .. 2.0 or above] scores (95 .. 10)	Thermal comfort is measured by PMV in accordance with ISO 7730 that Met = 1 and Clo = 0.8 will be applied for Hong Kong situation.	8
21	Indoor air quality	[compliance with ASHRAE 62.1-2010, compliance with statute, incompliance] scores (90 , 60 , 10)	ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality	5
22	Electrical power outlets	[three 13A power outlets/person or more .. one 13A power outlets/two persons or less] scores (90 .. 20) in 1000 m^2	13A electric power points are important for the occupants to use portable electric appliances such as chargers, additional lights, notebook computers , printers , projectors and etc.	9
23	Electrical power supply	[spare 100A three phase supply/1000m^2. spare 10A three phase supply/1000m^2] scores (90 .. 20)	Modern intelligent buildings are heading towards electronic and electrical styles. Adequate electric power supply to every floor is critical to the overall productivity of the building.	6
24	Daylightings	Average daylight factors [3% or above .. 0%] scores (90 .. 10)	Normally, daylighting is measured in terms of daylight factor which is the ratio of the lux level at a particular location inside the building to the average lux level outside the building in open space. Here, the average indoor lux level is to be used. Hence, the auditor must take sampled values by turning off all artificial lightings and opening all internal shading devices. The Lighting Guide LG10: 1999 Daylighting and Window Design published by CIBSE can be referred to.	1
25	Permanent artificial lighting average power density	[Full compliance of Local Energy Codes, Not Compliance] scores (90 .. 10)	Better than the Energy Codes can score higher.	1
26	Lighting uniformity	[5%/metre or lower .. 50%/metre or higher] scores (90 .. 10)	In order to ensure a good working environment provided to the occupants, the illumination level inside the indoor environment must be as uniform as possible, notwithstanding its absolute average lux level. A lux meter can be used to measure the changes in lux level within a distance of 1 metre at a vertical height of 1.3 m above the floor level. Random checking at every floor needs to be carried out and the average value is adopted.	8
27	Ease of lighting control	[automatic control , timer control , manual control] to	Ease of control is an important factor in energy saving. A poor lamp control scheme will hinder the implementation of any energy saving exercise within the building.	6

		(80 , 60 , 30) Add 20 to lighting with dimming control		
28	Suitability of lighting task	[full compliance with the CIBSE guide .. average deviation by more than 50%] scores (90 .. 10)	For the level of illumination, the requirements deviate significantly from room to room and from task to task, hence compliance with CIBSE lighting guide being a strong recommendation. Here, the lux level at individual room is measured and compared with that listed in the Code for Interior Lighting: 1994 published by CIBSE. The building will get a score of 10 if the average deviation from the handbook is more than 50%.	8
29	Lighting glare	[16 or less .. 22] scores (90 .. 50)	For the estimation of glare index, auditors are recommended to Linked to Technical Memoranda TM 10: 1985 on The Calculation of Glare Indices and Lighting Guide LG7: 1993 on Lighting for Office. They are also applied by the present sustainability assessment Code: BEAM Plus, version 1.2 published in 2012.	9
30	General appearance of facilities	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Including the appearance of air-conditioning system, lighting system, etc. Consider the effects of the appearance on comfort.	4
31	Colour and indoor decoration	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Human beings are very colour sensitive. Colour of an indoor environment can seriously affect the mood of the occupants. However, different colours are suitable for different areas for different purposes. The availability of a colour design scheme and the consideration of colour comfort in the design can have bonus scores. It is left to the auditor to make the final judgment.	2
32	Building architectural design	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The overall architectural appearance of the building also has an impact on the working efficiency. It is believed that people are getting more innovative and are intending to get breakthroughs when they are working under a post-modern environment. However, it is very subjective and the decision of the auditor is relied on.	3
33	Number of lavatory and provision of appliances	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Item 38 of Remarks and References of Chapter 3 gives the guidelines on the minimum design of lavatories (compliance scores 60, incompliance scores 10). It is a subjective matter and the judgment from the auditor is relied on. Normally inside a lavatory, there must be at least one closet cubicle for the disabled. For more information on the required provisions of disabled toilets, international or local design guides shall be referred to. The auditor can consider upgrading the score if there is provision of executive toilets and showers facilities.	2
34	Provision of a lobby lounge on every floor	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The lobby lounges should include seats, vending machines and specially ventilated smoking rooms.	4
35	Lavatory serviceability	[all lavatories together with consumables are fully available, all lavatories are available but not all consumables, some lavatories unavailable] scores (90 , 50 ,	It is from the user's point of view. When the lavatory is operational, that means it is open to the general public. Even though every lavatory is operational in the building, the consumables inside may not be fully available. Ten lavatories are randomly assessed within the whole building.	4

		10)		
36	Location of lavatory	[30 m or below .. 90 m or above] scores (90 .. 10)	Lavatories must be located to suit the convenience of occupants as far as possible. The estimation here is based on the distance that an occupant needs to walk in order to reach the nearby lavatory from anywhere inside the building.	5
37	Availability of e-Services infrastructure	[Available .. Not Available] scores (90 .. 10)	The availability of a backbone and local area network (LAN) or wireless networks (Wi-Fi) for all occupants to assess broad band Internet facilities and Intranet inside the building is a must in modern intelligent buildings.	7
38	Building IT security	For Wi-Fi accessed at public areas only [yes , no] scores (90 , 10)	The provision of a building-based firewall for virus proof and hacking protection is important.	7
39	Broad band IT service	For Wi-Fi accessed at public areas only [1 workstation/occupant .. 0.1 workstation/occupant] scores (90 .. 10)	The number of workstations with LAN access per occupant must be evaluated. These may not be provided by the building owners but by the tenants themselves.	3
40	Fixed or shared IP address	[1 unique IP address/staff or more .. 0.1 IP address/staff or less] scores (90 .. 10)	IP address is important to uniquely and correctly identify the owner of it, i.e. the user of it, in the Internet world. The provision of a unique IP address to every occupant inside the building is useful but not very important. This should be centrally allocated.	3
41	Availability of multi-media facilities such as video on demand and image communications etc.	[yes , no] scores (90 , 50)	It will be the judgment of the auditor regarding the availability of multi-media facilities for the occupants.	3
42	Public address system	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is a very subjective clause and the judgment of the auditor is relied on to give a fair ranking on the overall public address system of the building.	5
43	Voice mail and music for telephone system	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Voice mails for leaving messages to an occupant when he/she is not at his/her seat are important to the working efficiency. If both voice mail and background music are available, that is excellent. If voice mail is available, that is good. It is left to the judgment of the auditor.	6
44	Intranet management system	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Intranet is a key facility in a modern intelligent building. An Intranet management system must be established for efficient data communication within the building. It is left to the auditor to judge whether the system is satisfactory or not.	6
45	Satellite conferencing and TV or high speed video conference by a superhighway	[available , unavailable] scores (90 , 50)	1. Conferencing is important for real-time meeting between occupants inside the building and occupants inside another building either locally or overseas. Either satellites or cross-ocean fibre optics can be considered effective means for the communication. 2. Reception of terrestrial & satellite TV, pay TV and/or Cable TV services, facilities for tenants to have their own satellite dishes (i.e. VSAT, very small aperture terminal), etc.	3
46	Office automation	[excellent , good , fair , worst]	Fax, network printers, data servers inside most offices are considered. Since these kinds of	8

		scores (90 , 70 , 40 , 10)	tenant services are usually provided by the tenants, a random assessment to ten tenants in the building will be good enough to make a decision on this clause.	
47	Security control automation at main entrances	[extensive use of biometric (i.e.), finger print or retina recognition , extensive use of access card , key pad , manual control , no control at all] scores (90 , 80 , 70 , 50 , 10)	Different technologies can be utilized to control people entering and leaving the building at main entrances. The most advanced one is fingerprint or retina recognition while the lowest type is “no-control”. Speed dialling / direct link to central control – bonus score	8
48	Area monitored by CCTV	[Score equals to the percentage of common area monitored by CCTV , No CCTV at all] scores (90 .. 10)	All public areas inside an intelligent building must be monitored by CCTV cameras. The percentage of public and common areas inside the whole building being monitored by the CCTV system can reflect the ranking of this clause.	6
49	Usage of electronic payment	[yes , no] scores (90 , 50)	Various services provided by the building management may need payment by the occupants or visitors. This clause refers to the extensive utilization of electronic paying machines.	2
50	Usage of electronic directory	[extensive use of electronic directory , extensive use of signage boards , some signage boards , none] scores (90 , 70 , 40 , 10)	Signage or a clear indication for visitors to go to the right place to find the right people is one important feature of an intelligent building. The extensive use of electronic directory will score good mark to this ranking.	4
51	Provision of updated information at public area from e-services	[fully provided , partially provided , not provided] scores (90 , 50 , 10)	This clause refers to big LED boards installed at the main terminal or lift lobby at every floor so that updated information such as economics news, weather reports and traffic conditions etc. are displayed.	3
52	Remote monitoring of lifts and escalators	[yes , no] scores (90 , 50)	Modern lifts can be monitored by control centres operated by the maintenance companies remotely so that the performance and real-time status of every lift can be analysed and recorded. This clause refers to the existence of such a feature.	3
53	Provision of webpage for the building	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	A modern intelligent building should have its own web site so that people outside are able to find our information about the general structure of the building, brief data of the tenants and occupants as well as any up-dated activities organised inside the building. It is rather subjective and the auditor’s decision is relied on.	3
54	Provision of e-hotline	[yes , no] scores (90 , 10)	The building management should provide services of public relationship so that people outside can consult the building management regarding property management, renting, activities and other issues via a hotline. Such a hotline can be either in form of telephone line or an e-mail address with immediate reply.	3
55	Number of telephone lines	[at least 1/staff .. 0.1/staff] scores (90 .. 10) if PBX is available, add 20	The number of telephone lines per staff is important for voice communication between occupants inside the same building as well as between occupants and outsiders. If the telephone services are using integrated service digital network and an advanced private	8

