BEAM Plus
New Data Centres

Version 1.0 (Beta 0)
03.2020

HKGBC
香港綠色建築議會

BEAM
建築環保評估協會

Disclaimers of BEAM Plus New Data Centres V1.0 (Beta 0)

The BEAM Plus New Data Centres V1.0 (Beta 0) is released as a beta version for pilot use. This must not be taken as an official launch of the final version which is subject to changes in due course.

In no circumstances shall a reader rely on this version for any purpose other than treating this as a beta version for pilot use.

BEAM Society Limited, its commissioned consultant, participants of Steering Committee and all individuals involved in the development of BEAM Plus New Data Centres accept no liability for any loss or damage arising from any use or misuse of or reliance on any information in this manual.

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Note:

⏲ The proponent is cautioned that the supporting information for credit claim has to be taken at the material time, which needs to be captured during the process and cannot be done retrospectively.

1. Introduction

1.1 Overview

BEAM

Building Environmental Assessment Method (BEAM) Plus is a comprehensive environmental assessment tool for assessing buildings on a voluntary basis. It defines the best practice criteria for a range of sustainability issues across the whole life-cycle of buildings and projects, such as how buildings should be designed, constructed, managed and operated, etc. Recognised as one of the world's leading green building assessment tools, it provides a comprehensive set of sustainability performance standards that can be pursued by developers and owners.

Owned and operated by the BEAM Society Limited (BSL), BEAM Plus New Data Centres (DCs) is one of the BEAM Plus rating tools that covers the design and construction of new DCs.

Based on the credit achievement from the assessment, the DC will be graded to levels of Platinum, Gold, Silver or Bronze, to reflect the overall performance.

BEAM Plus New Data Centres Version 1.0 (New DCs V1.0)

The BEAM Plus New Data Centres Version 1.0 (New DCs V1.0) aims to be easy to apply, comprehensive through making references to local and global industry green practices on items including energy consumption and efficiency of data centre facilities and IT equipment of new data centre. The BEAM Plus – DCs tools were prepared on the following key fundamentals:

Above Statutory Requirements – Requirements for prerequisites and credits should be set above the statutory requirements.

Adaptability – The assessment framework is adapted to the specific requirements of DCs, including buildings that house the DCs.

Certainty – Assessment criteria are clearly defined to reduce ambiguity and promote better certainty in the assessment process. Submittal requirements should be standardised as far as practicable.

Practicality – Assessment criteria are set by making references to DC industry best practices and technology advancements of DC in order to promote wider adoption of cost effective green building and green data centre practices easily.

BEAM Society Limited (BSL)

BEAM is owned and operated by BSL, an independent non-profit public body whose membership is drawn from many professional and interest groups in Hong Kong's building construction and real estate sectors. BSL is committed to developing and implementing the BEAM assessment tools, assessing green buildings and training professionals.

Hong Kong Green Building Council (HKGBC)

HKGBC was established in 2009 as Hong Kong's industry body that coordinates efforts towards green building. HKGBC certifies BEAM Plus projects, accredits BEAM Professional (BEAM Pro), BEAM Affiliate (BA) and BEAM Assessors (BAS).

Development of BEAM Plus New DCs Version 1.0

The development of BEAM Plus New DCs V1.0 was led by a BSL Steering Committee comprising industry practitioners and experts. Industry stakeholders have been consulted via engagement workshops for feedback and opinion on areas including but not limited to the overall framework, performance categories and their relative emphasis, assessment criteria, submission requirement and grading methodology. The Steering Committee comprises:

Convener – Ir Victor Cheung

Members – Ir Colin Chung; Mr KM So; Ir Sr Martin Wan; Mr MK Leung; Ms Yvonne Ieong; Ir Alvin Lo; Ir Sr Jonathan Lee; Ir Kenneth Li; Mr Ho Wing Hung; Dr Benny Chow; Mr Keith Chung; Mr Charles Lee; Mr Paul Chong; Ms Grace Kwok; Ms Carmen KM Wong; Ir Kim Tang Cheuk; Sr Kenneth Yun; Mr Herbert Chan; Mr Taylor Man; Mr Martin Chan; Dr Anthony Lo; Ir Raymond Choi; Dr Luo Xiaowei; Prof Wang Shengwei; Ir Michael Waye; Mr Ben Tam