		if ISDN is used, add 20 more Score is limited to 100	automatic branch exchange, the building should score additional marks. Of course, the highest mark can only be 100.	
56	GOS and number of exchange lines	[GOS = 0.005 or lower .. GOS = 0.1 or higher] scores (90 .. 10)	It is uneconomic for a telecommunication network to have sufficient circuits for all subscribers to make calls simultaneously. Instead, sufficient circuits are provided to minimize the probability of a subscriber finding congestion, i.e. all circuits are busy, on the required route to be acceptably small in the busy hour. This probability is called the grade of service (GOS). **A GOS = 0.01 means only one of our one hundred users cannot find a circuit to make a city call.** Once the GOS has been determined, the total number of exchange lines provided by the public switched telecommunication network (PSTN) can be designed based on the total expected number of phone calls inside the building during the peak hour.	7
57	Provision of Cat 5 copper cable and fibre-optics	[excellent , Cat 5] scores (90 , 50)	Very often, the provision of fibre-optic network is being considered in the industry as a representing symbol of intelligent buildings. A high-speed fibre-optic cable network offers a data transmission rate of 100 Mbps. The digital data is transmitted into high-speed light pulses by laser diodes and received at the other end. The wiring consists of two fibre-optic cables bundled together forming a ring and the access method is token passing. Two advantages of fibre-optic network are speed and security while the downside is high cost. Here, the availability of fibre-optic network in the building is the deciding factor. Cross-floor shared trunking shall be provided to allow occupants to lay their own telecom and signal cable within the building	8
58	Building services automation system	[% of permanently installed devices under control and monitoring by BAS , No BAS] scores [90 .. 50]	A comprehensive building automation system (BAS) is a “must” in all intelligent buildings. A modern BAS possesses features such as control, monitoring, condition based maintenance, risk management, energy management, asset control and trend logging etc. Here, the overall percentage of all permanently installed devices in the building that are connected to the BAS is used as the score of this clause.	9
59	Grade of BAS	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is rather subjective and the decision of the auditor is relied on. CIBSE Guide H on Building Control Systems is an excellent reference. Full compliance with the control features mentioned in the guide means an excellent BAS.	8
60	Information display system	[exist extensively , just a few or does not even exist at all] scores (90 , 10)	Large size wall LCD or plasma display panel: This kind of large size wall display panel is getting more and more popular. During normal function, it can display a great scene to alleviate the occupants from high working pressure. When deem necessary or appropriate, it is just like a big TV monitor or display for data communication or video conferencing. Here, we are talking about the extensive use of this kind of display panel.	1
61	Advanced carpark facilities	Management facilities: [excellent , good , fair , worst] scores (90 , 70 , 40 , 10); Automatic Payment Facilities: Octopus / Credit Card and	Here, we are referring to those advanced features such as guided directory of vacant parking spaces, automatic tracking of cars, recognition of license number for security purpose or even automatic car parking etc. It is rather subjective and the decision of the auditor is relied on. The relative location of Shroff against the carparking space shall also be taken into consideration.	6

		convenient location, …, Manual payment system, very inconvenient location of shroff] scores (90, 50, 10)		
62	Area of mobile phone and Wi-Fi and 4G coverage	[% of area of the whole building with at least 60% strength] scores (90 .. 10)	The auditor walks around the building and record the strength of signals for mobile phones. The strength is considered adequate if it is at least 60% of that in the open air. Basement and lift car coverage has to be provided in order to score high.	4
63	Signage / Building Directory / Directional Signs / Maps	Computerised / Interactive Signage, .. Hardware, .. No] scores [90, 60, 0]	Signages for disabled and signages for evacuation are of special importance. Other signages for the ease of locating oneself, locating the place looking for, and locating help or information, shall be adequately and efficiently provided. Automatic, interactive and intelligence design of signages may score bonus.	4
64	Provision of clean earth	[yes , no] scores (90 , 50)	The provision of clean earth is for the telecommunication equipment and it is necessary to provide a clean earth for good performance of telecommunication equipment.	4
65	Bank or ATM Service at podium	[provided , not provided] scores (90 , 50)	Banking service provision offers great convenience to building users	5
66	Lighting cleanliness	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This is a sense of feeling as perceived by the auditor regarding the general cleanliness of all light fittings. That is important from a comfort point of view.	3
67	Light fitting maintenance factor	[90% or above .. 50%] scores (90 .. 50)	The maintenance factor refers to ratio of the total lumen output of a lamp together with the fitting due to aging and dirt to the total lumen output of it when new. One lamp is randomly chosen from every floor throughout the building and the test is carried out.	2
68	Modernization of Major Facilities	[System in place, .., no] to (90 , .., 50)	A sinking fund and maintenance fund available for modernization of major facilities. It is important to identify whether a system is in place to monitor the performance of major facilities for the consideration of modernization.	3
69	Building provisions for spare, equipment, and facilities	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Considerations should include spare riser space, spare plant space, spare conduits, adequate floor loading, headroom, raised floor, false ceiling etc.	7
70	Property management	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is difficult to quantify the quality of property management and therefore the judgment of the auditor is relied on. However, the auditor is strongly recommended to consider at least the following aspects: o Facility management o Cost efficiency o Good tenant mixture o Minimum vacant units within the building o Competency and knowledgeable staff o Strong ability to handle disaster appropriately and promptly o Cleanliness o Organization of functions for the buildings o Proper working of the utility services	7

			o Adequate security staff o A good image of the building Provision of free shuttle bus services o Good promotion and advertisement o Public safety within the building o No illegal activity o General attitude of the operational staff o Concierge services o Tenant and management communication channels	
71	Choice of fixed network service providers	[all …nil] scores (90…10)	Choice of service providers in the building. This will relate to the number of valid services providers in that country of region. For example, there are 3 valid fixed network services providers in the city. Then, a building with the 3 services providers shall be the best in the city in this aspect.	6
72	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1	2_01		AR	RD	D	3
2	2_02		AR	RD	D	3
3	2_03	In Hong Kong, refer to BD's UFA definition.	AR	RD	D	3
4			AR	RD/V	D	3
5	2_05	In Hong Kong, recommendations from the Hong Kong Planning Standards and Guidelines published by the Planning Department can be referred to. Table 11 of Hong Kong Planning Standards and Guidelines published by Planning Department (2005), 2011 Revision, will be used. http://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/ch8/ch8_tbl_11.htm	AR	RD	D	3
6	2_06		AR	PJ	D	3
7	2_09		AR	RD	D	3
8	2_15		AR	RD/V	D/P	3
9	3_05		AR	RD/T	D	3
10	3_06		GE	C	D/P	3
11			AR	V	D	3
12	2_08		AR	RD	D	3
13			LE	RD/V	D	4
14			LE	V	D	3
15	1_06		LE	RD	D	3
16	1_08		LE	RD	D/P	3
17	1_09		LE	RD	D/P	3
18			LE	T/V	D	3
19		The Code of Practice on the Examination, Testing and Maintenance of Lifts and Escalators, published by EMSD of HKSAR is referred to.	LE	LB	P	3
20	1_16		AR	RD/T	D/P	3
21	1_38	Refer ASHRAE62.1 and reference: Chow, T.T., & Lam, J.C. (1992). Thermal comfort and energy conservation in commercial buildings in Hong Kong. Architectural Science Review, 35(2), 67-72.	AC	RD/T	D/P	3
22			EE	RD	D	3
23		Electrical Loading Standards in W/m^2 are available in GB standards (for Mainland China) and Building Energy Code 2012 will be referred in HK	EE	RD	D	3
24	1_27		LI	RD/T	D/P	3
25	1_28	Table Ref 1_28 extracted from the Building Energy Codes of Hong Kong 2012 for reference	LI	RD	D	3
26			LI	T	D/P	3
27	1_33		LI	PJ/RD	D/P	3

28	3_34		LI	RD	D/P	3
29	3_33	Table Ref 1_28 extracted from the Building Energy Codes of Hong Kong 2012 for reference	LI	RD	D	3
30	3_37		AR	V	D/I/P	3
31	3_36	The paper “Indoor lighting design incorporating human psychology”, by So A. T. P. and Leung L. M., published in Architectural Science Review, Vol. 41, No. 3, 1998, pp 113 – 124, is a relevant reference.	AR	C/PJ	D/I/P	3
32			EE	PJ	D	3
33	3_38	In Hong Kong, PNAP 297 (http://www.bd.gov.hk/english/documents/pnap/Pnap297.pdf) or Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations for the required provisions of sanitary fitments; and the Design Guide for Barrier Free Access 2008 for the required provisions of disabled toilets.	PD	V/PJ	D	3
34	3_04		AR	RD/C	D	3
35			PD	T	P	3
36	3_39		PD	V/PJ	D	3
37			EE	RD	D	2
38			EE	RD	D	2
39		Spare for public usage	EE	RD/V	D	2
40			EE	RD	D	2
41			EE	RD	D	2
42			EE	RD	D	2
43			EE	PJ/T	D	2
44			EE	RD/PJ	P	2
45			EE	RD/PJ	D	2
46			EE	V	D	1
47			EE	RD/V	D	1
48			EE	RD/V	D	2
49			EE	RD/V	D	2
50			EE	RD/V	D	2
51			EE	RD/V	D/P	2
52			EE	RD/V	D/P	2
53			EE	T	D	2
54			EE	T	D	2
55			EE	RD	D	2
56			EE	RD	D	2
57			EE	RD	D	2
58			EE	RD/V	D	1
59			EE	PJ/T	D	2

60			EE	V	D	2
61			EE	RD/V	D	2
62			EE	RD/T	D	2
63	3_50		GE	V	D	2
64			EE	RD	P	2
65			GE	V	P	3
66	3_49		LI	PJ	P	3
67	1_71		LI	RD/LB	P	3
68	1_69		GE	C/PJ	P	3
69	2_13		AR	RD	D	3
70		In Hong Kong, the compliance with the Code of Practice on Building Maintenance and Management issued by Home Affairs Department under Building Management Ordinance, Cap. 344. (http://www.buildingmgt.gov.hk/en/cop/cop.htm)	MA	RD/C	P	3
71			GE	V	P	3
72	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 7 CULTURE INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_5 CULTURE INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Feng Shui	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Feng Shui is popularly accepted in the Chinese construction industry. Although there are not many people who publicly declare that they strong believe in Feng Shui, most Chinese people do not dare to go against Feng Shui intentionally. The siting of a building, the orientation of the building related to roads and geography nearby, the design of the main entrance, the shape of the building and the internal layout very often comply with Feng Shui rules. If the auditor is not acquainted with Feng Shui rules, what he/she needs to do is to get the confirmation with the building owner whether Feng Shui was particularly included in the original design of the building. And more important, the auditor should ask for the confirmation whether Feng Shui rules are continuously consulted during the normal operation of the building. Note: This clause is mainly related to environmental perception therefore serious superstition must be avoided.	5
2	External landscape	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	There are two aspects: The first one refers to the landscape immediately adjacent to the building such as the existence of native species, urban agriculture, walkways, small gardens, small streams, small fountains, atria etc. The second one refers to the harmonisation between the building and the area nearby. For example, an intelligent office building should be sited in the downtown commercial centre or in the rural area where it is a science park or a technology park etc. If the intelligent office building is surrounded by domestic buildings or theme parks etc., the harmonisation is considered poorer. It is however understood that very often, the choice of the building just cannot be the favourable subject on the desire of the developers.	8
3	External view (sea view, mountain view, garden view, sunrise view, sunset view etc.)	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	In Hong Kong, flats with unobstructed sea view normally get a high price, followed by mountain view and garden view. Sunrise and sunset views are not very attractive in Hong Kong but they may be welcome in other countries. A flat facing another building at just tens of metres away is certainly not attractive. All these affect the price and rent of the building because they affect the productivity of it. It is however understood that very often the choice of the building just cannot be two favourable subject to the desire of the developers.	6
4	Privacy	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Here, privacy of all occupants inside the building is being taken care of, from the top management to those people of the lowest rank. The foci are on privacy of various activities, say	7

			works, entertainment, rest, meals, telephone conversation and meetings etc.	
5	Office layout	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The arrangement of seats inside an office very much depends on the traditional practice, i.e. culture. For example, the Japanese prefers those officers with higher ranks sit closed to the windows facing their subordinates. The whole office is truly open in that everybody can be monitored by others. This arrangement is not welcome in Hong Kong where some sort of privacy needs to be retained but an open office is still the main trend.	5
6	Culturally based interior design	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	In buildings of Chinese traditional style, people like to hang some paintings, art, couples, calligraphies on the walls and special wooden furniture can be found everywhere.	3
7	Colour and indoor decoration	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Human beings are very colour sensitive. Colour of an indoor environment can seriously affect the mood of the occupants. However, different colours are suitable for different areas for different purposes. The availability of a colour design scheme and the consideration of colour comfort in the design can have bonus scores. It is left to the auditor to make the final judgment.	6
8	Entertainment facilities	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	In some countries, like Japan, entertainment facilities within an office building are necessary because the officers tend to stay in the building from very early in the morning till very late in the evening. However, this practice is not common in the western countries. In Hong Kong, it is getting more and more popular. Entertainment facilities include restaurants, cafes, health clubs, lounges, sky gardens, podium gardens, roof gardens, vending machines, pantries etc, for informal gathering meals and relaxation. It is left to the auditor to make the final judgment because it is quite subjective whether the facilities are appropriate and sufficient.	5
9	Religious facilitation	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Cosmopolitans, like Hong Kong, in developed countries normally enjoy religious freedom. If somewhere inside the building facilitates religious worshipping, that will be excellent.	1
10	Indoor plants (including artificial ones)	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The green colour of plants can give a refreshing stimulation to occupants, giving the occupants a sense of returning to the nature, thus improving the work efficiency. Extensive placement of flowers is also favourable.	4
11	Promotion activity	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Organizing promotion activities regularly for building tenants is essential in modern building management.	4
12	Food and beverage supply	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Restaurants and bars are very often presented in the office buildings of Hong Kong. It is something related to entertainment, providing occupants a good environment for casual discussion and relaxation.	7
13	User Friendliness	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	User friendliness includes many aspects, such as language choice in information display, consideration of the cultures of users, etc.	5
14	Maintenance and Management Policy and Facilities Audit for this Module	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	7
15	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Level of Intel [4]
1			GE	V/PJ	D/P	3
2			AR	V/PJ	D/P	3
3			GE	PJ	D	3
4			GE	V/PJ	D/P	3
5			AR	RD/PJ	D/P	3
6			GE	PJ/C	D/P	3
7	3_36	The paper "Indoor lighting design incorporating human psychology", by So A. T. P. and Leung L.M., published in Architectural Science Review, Vol. 41, No. 3, 1998, pp 113 – 124, is a relevant reference.	AR	C/PJ	D/I/P	3
8	3_46		GE	C/PJ	D/P	3
9			GE	C/PJ	D/P	3
10			AR	V/PJ	D/P	3
11			GE	C/PJ	P	3
12			GE	V/PJ	P	3
13			GE	V/PJ	D/P	2
14	2_17		MA	RD/LB	P	3
15	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 8 e-SERVICE AND TECHNOLOGY INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_6 e-SERVICE AND TECHNOLOGY INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Availability of e-Services infrastructure	[Available .. Not Available] scores (90 .. 10)	The availability of a backbone and local area network (LAN) or wireless networks (Wi-Fi) for all occupants to assess broad band Internet facilities and Intranet inside the building is a must in modern intelligent buildings.	4
2	Building IT security	For Wi-Fi accessed at public areas only [yes , no] scores (90 , 10)	The provision of a building-based firewall for virus proof and hacking protection is important.	7
3	Broad band IT service	For Wi-Fi accessed at public areas only [1 workstation/occupant .. 0.1 workstation/occupant] scores (90 .. 10)	The number of workstations with LAN access per occupant must be evaluated. These may not be provided by the building owners but by the tenants themselves.	5
4	Fixed or shared IP address	[1 unique IP address/staff or more .. 0.1 IP address/staff or less] scores (90 .. 10)	IP address is important to uniquely and correctly identify the owner of it, i.e. the user of it, in the Internet world. The provision of a unique IP address to every occupant inside the building is useful but not very important. This should be centrally allocated.	3
5	Intranet management system	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Intranet is a key facility in a modern intelligent building. An Intranet management system must be established for efficient data communication within the building. It is left to the auditor to judge whether the system is satisfactory or not.	4
6	Satellite conferencing and TV or high speed video conference by a superhighway	[available , unavailable] scores (90 , 50)	1. Conferencing is important for real-time meeting between occupants inside the building and occupants inside another building either locally or overseas. Either satellites or cross-ocean fibre optics can be considered effective means for the communication. 2. Reception of terrestrial & satellite TV, pay TV and/or Cable TV services, facilities for tenants to have their own satellite dishes (i.e. VSAT, very small aperture terminal), etc.	5
7	Usage of electronic payment	[yes , no] scores (90 , 50)	Various services provided by the building management may need payment by the occupants or visitors. This clause refers to the extensive utilization of electronic paying machines.	1
8	Usage of electronic directory	[extensive use of electronic directory , extensive use of signage	Signage or a clear indication for visitors to go to the right place to find the right people is one important feature of an intelligent building. The extensive use of electronic directory will score good mark to this ranking.	6

		boards , some signage boards , none] scores (90 , 70 , 40 , 10)		
9	Provision of updated information at public area from e-services	[fully provided , partially provided , not provided] scores (90 , 50 , 10)	This clause refers to big LED boards installed at the main terminal or lift lobby at every floor so that updated information such as economics news, weather reports and traffic conditions etc. are displayed.	5
10	Provision of webpage for the building	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	A modern intelligent building should have its own web site so that people outside are able to find our information about the general structure of the building, brief data of the tenants and occupants as well as any up-dated activities organised inside the building. It is rather subjective and the auditor's decision is relied on.	3
11	Provision of e-hotline	[yes , no] scores (90 , 10)	The building management should provide services of public relationship so that people outside can consult the building management regarding property management, renting, activities and other issues via a hotline. Such a hotline can be either in form of telephone line or an e-mail address with immediate reply.	2
12	Number of telephone lines	[at least 1/staff .. 0.1/staff] scores (90 .. 10) if PBX is available, add 20 if ISDN is used, add 20 more Score is limited to 100	The number of telephone lines per staff is important for voice communication between occupants inside the same building as well as between occupants and outsiders. If the telephone services are using integrated service digital network and an advanced private automatic branch exchange, the building should score additional marks. Of course, the highest mark can only be 100.	2
13	GOS and number of exchange lines	[GOS = 0.005 or lower .. GOS = 0.1 or higher] scores (90 .. 10)	It is uneconomic for a telecommunication network to have sufficient circuits for all subscribers to make calls simultaneously. Instead, sufficient circuits are provided to minimize the probability of a subscriber finding congestion, i.e. all circuits are busy, on the required route to be acceptably small in the busy hour. This probability is called the grade of service (GOS). **A GOS = 0.01 means only one of our one hundred users cannot find a circuit to make a city call.** Once the GOS has been determined, the total number of exchange lines provided by the public switched telecommunication network (PSTN) can be designed based on the total expected number of phone calls inside the building during the peak hour.	7
14	Provision of Cat 5 copper cable and fibre-optics	[excellent , Cat 5] scores (90 , 50)	Very often, the provision of fibre-optic network is being considered in the industry as a representing symbol of intelligent buildings. A high-speed fibre-optic cable network offers a data transmission rate of 100 Mbps. The digital data is transmitted into high-speed light pulses by laser diodes and received at the other end. The wiring consists of two fibre-optic cables bundled together forming a ring and the access method is token passing. Two advantages of fibre-optic network are speed and security while the downside is high cost. Here, the availability of fibre-optic network in the building is the deciding factor. Cross-floor shared trunking shall be provided to allow occupants to lay their own telecom and signal cable within the building	7

15	Information display system	[exist extensively , just a few or does not even exist at all] scores (90 , 10)	Large size wall LCD or plasma display panel: This kind of large size wall display panel is getting more and more popular. During normal function, it can display a great scene to alleviate the occupants from high working pressure. When deem necessary or appropriate, it is just like a big TV monitor or display for data communication or video conferencing. Here, we are talking about the extensive use of this kind of display panel.	3
16	Area of mobile phone and Wi-Fi and 4G coverage	[% of area of the whole building with at least 60% strength] scores (90 .. 10)	The auditor walks around the building and record the strength of signals for mobile phones. The strength is considered adequate if it is at least 60% of that in the open air. Basement and lift car coverage has to be provided in order to score high.	4
17	Internet connection	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is the ability to control and monitor everything inside the building via Internet with a satisfactory level of security. Furthermore, if the concept of SOHO (small office and home office) can easily be implemented in the building so that staffs do not need to return to the office every working day, it is considered a good condition. It is subjective and the opinion of the auditor is relied on.	8
18	Remote monitoring of lifts and escalators	[yes , no] scores (90 , 50)	Modern lifts can be monitored by control centres operated by the maintenance companies remotely so that the performance and real-time status of every lift can be analysed and recorded. This clause refers to the existence of such a feature.	4
19	Existence of AI based supervisory vertical transportation system control	[yes , no] scores (90 , 50)	Vertical transportation systems within an intelligent building is one of the most important building services systems related to working efficiency of human occupants because people need to go to work, to move round the building for works and to leave the building after works. A modern elevator system can ensure fast circulation of the population by using new group supervisory control systems. These systems very often can learn the traffic patterns of the general population by possessing some artificial intelligence (AI) based control algorithms and switch itself to modes that optimally fits the requirements on a real-time basis to shorten the waiting time and journey time and increase the overall handling capacity. Numerical figures are assessed in the following clauses. In this clause, only the existence of AI based algorithms is considered.	5
20	Horizontal and vertical people movers	[available , unavailable] scores (90 , 50)	Currently, elevators are merely for vertical transportation inside the building. In the near future, elevators should be able to move in two dimensions so that a passenger can actually reach the exact destination by taking an elevator from the main terminal.	2
21	Electrical power outlets	[three 13A power outlets/person or more .. one 13A power outlets/two persons or less] scores (90 .. 20) in 1000 m^2	13A electric power points are important for the occupants to use portable electric appliances such as chargers, additional lights, notebook computers , printers , projectors and etc.	7