Advisors – Mr KC Mak; Ms Pelene Ng; Mr Alvin Lo; Ir Ernest Yeung; Mr Patrick KK Chan

Disclaimer

BEAM Plus New DCs has been prepared with the assistance and participation of many individuals and representatives from various organisations. The outcome represents a general consensus, but unanimous support from each and every organisation and individual consulted is not implied. The BEAM Plus New DCs documentation shall be revised on a regular basis and as frequently as necessary. BSL reserves the right to amend, update and change this Manual from time to time without prior notice. Where changes in regulations necessitate changes to the assessment criteria, they will be issued to all parties involved in an assessment and will be announced in the BSL's website. An appropriate transitional period shall be allowed for projects undergoing assessment process.

It should be noted that none of the parties involved in the funding of this manual, including BSL and its members, provide any warranties or assume any liability or responsibility to the users of this manual, or any third parties for the accuracy, completeness or use of, or reliance on, any information contained in this manual, or from any injuries, losses, or damages arising out of such use or reliance.

As a condition of use, users covenant not to sue, and agree to waive and release BSL, its members, participants of Steering Committee and all individuals involved in the development of BEAM Plus New DCs from any and all claims, demands and causes of actions for any injuries, losses and damages that users may now or hereafter have a right to assert against such parties as a result of the use of, or reliance of this manual.

Limitations

BSL does not endorse any self-assessed grading awarded by the use of BEAM Plus for New DCs.

HKGBC offers a formal certification process of grading, this service provides independent third-party review of credits claimed to ensure all credits can be demonstrated to be achieved by the provision of the necessary documentary evidence. The use of BEAM Plus New DCs without formal certification does not entitle the user or any other party to promote any grading awarded.

Application and Eligibility

Assessed DC must with area not less than 500 m^2. Typically, DC refers to organised space, commonly known as data halls, containing racks of IT

equipment, such as servers, data storage, etc., plus any spaces for supporting infrastructure and facilities (e.g. switch rooms, UPS rooms, battery rooms, etc.). The data halls and any related plant space should make up a significant majority of the floor area of the assessed DCs.

Assessed DC associated function areas must not be larger than 25% of the floor area under assessment. The DC associated function areas primarily is to support the operation of data centre, including areas as illustrated below:

i. Reception and waiting areas;
ii. Office areas (including meeting and training rooms);
iii. Building management offices;
iv. Staff canteen and/or kitchen facilities;
v. Pantry;
vi. Staff gym;
vii. Restrooms, WCs and changing facilities;
viii. Circulation areas;
ix. Guard/ Security room;
x. Staging rooms; and
xi. Command centres, etc.

The above list is not exhaustive, but serves to indicate the type of areas covered by the scope of this BEAM Plus DCs

DC certification area must be separable from other mixed-use elements of the buildings

BEAM Plus New DCs V1.0 covers the data centre development including, from whole building DC to DCs constructed in part of the building such as data centre converted from part(s) of industrial building which is commonly found in Hong Kong.

New DCs refers to the newly installed purpose-built DC from ground zero in either whole or part of building, including existing building/ DCs that is intended to be carried out major alteration or addition ('A&A')works such as constructing an additional floor and/or replacing the entire façade and revitalisation of industrial buildings or change of building use. Data centres of these kinds are eligible for the application of the BEAM Plus New DCs certification.

BEAM Plus DCs does not assess any unauthorised or any unauthorised portions of any buildings, i.e. any buildings or building works not complying with the Buildings Ordinance. In case any non-compliance works or unauthorised portions in a building are reported, both HKGBC and BSL reserve the right to deprive the awarded rating from the Applicant.

Assessment Boundaries

The Applicant shall define the project boundary to undergo the BEAM Plus DCs assessment. The project boundary needs not necessarily follow the site boundary of the development, which however, should be consistent throughout the project assessment.

Certification Framework

Assessment under BEAM Plus New DCs covers the demolition, planning, design, construction and commissioning of a DC and should be initiated in the early stages of project development. BEAM Plus New DCs aims to promote building green data centres with the least environmental impacts while meeting the business and social needs and user satisfaction, through encouraging the adoption of well accepted and innovative practices and technology within reasonable cost.