22	Electrical power supply	[spare 100A three phase supply/1000m^2. spare 10A three phase supply/1000m^2] scores (90 .. 20)	Modern intelligent buildings are heading towards electronic and electrical styles. Adequate electric power supply to every floor is critical to the overall productivity of the building.	7
23	Uninterruptible power supported electrical power outlets	[one 13A power outlets/person or more .. one 13A power outlet/3 persons or less] scores (90 .. 10)	Uninterrupted power supply (UPS) or voltage regulating system is recommended for the computer system or dedicated electronic control system in modern IB.	6
24	Office automation	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Fax, network printers, data servers inside most offices are considered. Since these kinds of tenant services are usually provided by the tenants, a random assessment to ten tenants in the building will be good enough to make a decision on this clause.	4
25	Intelligent Building Maintenance Systems	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Continuous monitoring of symptoms in building components and facilities, automatic reporting or repairing systems, learning algorithms in diagnoses, etc.	7
26	Building services automation system	[% of permanently installed devices under control and monitoring by BAS , No BAS] scores [90 .. 50]	A comprehensive building automation system (BAS) is a “must” in all intelligent buildings. A modern BAS possesses features such as control, monitoring, condition based maintenance, risk management, energy management, asset control and trend logging etc. Here, the overall percentage of all permanently installed devices in the building that are connected to the BAS is used as the score of this clause.	8
27	Grade of BAS	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is rather subjective and the decision of the auditor is relied on. CIBSE Guide H on Building Control Systems is an excellent reference. Full compliance with the control features mentioned in the guide means an excellent BAS.	7
28	Extensive use of artificial intelligence	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	At present, techniques of artificial intelligence, such as expert systems, fuzzy logic and artificial neural networks etc., have been widely used in the industry. If they are widely used in an intelligent building such in multimedia man-machine interface, building systems like HVAC, lighting and elevators, egress of occupants and daily management etc., a high score must be assigned to it. It is rather subjective and the judgment of the auditor is relied on.	7
29	Extensive use of robots	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Robotics is a fast-developing discipline in the academic field and the manufacturing industry. Robots are at present not very popular in buildings. However, robots that can move around a hospital to deliver goods are available in the market. In the near future, robots can help us to survey an intelligent building, to attend first-line faults and to deliver goods between rooms. It is subject to the judgment of the auditor whether robots are widely used in the building.	1
30	Security control automation at main entrances	[extensive use of biometric (i.e.), finger print or retina recognition , extensive	Different technologies can be utilized to control people entering and leaving the building at main entrances. The most advanced one is fingerprint or retina recognition while the lowest type is “no-control”. Speed dialling / direct link to central control – bonus score	4

		use of access card , key pad , manual control , no control at all] scores (90 , 80 , 70 , 50 , 10)		
31	Area monitored by CCTV	[Score equals to the percentage of common area monitored by CCTV , No CCTV at all] scores (90 .. 10)	All public areas inside an intelligent building must be monitored by CCTV cameras. The percentage of public and common areas inside the whole building being monitored by the CCTV system can reflect the ranking of this clause.	7
32	Advanced carpark facilities	Management facilities: [excellent , good , fair , worst] scores (90 , 70 , 40 , 10); Automatic Payment Facilities: Octopus / Credit Card and convenient location, …, Manual payment system, very inconvenient location of shroff] scores (90, 50, 10)	Here, we are referring to those advanced features such as guided directory of vacant parking spaces, automatic tracking of cars, recognition of license number for security purpose or even automatic car parking etc. It is rather subjective and the decision of the auditor is relied on. The relative location of Shroff against the carparking space shall also be taken into consideration.	3
33	Substantial use of renewable energy	[substantial use, minimal use, nil] scores (90, 70, 50)	Renewable energy sources such as solar energy, wind energy, tidal energy are the key issues of this clause.	6
34	Building architectural design	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The overall architectural appearance of the building also has an impact on the working efficiency. It is believed that people are getting more innovative and are intending to get breakthroughs when they are working under a post-modern environment. However, it is very subjective and the decision of the auditor is relied on.	3
35	New construction materials	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	If the building is constructed by materials that can be re-used after the building is dismantled, it bears a high-tech image. Normally, we are referring to the extensive use of metallic beams and frameworks instead of the conventional reinforced concrete approach. It is subjective and the decision of the auditor is relied on.	4
36	Building provisions for spare, equipment, and facilities	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Considerations should include spare riser space, spare plant space, spare conduits, adequate floor loading, headroom, raised floor, false ceiling etc.	9
37	Choice of fixed network service providers	[all …nil] scores (90…10)	Choice of service providers in the building. This will relate to the number of valid services providers in that country of region. For example, there are 3 valid fixed network services providers in the city. Then, a building with the 3 services providers shall be the best in the city in this aspect.	8

38	Maintenance and Management Policy and Facilities Audit for this Module	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	7
39	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Level of Intel [4]
1	4_37		EE	RD	D	2
2	4_38		EE	RD	D	2
3	4_39	Spare for public usage	EE	RD/V	D	2
4	4_40		EE	RD	D	2
5	4_44		EE	RD/PJ	P	2
6	4_45		EE	RD/PJ	D	2
7	4_49		EE	RD/V	D	2
8	4_50		EE	RD/V	D	2
9	4_51		EE	RD/V	D/P	2
10	4_53		EE	T	D	2
11	4_54		EE	T	D	2
12	4_55		EE	RD	D	2
13	4_56		EE	RD	D	2
14	4_57		EE	RD	D	2
15	4_60		EE	V	D	2
16	4_62		EE	RD/T	D	2
17			CO	C/PJ	P	2
18	4_52		EE	RD/V	D/P	2
19	4_13		LE	RD/V	D	4
20			AR	RD	D	3
21	4_22		EE	RD	D	3
22	4_23	Electrical Loading Standards in W/m^2 are available in GB standards (for Mainland China) and Building Energy Code 2012 will be referred in HK	EE	RD	D	3
23			EE	RD	D/P	3
24	4_46		EE	V	D	1
25		The paper “Intelligent Building Maintenance - a Novel Discipline”, by Yiu, C.Y., published in Journal of Building Appraisal, 3(4), 305-318 can be referred to.	MA	RD	P	4
26	4_58		EE	RD/V	D	1
27	4_59		EE	PJ/T	D	2
28		Refer Yiu, C.Y. (2009) Intelligent Facilities Management, Joint Symposium, CIBSE and ASHRAE.	GE	PJ	P	4
29			GE	PJ/RD	P	1
30	4_47		EE	RD/V	D	1
31	4_48		EE	RD/V	D	2

32	4_61		EE	RD/V	D	2
33	1_51		EP	RD	D	3
34	4_32		EE	PJ	D	3
35			AR	RD/PJ	C	3
36	2_13		AR	RD	D	3
37	4_71		GE	V	P	3
38	2_17		MA	RD/LB	P	3
39	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 9 SAFETY AND STRUCTURE INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_7 SAFETY AND STRUCTURE INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Structural designs for Natural Disasters prevention / mitigation	[full compliance with the latest code, compliance with the old code at the time it was built, otherwise] scores (60 , 50 , 10)	The structural design and construction against disasters such as earthquake, hurricane and flooding and/or the impact of any earth movement on the overall building structure is referred to. If the building is designed (in a standard higher than the statutory requirements, if any) or equipped with such, a higher scores (>80) can be awarded. If the building is not located in the disaster zone, this requirement is not applicable (NA).	4
2	Non-structural building components failure prevention/mitigation measures	[exist , not exist] scores (90 , 50)	Non-structural building components, such as finishes, windows, glazing, doors and etc., which may cause safety problem that can be prevented or mitigated in case of failures. For example, tile debonding is a very common problem nowadays and it is a very labour intensive job to find out the debonded tiles, locate their exact positions and then carry out repair work. Debonded tiles falling down from the external walls can seriously injury pedestrians. The whole issue is very dangerous, calling for immediate attention. Tile debonds can be prevented by protective paint, etc.	9
3	Indefensible space	90 - 0% of indefensible space scores (0 – 90)	Indefensible space refers to space inside the building where thieves, illegal intruders or robbers can hide themselves to make sure nobody can discover them during routine surveillance of the building. Therefore, the meaning here is that indefensible space is from the illegal intruders' point of view. The total amount of indefensible space inside the building must always be kept to a minimum. Hence, the score is based on the total amount of indefensible space in percentage of the total area of the building.	4
4	General building structural condition survey	[exist , not exist] scores (60 , 10)	In Hong Kong, scheduled building ages over 10 years must conduct a building safety audit according to the Mandatory Building Inspection Scheme held by Building Departments of Hong Kong. A voluntary scheme held by Hong Kong Housing Society is applied for any building upon the building owners' wish. The survey to be done every 10 years could allow a close structural monitoring. For buildings over 10 years constructed in earthquake region, the condition survey should be performed every 5 years. For buildings less than 10 years, this element may be not applicable.	9
5	Unauthorized building work within building	[exist , not exist] scores (10 , 60)	No intelligent building can tolerate unauthorized structural works.	6
6	Structural components' monitoring devices	[exist , not exist] scores (90 , 50)	Equipment or facilities, either permanent or temporary, installed to monitor the impacts due by such as earthquake and/or any earth movement, on the overall building structure is referred to.	4

			If the building is equipped with such equipment, a high score can be awarded. For example, the installation of smart materials or intelligent materials for monitoring purposes.	
7	Non-structural components monitoring devices	[exist , not exist] scores (90 , 50)	Example of these devices such as water leakage sensors, flooding sensors, high level sensors and etc.	3
8	Structural monitoring on large structures	[exist , not exist, NA] scores (90 , 10, NA)	Large structure, such as space frame, should have advanced decision-based monitoring equipment to keep track on the structure stability like loading, strain and stress, vibration, displacement and computer system for advising the status with alerting and feedback facilities. This element applies to large structure.	9
9	Comprehensive scheme of preventive maintenance	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	"excellent" means the scheme is very comprehensive; "good" means the scheme has obvious shortfalls; "fair" means the scheme is just available but without details; "worst" means the scheme is not available at all.	8
10	Overall building (including services) operation and maintenance plan and audit	[excellent , good , fair , bad] scores (90 , 70 , 40 , 10)	Good operation and maintenance is an essential element of Intelligent Buildings Management. Intelligent Buildings Maintenance approaches can earn bonus scores.	8
11	Average width of corridor	[2 m or above .. 1 m] scores (90 .. 50)	To provide an efficient environment for people to move around the building, the corridors, at least the common ones, must be as wide as possible. Width of corridors basically filled the Statuary requirement shall be scored at least 60.	3
12	Means of escape	[full compliance with the latest code, compliance with the old code at the time it was built, otherwise] scores (60 , 50 , 10)	The score is based on compliance with the latest Local building fire safety code such as COP for Fire Safety in Building 2011 of Hong Kong and other internationally recognized Performance-based Regulatory Systems. COP for means of escape in case of fire and emergency at the city where the building is located. If the design is at a standard higher than the code, a higher scores (>80) can be given. International Standards such as BS 9999: 2008 can be referred to. COP for Fire Safety in Building 2011, Hong Kong: The development of the framework for fire safety in buildings is based on hierarchical approach, which is adopted in the performance-based regulatory systems of Australia, United States of America and New Zealand. With reference to the relevant legislations, the framework for fire safety in buildings is formulated as follows: (a) Buildings Ordinance (Cap.123) provides an over-arching goal. (b) Regulations provide the detailed objectives and Functional Statements for fire safety as well as Performance Requirements for achieving the objectives of fire safety. (c) This Code provides the means of compliance (Deemed-to-Comply provisions) and guidelines for adopting the fire engineering approach (Alternative Solution).	9
13	Circulation for the disabled	[full compliance with the statutory requirements,	Design guide for the disabled or for barrier free access shall be referred to. For example, BS 8300:2010.	3

		compliance with old code, otherwise] scores (60 , 50 , 10)		
14	Fire services installations (including fire detection and fire-fighting installations)	[full compliance with the latest code, compliance with the old code at the time it was built, otherwise] scores (60 , 50 , 10)	The score is based on compliance with the latest code of practice for fire services installations at the city where the building is located. If the installations are at a standard higher than the code, a higher scores (>80) can be given.	9
15	Fire resisting construction	[full compliance with the latest code, compliance with the old code at the time it was built, otherwise] scores (60 , 50 , 10)	The score is based on compliance with the latest code of practice for fire resisting construction at the city where the building is located. If the provisions are at a standard higher than the code, a higher scores (>80) can be given. International Standards such as BS 9999: 2008 can be referred to.	9
16	Means of access	[full compliance with the latest code, compliance with the old code at the time it was built, otherwise] scores (60 , 50 , 10)	The score is based on compliance with the latest code of practice for means of access for firefighting and rescue at the city where the building is located. If the provisions are at a standard higher than the code, a higher scores (>80) can be given. International Standards such as BS 9999: 2008 can be referred to.	8
17	Electrical wiring regulation	[full compliance with the latest code , full compliance with the old code at the time it was built, full compliance with IEE Wiring Regulations 1981, otherwise] scores (60 , 50 , 40 , 10)	The score is based on compliance with the latest code of practice for electrical wiring at the city where the building is located. If the provisions are at a standard higher than the code, a higher scores (>80) can be given.	9
18	Reliability of elevator systems	[MTBF = 6 months or above .. MTBF = 1 month or below] scores (90 .. 10)	The entire elevator system of the building should be evaluated as a whole. The mean time between failures (MTBF) refers to the mean time between any two failures of any lifts or escalators within the whole system. Failure includes abnormal stoppage and accidents involving either human injury or fatality.	3
19	Time to identify trapped passengers without a mobile phone	[1 minute or below .. 30 minutes] scores (90 , 10)	It is a very dangerous situation when passengers are being trapped inside the lifts. Here, the time for any trapped passenger to be identified by the building management is estimated, not the time to rescue the trapped passenger. It is assumed that the rescuing work can be done as soon as possible after discovery. Suppose no mobile phone being used to locate trapped passengers.	4
20	Time needed for public announcement of disasters	[5 seconds or shorter .. 2 minutes or longer] scores (90 .. 10)	After the building management is informed, time required to announce a disaster, such as fire, typhoon, earthquake and etc, to everybody inside the building is also very critical for egress of occupants or for other positive actions taken by the occupants.	5

21	Time for total egress	[10 minutes or less .. 30 minutes or more] scores (90 .. 10)	When the building faces an emergency condition, such as a fire outbreak, all occupants need to escape to the streets or the refuge floors. Here, the total time span for all occupants to arrive at safe locations after receiving the general alarms from the public address system is estimated.	7
22	Quality of systematic escape route plan and audit	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The consideration is on the quality of any systematic plan of the escape route for every individual inside the building. It is rather subjective and therefore the judgment of the auditor is relied on.	3
23	Essential electric power	[20% or more .. 5% or less] scores (90 .. 10)	Electric power supply inside an office building is normally divided into two categories, namely the essential part and the non-essential part. The essential supply is normally fed from the non-essential part, but backed up by emergency generators. A general rule of thumb is that essential power accounts for about 10% of the whole power supply. It is more favourable to have a higher ratio of essential power, in particular, when there is a power failure from the electric power authority. Here, the percentage of total electric power supply inside a building, which is backed up by secondary supplies say diesel generators etc., is considered.	5
24	Water leakage	[none .. 1 leakage point per 10,000 m2 GFA or more throughout the whole building] scores (90 .. 10)	Diagnoses shall be carried out and Repair Strategies have to be set for deciding repair methods. For concrete structure, EN1504 European Standards on Concrete Repair shall be referred to.	5
25	Structural defects (such as cracks or spalling)	[none .. 10 minor defects (cracks/spalls) or more or 1 major defect (crack/spall) or more throughout the whole building] scores (90 .. 10)	Diagnoses shall be carried out and Repair Strategies have to be set for deciding repair methods. For concrete structure, EN1504 European Standards on Concrete Repair shall be referred to.	6
26	Major non-structural building defects (such as wall tile debonds)	[exist of fatal items , exist of non-fatal items substantially, exist of minor items , not exist] scores (5, 10 , 40, 90)	Non-structural building components, such as finishes, windows, doors, etc., which may cause safety problem shall be monitored. For example, debonded tiles falling down from the external walls can seriously injury pedestrians. There are several common methods to identify debonding of tiles of external walls, e.g. coring, hammer tapping, thermal imaging and other NDTs. For building ages more than 10 years, a plan and a test should be in place to control this serious problem. For example, missing of fire doors is considered a fatal item, whereas an expiry of WR1 certificate is a non-fatal item.	9
27	Settlement monitoring plan and audit	[exist , not exist] scores (90 , 10)	Settlement is a serious problem that affects the structural integrity of the whole building. A settlement monitoring plan with annual monitoring should be in place.	5
28	Building disaster/risk management plan and audit	[exist , not exist] scores (90 , 10)	The risk management plan is essential in Intelligent Buildings Management. The following technical note can be referred to: NIST Technical Note 1795: Developing Guidelines and Standards for Disaster Resilience of the Built Environment: A Research Needs Assessment, National Institute of Standards and Technology, USA	7
29	Security & crowd control management plan and	[exist , not exist] scores (90 , 10)	For safety and security, crowd control plan is essential in Intelligent Buildings Management. Intelligent Buildings: Understanding and managing the security risks, The Institution of	7

	audit		Engineering and Technology, UK, can be referred to. About crowd control: BS 9999:2008: Fire safety code of practice for the design, management and use of buildings can be referred to.	
30	Precautionary plan and audit for terrorist attack	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Here, any plan or precaution against terrorist attack and vandalism is referred to. The risk at the region where the building located is to be assessed and judged by the auditor. Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks (2013) This primer introduces a series of concepts that can help building designers, owners, and State and local governments mitigate the threat of hazards resulting from terrorist attacks on new buildings. Government Printing Office (GPO), USA.	2
31	Safety management system	The score of the Registered Safety Auditor's report will be followed.	Good safety management practice is essential in Intelligent Buildings Management. In construction of Intelligent Building: COP on Safety Management, HK This SMS system is now enshrined in the Factories and Industrial Undertakings (Safety Management) Regulation [hereinafter called "the Safety Management Regulation"] passed on 24 November 1999. Under the Safety Management Regulation, proprietors or contractors of certain industrial undertakings are required to develop, implement and maintain in respect of the undertakings a safety management system which contains a number of key process elements. They are also required to have the system regularly audited or reviewed. This Code of Practice on Safety Management is a Code of Practice issued by the Commissioner for Labour under section 7A(1) of the Factories and Industrial Undertakings Ordinance (Cap. 59). It aims to provide practical guidance for proprietors and contractors of relevant industrial undertakings to comply with the aforesaid legal requirements. It sets out, in Part 4, how proprietors or contractors should develop, implement and maintain a safety management system. It provides, in Part 5, practical guidance in respect of the 14 elements of a safety management system. It also provides, in Part 6 and Part 7, practical guidance on safety audits and safety reviews. At UK: CDM Regulations (Construction Design and Management) (2007) The CDM Regulations are aimed at improving the overall management and co-ordination of health, safety and welfare throughout all stages of a construction project to reduce the large number of serious and fatal accidents and cases of ill health which happen every year in the construction industry. The HSE says that the new regulations emphasise planning and management to secure a safe project, rather than paperwork. The Regulations place duties on all those who can contribute to the health and safety of a construction project. Duties are placed upon clients, designers and contractors with more power given to the CDM Coordinator in what is considered a more authorative and policing role. The new regulations combine the Construction (Health, Safety and Welfare) Regulations (1996) and CDM 1994 into one single set of regulations. However, they also introduce some important changes to the safety regime.	9
32	Special feature(s) recommended by the	No special features shall score 0 and up to 100 as determined	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

	auditor	by the Auditor		

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1		In Hong Kong: the Code of Practice of the Structural Use of Steel: 2011, the Code of Practice for Foundation (2004), the Code of Practice of the Structural Use of Concrete (2013), the Code of Practice on Wind Effects in Hong Kong (2004), and the Code of Practice for Precast Concrete (2003) shall be complied with. (http://www.bd.gov.hk/english/documents/index_crlist.html)	SE	RD	D	3
2		In Hong Kong: PNAP 303 refers to the wet-fixed external wall tiles; PNAP 106 refers to Curtain Wall, Window and Window Wall Systems, PNAP 248 refers to Aluminum Windows, etc (http://www.bd.gov.hk/english/documents/index_pnap.html)	SE	RD/LB	D	3
3			AR	C/V	D	2
4		In Hong Kong, Mandatory Building Inspection Scheme had been in-forced since 2012. (http://www.bd.gov.hk/english/services/index_MBIS_MWIS.html) Voluntary Building Inspection Scheme held by Hong Kong Housing Society was launch in 2012 (http://vbas.hkhs.com/en/about_vbas/background.html)	SE	RD/C	P	3
5			SE	RD/C	P	3
6			SE	RD	P	4
7		Reference to Yiu, C.Y. 2007,"Intelligent Building Maintenance - a Novel Discipline", Journal of Building Appraisal, 3(4), 305-318	SE	RD	P	4
8			SE	RD/LB	P	3
9			MA	LB	P	2
10		Reference to Yiu, C.Y. 2007,"Intelligent Building Maintenance - a Novel Discipline", Journal of Building Appraisal, 3(4), 305-318	MA	LB	P	4
11	2_02		AR	RD	D	3
12		In Hong Kong: the COP for the Fire Safety in Building 2012 and the COP Provision of Means of Escape in Case of Fire 1996 published by the Buildings Department HKSAR are is referred to.	AR	RD	D	3
13	2_04	In Hong Kong, PNAP APP-41 (2012) and Design Manual for Barrier Free Access (2008) published by BD are the major design guidelines. The 2008 design manual mainly focus on: o Dimension of the circulation area o Provision of ramp o Disabled friendly lifts (http://www.bd.gov.hk/english/documents/index_pnap.html)	AR	RD	D	3
14		In Hong Kong: the Code of Practice for Minimum Fire Service Installations and Equipment and Inspection and Testing and Maintenance of Installations and Equipment 2012 published by the Fire Services Department of HKSAR is referred to. (http://www.hkfsd.gov.hk/eng/code.html)	FS	RD	D	3
15		In Hong Kong: the COP for the Fire Safety in Building 2012 and The Code of Practice for Fire	AR	RD	D	3

		Resisting Construction published by the Buildings Department of HKSAR in 1989 and 1996 are referred to. (http://www.bd.gov.hk/english/documents/index_crlist.html)				
16		In Hong Kong: the COP for the Fire Safety in Building 2012 and The Code of Practice for Means of Access for Firefighting and Rescue 2004 published by the Buildings Department of HKSAR are referred to. (http://www.bd.gov.hk/english/documents/index_crlist.html)	FS	RD	D	3
17		In Hong Kong, the Code of Practice for the Electricity (wiring) Regulations 2009 published by EMSD of HKSAR is referred to. Before this code was published, the IEE Wiring Regulations could be referred to. (http://www.emsd.gov.hk/emsd/e_download/pps/pub/COP_E.pdf)	EE	RD	D	3
18		The Code of Practice on the Examination, Testing and Maintenance of Lifts and Escalators, published by EMSD of HKSAR is referred to. (http://www.emsd.gov.hk/emsd/e_download/pps/circular/A2/4_2003.pdf)	LE	LB	D/I/P	3
19			LE	C	P	2
20			FS	C/TE	P	2
21			AR	C/LB	P	3
22			AR	V/PJ	D/P	3
23			EE	RD	D	3
24		The following items must be considered: (1) details at openings; (2) caulking materials; (3) honeycombing of concrete; (4) removal of rubber tubes; (5) details at construction joints; (6) provision of canopy; (7) strength of aluminum windows.	SE	LB	C/P	3
25		The following points can be considered: (1) protection to concrete surface; (2) protection to reinforcement; (3) thermal and shrinkage stresses at the substrate/backing; (4) expansion and contraction joints.	SE	LB	C/P	3
26		The following points can be considered: (1) protection to concrete surface; (2) protection to reinforcement; (3) thermal and shrinkage stresses at the substrate/backing; (4) expansion and contraction joints; (5) freeze and thraw effect.	SE	RD/LB	C/P	3
27			SE	RD	P	2
28			MA	RD/LB	P	2
29			MA	RD/LB	P	2
30			MA	RD/C	P	2
31		In Hong Kong: refer to the Factories and Industrial Undertaking (Safety Management System) Regulation. For Audit and Risk Assessment of the Safety Management System, please reference to: - Fung, I. W., Tam, V. W., Lo, T. Y., & Lu, L. L. (2010). Developing a Risk Assessment Model for construction safety. *International Journal of Project Management*, *28*(6), 593-600.	MA	LB	P	2

		- Fung, I. W., Lo, T. Y., & Tung, K. C. (2012). Towards a better reliability of risk assessment: Development of a qualitative & quantitative risk evaluation model (Q^2REM) for different trades of construction works in Hong Kong. *Accident Analysis & Prevention, 48*, 167-184.				
32	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 10 MANAGEMENT PRACTICE AND SECURITY INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_8 MANAGEMENT PRACTICE AND SECURITY INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Carpark and transportation : Security of carpark	Area of coverage of under continuous monitoring = score in percentage. If no CCTV is provided, score of 10 will be given. An extra 20 can be added to the total score if the car plate number recognition system is available. [90% coverage .. 10% coverage] scores (90 .. 10)	The percentage of total area of the carpark under CCTV monitoring can be used to indicate the security of the carpark. If a car plate number recognition system is installed so that every car when entering the carpark has its car plate number recognised automatically, extra score can be given to this clause.	3
2	Security control automation at main entrances	[extensive use of biometric (i.e.), finger print or retina recognition , extensive use of access card , key pad , manual control , no control at all] scores (90 , 80 , 70 , 50 , 10)	Different technologies can be utilized to control people entering and leaving the building at main entrances. The most advanced one is fingerprint or retina recognition while the lowest type is “no-control”. Speed dialling / direct link to central control – bonus score	8
3	Number of unmonitored exits and entrances	% of free exits and entrances under monitoring, either by CCTV, human keepers or locked = score no exit nor entrance is monitored or locked = 10	Exits and entrances are the connections between the building and the outside world. Illegal intruders can easily get into and escape from the building through unmonitored exits and entrances. Therefore, they must be removed as far as possible.	5
4	Area monitored by CCTV	[Score equals to the percentage of common area monitored by CCTV , No CCTV at all] scores (90 .. 10)	All public areas inside an intelligent building must be monitored by CCTV cameras. The percentage of public and common areas inside the whole building being monitored by the CCTV system can reflect the ranking of this clause.	6
5	Security control system	[excellent or with good AI system, conventional and good system, worst, no] scores (90 , 70 , 40 , 10)	This clause refers to the general view of the auditor towards the whole security control plan of the building. Here, the employment of artificial intelligence (AI) based security system is being considered. Essential contents are (i) monitoring, (ii) alarming & alerting, (iii) feedback & self-learning.	8
6	Advanced AI based security system	[good , medium , no] scores (90 , 70 , 50)	Employment of artificial intelligence (AI) based security system is being considered. Essential contents are (i) monitoring, (ii) alarming & alerting, (iii) feedback & self-learning.	9
7	Lift and escalators	[2 times of out-of-service/month or less .. 10	A good elevator system should keep its frequency of out-of-service as low as	4

	servicing and repair	times or more/month] scores (90 .. 10)	possible. Only monthly or half-monthly shutdown due to routine maintenance is acceptable. Here, the number of out-of-services due to routine maintenance, repair or other kinds of ad hoc servicing per month is a good indicator of the overall condition of the lift system. Data can be collected from the maintenance logbook normally kept inside the machine room. Here, any lift group within the whole building is treated as an element of the elevator system or a whole. If maintenance services and spare parts are provided by the manufacturer of the lift and escalators can earn bonus scores.	
8	Light fitting maintenance factor	[90% or above .. 50%] scores (90 .. 50)	The maintenance factor refers to ratio of the total lumen output of a lamp together with the fitting due to aging and dirt to the total lumen output of it when new. One lamp is randomly chosen from every floor throughout the building and the test is carried out.	2
9	Reliability of elevator systems	[MTBF = 6 months or above .. MTBF = 1 month or below] scores (90 .. 10)	The entire elevator system of the building should be evaluated as a whole. The mean time between failures (MTBF) refers to the mean time between any two failures of any lifts or escalators within the whole system. Failure includes abnormal stoppage and accidents involving either human injury or fatality.	3
10	Comprehensive scheme of preventive maintenance	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	“excellent” means the scheme is very comprehensive; “good” means the scheme has obvious shortfalls; “fair” means the scheme is just available but without details; “worst” means the scheme is not available at all.	8
11	Extensive use of artificial intelligence	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	At present, techniques of artificial intelligence, such as expert systems, fuzzy logic and artificial neural networks etc., have been widely used in the industry. If they are widely used in an intelligent building such in multimedia man-machine interface, building systems like HVAC, lighting and elevators, egress of occupants and daily management etc., a high score must be assigned to it. It is rather subjective and the judgment of the auditor is relied on.	7
12	Building services automation system	[% of permanently installed devices under control and monitoring by BAS , No BAS] scores [90 .. 50]	A comprehensive building automation system (BAS) is a “must” in all intelligent buildings. A modern BAS possesses features such as control, monitoring, condition based maintenance, risk management, energy management, asset control and trend logging etc. Here, the overall percentage of all permanently installed devices in the building that are connected to the BAS is used as the score of this clause.	9
13	Safety management system	The score of the Registered Safety Auditor’s report will be followed.	Good safety management practice is essential in Intelligent Buildings Management. In construction of Intelligent Building: COP on Safety Management, HK This SMS system is now enshrined in the Factories and Industrial Undertakings (Safety Management) Regulation [hereinafter called "the Safety Management Regulation"] passed on 24 November 1999.	9

			Under the Safety Management Regulation, proprietors or contractors of certain industrial undertakings are required to develop, implement and maintain in respect of the undertakings a safety management system which contains a number of key process elements. They are also required to have the system regularly audited or reviewed. This Code of Practice on Safety Management is a Code of Practice issued by the Commissioner for Labour under section 7A(1) of the Factories and Industrial Undertakings Ordinance (Cap. 59). It aims to provide practical guidance for proprietors and contractors of relevant industrial undertakings to comply with the aforesaid legal requirements. It sets out, in Part 4, how proprietors or contractors should develop, implement and maintain a safety management system. It provides, in Part 5, practical guidance in respect of the 14 elements of a safety management system. It also provides, in Part 6 and Part 7, practical guidance on safety audits and safety reviews. At UK: CDM Regulations (Construction Design and Management) (2007) The CDM Regulations are aimed at improving the overall management and co-ordination of health, safety and welfare throughout all stages of a construction project to reduce the large number of serious and fatal accidents and cases of ill health which happen every year in the construction industry. The HSE says that the new regulations emphasise planning and management to secure a safe project, rather than paperwork. The Regulations place duties on all those who can contribute to the health and safety of a construction project. Duties are placed upon clients, designers and contractors with more power given to the CDM Coordinator in what is considered a more authorative and policing role. The new regulations combine the Construction (Health, Safety and Welfare) Regulations (1996) and CDM 1994 into one single set of regulations. However, they also introduce some important changes to the safety regime.	
14	Precautionary plan and audit for terrorist attack	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Here, any plan or precaution against terrorist attack and vandalism is referred to. The risk at the region where the building located is to be assessed and judged by the auditor. Primer for Design of Commercial Buildings to Mitigate Terrorist Attacks (2013) This primer introduces a series of concepts that can help building designers, owners, and State and local governments mitigate the threat of hazards resulting from terrorist attacks on new buildings. Government Printing Office (GPO), USA.	2
15	Indefensible space	90 - 0% of indefensible space scores (0 – 90)	Indefensible space refers to space inside the building where thieves, illegal intruders or robbers can hide themselves to make sure nobody can discover	4

			them during routine surveillance of the building. Therefore, the meaning here is that indefensible space is from the illegal intruders' point of view. The total amount of indefensible space inside the building must always be kept to a minimum. Hence, the score is based on the total amount of indefensible space in percentage of the total area of the building.	
16	Time to identify trapped passengers without a mobile phone	[1 minute or below .. 30 minutes] scores (90 , 10)	It is a very dangerous situation when passengers are being trapped inside the lifts. Here, the time for any trapped passenger to be identified by the building management is estimated, not the time to rescue the trapped passenger. It is assumed that the rescuing work can be done as soon as possible after discovery. Suppose no mobile phone being used to locate trapped passengers.	4
17	Response to emergence	[2 minutes or shorter .. 15 minutes or longer] scores (90 .. 10)	It is the maximum time needed for the building management to take a positive action in response to any special event occurring in any location within the whole building. This time interval represents the dynamics, responsibilities and mobility of the management staff. The management records shall provide the evidence.	7
18	Time needed to report a disastrous event to the building management	[5 seconds or shorter .. 2 minutes or longer] scores (90 .. 10)	Time required to report a disastrous event. Say a theft or a fire or a bursting of water pipes etc., is very critical in solving the problem or taking proper actions. Management records shall show the evidence.	5
19	Time needed for public announcement of disasters	[5 seconds or shorter .. 2 minutes or longer] scores (90 .. 10)	After the building management is informed, time required to announce a disaster to everybody inside the building is also very critical for egress of occupants or for other positive actions taken by the occupants.	5
20	Time for total egress	[10 minutes or less .. 30 minutes or more] scores (90 .. 10)	When the building faces an emergency condition, such as a fire outbreak, all occupants need to escape to the streets or the refuge floors. Here, the total time span for all occupants to arrive at safe locations after receiving the general alarms from the public address system is estimated.	7
21	Quality of systematic escape route plan and audit	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	The consideration is on the quality of any systematic plan of the escape route for every individual inside the building. It is rather subjective and therefore the judgment of the auditor is relied on.	3
22	Building disaster/risk management plan and audit	[exist , not exist] scores (90 , 10)	The risk management plan is essential in Intelligent Buildings Management.	7
23	Security & crowd control management plan and audit	[exist , not exist] scores (90 , 10)	For safety and security, crowd control plan is essential in Intelligent Buildings Management.	7
24	Property management	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	It is difficult to quantify the quality of property management and therefore the judgment of the auditor is relied on. However, the auditor is strongly recommended to consider at least the following aspects:	7

			o Facility management o Cost efficiency o Good tenant mixture o Minimum vacant units within the building o Competency and knowledgeable staff o Strong ability to handle disaster appropriately and promptly o Cleanliness o Organization of functions for the buildings o Proper working of the utility services o Adequate security staff o A good image of the building Provision of free shuttle bus services o Good promotion and advertisement o Public safety within the building o No illegal activity o General attitude of the operational staff o Concierge services o Tenant and management communication channels	
25	General building structural condition survey	[exist , not exist] scores (60 , 10)	For building ages over 10 years, there should be a plan for general building structure condition survey. (Structure covers main structure, sub-structures like canopy and balcony and precast elements) The survey could be done every 10 years in order to have a close structural monitoring. For buildings over 10 years constructed in earthquake region, the condition survey should be performed every 5 years. For buildings less than 10 years, this element may be not applicable.	9
26	Indoor air quality	[compliance with ASHRAE 62.1-2010 , compliance with statute, incompliance] scores (90 , 60 , 10)	ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality	4
27	Promotion activity	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Organizing promotion activities regularly for building tenants is essential in modern building management.	4
28	Management Plans for Waste Minimization and Materials Recycling	[yes , no] scores (90 , 50)	Evidence of management plan and achievements in waste minimization and materials reuse and recycling.	4
29	Maintenance and Management Policy and Facilities Audit for	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	7

	this Module			
30	Energy Management / Energy Savings Measures / Energy Audit / Carbon Audit	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	For example, the Danish Board of Technology suggests the following: Passive house Standard: 17.5kWh/sm/year + 550kWh/heated area; Low energy class 1: 35kWh/sm/year + 1100kWh/heated area. Other international standards such as The Passive house Standard or the AECB Carbon Lite Standards, can be referred to. Other international energy management standards such as BS EN 16001 / ISO 50001 Energy Management Systems, ANSI/ASHRAE/IESNA Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings can also be referred to.	4
31	Water Management / Water Savings Measures / Audit	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Achieving all the following four may be considered excellence: (1) active leakage control; (2) water conservation measures; (3) seawater for flushing; and (4) water reclamation. The award of government certificate on water savings can be referred.	4
32	Health and hygiene management practice	I. [* achieved, not achieved] scores (goto II, 1) II. [Any five practices, any four practices, any three practices, any two practices, any one practice, nil] scores (90, 70, 50, 40, 30, 10)	Provisions of management practice to reinforce both water systems * Employment of licensed plumbers and registered professional engineers for design and construction work (statutory requirement) a. Regular cleaning and maintaining tidiness of equipment (e.g. plant room) b. Regular cleaning and maintaining tidiness of facilities (pipework) c. Extend of deterioration (e.g. rusting and corrosion) d. Prevention of contamination (e.g. access panel tightness, pest control, sample tests) e. Maintenance record keeping f. Maintenance planning	8
33	Aid provided by the building management to the disabled	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	This clause is something related to the service provided by the management staff of the building to the disabled. It is a subjective judgment and therefore, it is left to the auditor to determine.	2
34	Circulation for the disabled	[full compliance with the statutory requirements, compliance with old code, otherwise] scores (60 , 50 , 10)	Design guide for the disabled or for barrier free access shall be referred to. For example, BS 8300:2010.	3
35	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1			EE	RD/C	D/P	3
2	4_47		EE	RD/V	D	1
3			GE	V/PJ	D	3
4	4_48		EE	RD/V	D	2
5			GE	C/PJ	D	3
6			EE	RD	D	4
7	4_19	The Code of Practice on the Examination, Testing and Maintenance of Lifts and Escalators, published by EMSD of HKSAR is referred to.	LE	LB	P	3
8	1_71		LI	RD/LB	P	3
9	7_18	The Code of Practice on the Examination, Testing and Maintenance of Lifts and Escalators, published by EMSD of HKSAR is referred to. (http://www.emsd.gov.hk/emsd/e_download/pps/circular/A2/4_2003.pdf)	LE	LB	D/I/P	3
10	7_09		MA	LB	P	2
11	6_28	Refer Yiu, C.Y. (2009) Intelligent Facilities Management, Joint Symposium, CIBSE and ASHRAE.	GE	PJ	P	4
12	4_58		EE	RD/V	D	1
13	7_31	In Hong Kong: refer to the Factories and Industrial Undertaking (Safety Management System) Regulation. For Audit and Risk Assessment of the Safety Management System, please reference to: - Fung, I. W., Tam, V. W., Lo, T. Y., & Lu, L. L. (2010). Developing a Risk Assessment Model for construction safety. *International Journal of Project Management*, *28*(6), 593-600. - Fung, I. W., Lo, T. Y., & Tung, K. C. (2012). Towards a better reliability of risk assessment: Development of a qualitative & quantitative risk evaluation model (Q^2REM) for different trades of construction works in Hong Kong. *Accident Analysis & Prevention*, *48*, 167-184.	MA	LB	P	2
14	7_30		MA	RD/C	P	2
15	7_03		AR	C/V	D	2
16	7_19		LE	C	P	2
17			MA	C/T	P	3
18			MA	C/T	P	3
19	7_20		FS	C/TE	P	2

20	7_21		AR	C/LB	P	3
21	7_22		AR	V/PJ	D/P	3
22	7_28		SE	RD	P	2
23	7_29		MA	RD/LB	P	2
24	4_70	In Hong Kong, the compliance with the Code of Practice on Building Maintenance and Management issued by Home Affairs Department under Building Management Ordinance, Cap. 344. (http://www.buildingmgt.gov.hk/en/cop/cop.htm)	MA	RD/C	P	3
25	7_04	In Hong Kong, Mandatory Building Inspection Scheme had been in-forced since 2012. (http://www.bd.gov.hk/english/services/index_MBIS_MWIS.html) Voluntary Building Inspection Scheme held by Hong Kong Housing Society was launch in 2012 (http://vbas.hkhs.com/en/about_vbas/background.html)	SE	RD/C	P	3
26	1_38	Refer ASHRAE62.1 and reference: Chow, T.T., & Lam, J.C. (1992). Thermal comfort and energy conservation in commercial buildings in Hong Kong. Architectural Science Review, 35(2), 67-72.	AC	RD/T	D/P	3
27	5_11		GE	C/PJ	P	3
28	1_72	In Hong Kong, refer PNAP 98, 243, and 245	MA	RD/C	P	3
29	2_17		MA	RD/LB	P	3
30	1_73	Mandatory Energy Efficient scheme has been launched to Hong Kong in 9/2012. Building energy efficient assessment can be done by Registered Energy Assessor (EMSD HK).	MA	T/LB	P	3
31	1_75	In Hong Kong, WSD's TWM leaflet at http://www.wsd.gov.hk/en/html/pdf/TWMe.pdf shows the details and the pilot scheme of water reclamation system. In Singapore, the NEWater Scheme on water reclamation was launched in 2001. The Water Efficiency Labeling Scheme is to be launched by WSD in 2009 in Hong Kong.	MA	RD/C	D/P	3
32			GE	LB	P	3
33			GE	C	P	3
34	2_04	In Hong Kong, PNAP APP-41 (2012) and Design Manual for Barrier Free Access (2008) published by BD are the major design guidelines. The 2008 design manual mainly focus on: o Dimension of the circulation area o Provision of ramp o Disabled friendly lifts	AR	RD	D	3
35	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 11 COST EFFECTIVENESS INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_9 COST EFFECTIVENESS INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Rent-to-cost Ratio, r	[r=0.9 or higher … r=0.1 or lower] scores (90 .. 10)	C = initial construction cost per square metre; M = property management, central air-conditioning and other fees for common facilities currently collected per square metre per annum (or the total expenses on annual operation and maintenance in case of owner-occupier; to be elaborated); F = additional funds per square metre, other than management fees, required for minor maintenance/renovation projects, collected between two most recent successive major renovations, divided by the number of years between these two major renovations; R = renovation cost per square metre (last major renovation or the next budgeted major renovation, whichever closer to the time of the assessment); T = renovation cycle, i.e. the duration between two most recent successive major renovations, in years; Y = gross rental value per square metre of gross floor area per annum; and y = average rental yield of the same category of buildings over the past ten years, published by the Department of Rating and Valuation of HKSAR Government. Historical cost data should be converted to present value figures using Construction Cost Indices published by the Architectural Services Department. Current cost information may be used to estimate the present values of projected future costs. The cost-to-rent ratio, r, is then calculated as follows: r = [C*y + M + (F+R) / T] /Y Underlying principle: The construction and operating costs of a building should be compatible to its rental income.	9
2	Maintenance and Management Policy and Facilities Audit for this Module	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	7
3	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

		determined by the Auditor		

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1		In Hong Kong, it can reference Life Cycle Assessment and Life Cycle Cost Tool for Commercial Building Development published by EMSD of Hong Kong (http://www.emsd.gov.hk/emsd/e_download/pee/lceabc_lcea.pdf) A shared reference software applied for Life Cycle Energy Analysis Software Tool for Commercial Building Development by EMSD Hong Kong can be accessed via: http://www.emsd.gov.hk/emsd/eng/pee/lceabc.shtml	QS	RD	D/I/P	4
2	2_17		MA	RD/LB	P	3
3	1_76		GE	PJ	D/I/P	1/2/3/4

CHAPTER 12 HEALTH AND SANITATION INDEX

INTELLIGENT BUILDING INDEX (AIIB – IBI v5)

Table 2_10 HEALTH AND SANITATION INDEX

Revision No.: v5.0 r0 Date: 1 July 14

Item	Heading	Marking scheme	Descriptions	Weight
1	Special ventilation for some areas, e.g. carpark, kitchen, restaurant and toilet	[Fully automated demand control achieving 20 AC/h or more, .. , just comply with statutory requirements , .. , incompliance] scores (90 , 60 , 10)	The provision of air change shall not be less than statutory requirements, and if fully automated demand control can be provided, 90 score shall be considered. Variation to suit the environmental change such as step control or timer control shall gain bonus scores. These special areas are normally not air-conditioned. The ventilation rate is very important to the personnel working in these areas. For example, ventilation rate to the carpark is important to keep the carpark at a reasonable temperature, in particular, during peak summer and to maintain a low density of poisonous gas. It is important to the health of the occupants. Notes: AC/h refers to "Air Change per hour". If alternative natural ventilation is provided, scores higher than 90 may be given. In US, International Energy Conservation Code: IECC 2012, Section R403.5 Mechanical Ventilation (Mandatory) published by International Code Council, Inc., Washington, DC: The building shall be provided with ventilation that meets the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other approved means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating. IECC 2012, Section R403.5.1 Whole-House Mechanical Ventilation System Fan Efficacy Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.5.1.	8
2	Infiltration provision for toilet ventilation (door lourve, undercut, etc.)	[provided with 0.75 sm face area, not provided] scores (90..50)	Required air flow rate shall be achievable with the door lourve provision.	6
3	Toilet exhaust condition	[To open air, to re-entrant] scores (90, 50)	Exhaust of toilet ventilation to open air is the best design.	5
4	Toilet/bath room ventilation	[No internal baths, have internal baths] scores (90, 50)	Internal toilets/bath arrangement refers to those toilets/bath do not have windows to outdoor, but a mechanical ventilation fan is provided. If such fan does not function due to electrical or mechanical failure, the room shall not be ventilated. This design should be avoided if possible.	3
5	Lifts and escalators	[20 AC/hr or above .. 10	Good ventilation inside the lift car is important to ensure health and comfort of the passengers,	8

<table>
<tr><td></td><td>ventilation rate</td><td>AC/hr or below] scores (90 .. 10)</td><td>in particular, when the lift car is in a halt. Normally, the hoistway is well ventilated by openings to the machine room at the top while the machine room is located above the roof so that fresh air can freely move in and out through big louvres. When the lift cars are traveling up and down, the piston effect can bring fresh air into the hoistway. Fresh air from gaps at landing doors of all floors can also move in and out of the hoistway. Ventilation into the lift car is normally by a fan locating at the ceiling of the car.
Temperature and moisture inside the lift cars shall be considered.</td><td></td></tr>
<tr><td>6</td><td>Indoor air quality</td><td>[compliance with ASHRAE 62.1-2010 , compliance with statute, incompliance] scores (90 , 60 , 10)</td><td>ANSI/ASHRAE Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality</td><td>8</td></tr>
<tr><td>7</td><td>Amount of fresh air changes per second</td><td>[9.5 litres/s/occupant .. 15 litres/s/occupant] scores (90 .. 10)
[9.5 litres/s/occupant .. 1 litre/s/occupant] scores (90 .. 10)</td><td>Fresh air supply is important to the health of occupants and thus the intelligence of them inside an intelligent building. The main objectives of fresh air supply are to provide enough oxygen and to remove odour from the indoor environment. Too much fresh air consumes unnecessary energy. Reference to ASHRAE Standard 62-2004
Recommended Air Change Rates proposed by Chartered Institute of Building Services Engineers Guide B is acceptable as an alternative assessment criteria:
<table>
<tr><td>Space</td><td>Air change rates per hour</td></tr>
<tr><td>Offices</td><td>4- 6</td></tr>
<tr><td>Dinning hall, restaurants</td><td>10 - 15</td></tr>
<tr><td>Carpark</td><td>6 - 10</td></tr>
<tr><td>Libraries, museums and galleries</td><td>3 - 4</td></tr>
<tr><td>Boiler rooms</td><td>15-30</td></tr>
</table></td><td>8</td></tr>
<tr><td>8</td><td>Non-smoking building</td><td>[specially isolated and ventilated smoking areas , non-smoking , otherwise] scores (90 , 60 , 10)</td><td>A non-smoking building is always appreciated compared with a smoking building. However, a building with specially designed isolated areas for smoking should be awarded a higher score.</td><td>5</td></tr>
<tr><td>9</td><td>Contamination of chilled and condensing water , virus, bacteria or other contaminants</td><td>[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)</td><td>The contamination refers to bacteria, virus and other contaminants. Regular water quality test report for monitoring is necessary.</td><td>5</td></tr>
<tr><td>10</td><td>Thermal comfort</td><td>Absolute Predicted Mean Vote (PMV) = [0.3 or below .. 2.0 or above] scores (95 .. 10)</td><td>Thermal comfort is measured by PMV in accordance with ISO 7730 that Met = 1 and Clo = 0.8 will be applied for Hong Kong situation.</td><td>5</td></tr>
<tr><td>11</td><td>Potable water quality</td><td>[Obtain recognized</td><td>Any one or more of the following provisions to enhance the potable water quality shall give</td><td>9</td></tr>
</table>

		certificate, not obtain] scores (70, 10)	bonus scores: a. U.V. lights b. Filtration system c. Other approved methods	
12	Potable water tanks cleaning frequency	[3 months .. 10 months or more] scores (60 ..10)	More frequent than once every 3 months may get bonus score. Other automatic and intelligent devices such as water quality monitoring system, automatic cleaning system, etc. may get bonus score.	6
13	Potable water examination	[Failure in E. coli, total coliform, pH, colour, turbidity, conductivity, iron, none] scores (10, 10, 50, 50, 50, 50, 50, 90)	In Hong Kong, Quality Water Recognition Scheme for Buildings is referred. Water quality testing parameters include pH, colour, turbidity, conductivity, iron, E. coli and total coliform. E.coli and coliform are 2 important parameters and will be capped on 10 if any one of them is failed.	8
14	Swimming pool, jacuzzi, sauna – filtration and water sampling in regular period	[Water test every month or less .. over 4 months] scores (90 .. 50)	Regular maintenance including filtration, water sample testing, piping system, etc. Water sample testing every 1 month is 'excellent'. Other automatic and intelligent devices such as water quality monitoring system, automatic cleaning system, etc. may get bonus score.	4
15	Flushing water tanks cleaning frequency	[3 months .. 10 months or more] scores (60 .. 10)	More frequent than once every 3 months may get bonus score. Other automatic and intelligent devices such as water quality monitoring system, automatic cleaning system, etc. may get bonus score.	4
16	Flushing water examination	[2 parameters passed, 1 parameter passed, nil] scores (90, 50, 10)	Water quality testing parameters are E. coli and total coliform.	8
17	Flushing water quality	[Any one of the following items, nil] scores (90, 50)	Provisions to reinforce the flushing water system a. Chlorine pills b. Bleaching agents c. Filtration system d. Other approved methods	3
18	Sufficient drainage pipe fall	[Achieved, not achieved] scores (90.. 10)	Sufficient fall of 1: 5 of drainage system after W.C. discharge to prevent cross flow contamination of W.C. sewage.	9
19	Main drainage stack condition	[All items achieved, any four items achieved, any three items achieved, any two items achieved, any one item achieved, nil] scores (90, 70, 60, 40, 30, 10)	Good main stack should be a. clean, b. free from corrosion and rust, c. no signs of leakage, d. no blockage, e. free from rough pipe surface.	8
20	Drainage pipe leakage	[All three items achieved,	Check for pipe leakage by visual observation of pipe surface and related:	9

	observation	any two items achieved, any one item achieved, nil] scores (90, 70, 40, 10)	a. corrosion, b. dirty water on floor, c. serious ponding on floor.	
21	Last drainage manhole cleaning	[Every month or less .. 4 months or more .. none] scores (90 .. 50 .. 10)	Every month cleaning is good practice.	5
22	Grease trap and petrol interceptor cleaning	[Every month or less .. 4 months or more .. none] scores (90 .. 50 .. 10)	Every month cleaning is good practice.	5
23	Drainage –bonus points	[Any four items achieved, any three items achieved, any two items achieved, any one item achieved, nil] scores (90, 80, 70, 60, 50)	Provisions of criteria: a. Double stacks drainage design separating the WC discharge and all others b. Management guidelines to add water to floor drains c. Proper and regular cleaning and maintenance record d. Proper access facilities from common areas for regular inspection and maintenance of drainage system e. Provision of central sewage treatment plant / septic tank f. 1-way self closing floor drain, g. Durable pipe, e.g. epoxy coated. h. Provision of rain garden	3
24	U-trap provision with water seal	[Provided and properly functioning, not properly functioning] scores (90.. 10)		9
25	Enclosed refuse collection room	[Provided, not provided] scores (90 .. 50)		6
26	Frequency of refuse removal from building	[24 hours or less .. 48 hours or more .. none] scores (90 .. 50 .. 10)		5
27	Frequency of refuse room cleaning	[24 hours or less .. 60 hours or more .. none] scores (90 .. 50 .. 10)		5
28	Refuse collection – bonus point	[all three items, any two items, any one item nil] scores (90, 70, 60, 50)	Provisions: a. Use automatic refuse collection system. b. Refuse collection by bags. c. Refuse collection by chutes.	3
29	General cleanliness of the building	[Rubbish covering area: 1% or less .. 60% or more] scores (90 .. 10)	Observation from roof to re-entrant canopies and air-conditioner eaves to check the collection of rubbish by percentage of area covered by rubbish.	8

30	Maintenance and Management Policy and Facilities Audit for this Module	[excellent , good , fair , worst] scores (90 , 70 , 40 , 10)	Measurements such as space audits, users feedback system, facility audits, availability of past data to enable life cycle cost analysis, etc.	8
31	Special feature(s) recommended by the auditor	No special features shall score 0 and up to 100 as determined by the Auditor	Contribution of the weight of this element must not exceed 5% of the sum of weights of all elements under this index.	-

REMARKS AND REFERENCES:

Item	Link	Remarks (incl. References for different cities)	Discipline Ref.[1]	Source [2]	Stage [3]	Dim of Intel [4]
1	1_41		AC	RD/C/V	D/P	3
2			AC	V/RD	D	3
3			AC	V/RD	D/P	3
4			AC	RD	D	3
5	3_10		LE	RD	D	3
6	1_38	Refer ASHRAE62.1 and reference: Chow, T.T., & Lam, J.C. (1992). Thermal comfort and energy conservation in commercial buildings in Hong Kong. Architectural Science Review, 35(2), 67-72.	AC	RD/T	D/P	3
7	1_39		AC	RD/C	D/P	3
8	1_40		AC	C/PJ	D/P	3
9	1_42		AC	PJ/LB	P	3
10	1_16		AR	RD/T	D/P	3
11			PD	LB	P	3
12		Food & Environmental Hygiene Department, Hong Kong Government, recommends cleaning of fresh water tank every 3 months for restaurants and food manufacturing industry.	PD	LB	P	3
13		In Hong Kong, Quality Water Recognition Scheme for Buildings is certified by Water Supplies Department of Hong Kong. Water quality testing parameters include pH, colour, turbidity, conductivity, iron, E. coli and total coliform. System inspection includes water pipe, filter, water pumps and water tank. (http://www.wsd.gov.hk/en/customer_services_and_water_bills/application_for_licence_certificate/quality_water_recognition_scheme_for_buildings/index.html) In Hong Kong, 90 marks can be achieved if this water quality certificate can be acquired. References: - Guidelines for drinking-water quality SECOND EDITION Volume 3 - Surveillance and control of community supplies, World Health Organization Geneva 1997	PD	LB	P	3
14			GE	LB	P	3
15			PD	LB	P	3
16			PD	LB	P	3
17			PD	RD	D/P	3
18			PD	RD/V	D	3
19			PD	V	D/P	3
20			PD	V/PJ	P	3
21			PD	LB	P	3
22			PD	LB	P	3

23		Rain garden design can reference to Lam, K.M., Li, Z.Y. and Cheng, C.C.K., Development of Safety Planning Model to integrate with BIM on Intelligent Building Construction in Hong Kong, International Conference Proceedings of Intelligent Systems, Structures and Facilities 2014.	PD	LB	D/P	3
24			PD	RD	D/P	3
25			GE	V	D	3
26			GE	LB	P	3
27			GE	LB	P	3
28			GE	C	D/P	3
29			GE	V	P	3
30	2_17		MA	RD/LB	P	3
31	1_76		GE	PJ	D/I/P	1/2/3/4