A notable attribute of BEAM Plus for New DCs, as compared with other mostly used schemes elsewhere, is that an assessment for new DCs consists of two stages, namely the Provision Assessment (PA) and Final Assessment (FA), ensuring that 'green' and 'sustainable' design features are actually implemented, and construction practice meets the required performance standards. Besides being in the interests of the Client and tenant in certifying the actual performance of the DC, this approach also serves to 'dovetail' assessment with BEAM Plus Existing DCs and Interiors. It would be expected that a building graded under BEAM Plus New DCs and suitably operated, maintained and renovated would achieve a similar grade under other BEAM Plus certification schemes.

Certification Process Independent BEAM Assessors (BAS) or BSL inhouse BAS would be assigned to each project to undertake the assessment works. The Technical Review Committee (TRC) of BSL will review the assessment reports done by the BAS and endorse the assessment results, followed by the issuance of certification by the HKGBC. Detail assessment procedures can be found in the BEAM Plus Project Assessment Procedures Manual which is available in HKGBC and BSL websites.

BEAM Professional/ Affiliate BEAM Professional (BEAM Pro)/ Affiliate mentioned in this manual should possess the valid credential for BEAM Plus New DCs V1.0 for facilitating the certification process and to ensure the compliance of relevant credit requirements.

Documentation The Applicant has the obligation to provide evidence to demonstrate credit compliance. In BEAM Plus New DCs V1.0, only the necessary amount of material required needs to be submitted. However, the Applicant must make sure all supporting information is timely collected and properly documented. Just in case when the BAS considers it necessary to demand additional material of the same sort for clarification, the Applicant is obligated to produce such material upon request.

Certification Fee BEAM Plus certification fee comprises 2 parts, namely Registration Fee and Assessment Fee which are payable to HKGBC and BSL respectively. Details on the fee structure can be found in the HKGBC and BSL websites

Credit Interpretation Request (CIR) CIR is designed to allow project teams to obtain specific guidance on whether certain BEAM Plus credits can be fulfilled pertaining to the special design of a project. Details on CIR can be found in HKGBC and BSL websites

Appeal The Applicant may submit an appeal on an individual credit if they disagree to and/ or do not accept the decision made by the BSL. More details can be found in the HKGBC and BSL websites.

1.2 Framework

Credit Performance Categories

Different assessment methods assign their credits under different categories according to the preferences of the tool developer. In BEAM Plus New DCs V1.0, credits are grouped into the following categories:

i. Integrated Design and Construction Management (IDCM);
ii. Sustainable Sites (SS);
iii. Materials and Waste (MW);
iv. Energy Use (EU);
v. Water Use (WU);
vi. Health and Wellbeing (HWB); and
vii. Innovations and Additions (IA).

While BEAM Plus New DCs adopts similar categories in other BEAM Plus tools as part of coherent set of schemes, the number and nature of credits within each category are specific to the context of data centre and Hong Kong and in the context of new DC projects.

Integrated Design and Construction Management (IDCM)

IDCM focuses on the integration between design and operation, integrated design between design team members and client, and integration throughout the development process from design to construction. The core objectives of IDCM are as follows:

i. Integrated Design Process;
ii. Green Construction Practices;
iii. Smart Design and Technologies; and
iv. Design for Engagement and Education on Green Buildings.

Sustainable Sites (SS)

SS focuses on the design and planning issues, and the integration of neighbourhood and site location. The core objectives of SS are as follows:

i. Neighbourhood Integration;
ii. Biodiversity Enhancement;
iii. Bioclimatic Design; and
iv. Climate Resilience and Adaptability.

Materials and Waste (MW)

MW focuses on the minimisation of operational materials and waste. The core objectives of MW are as follows:

i. Efficient Use of Materials;
ii. Selection of Materials; and
iii. Waste Reduction.

Energy Use (EU)

EU focuses on the reduction of building operation energy consumption. It is performance based and seeks to encourage quality passive design. The core objectives of EU are as follows:

i. Energy Use Reduction and Control;
ii. Renewable and Alternative Energy Systems; and
iii. Energy Efficient Equipment.

Water Use (WU)

WU focuses on the reduction of water consumption. The core objectives of WU are as follows:

i. Water Conservation;
ii. Effluent; and
iii. Water Harvesting and Recycling.

Health and Wellbeing (HWB)

HWB focuses on the human environmental quality. It is designed to expand the scope of previous indoor environmental quality (IEQ) category and absorb human centric design elements. The core objectives of HWB are as follows:

i. Design for Green Living;
ii. Inclusive Design; and
iii. Indoor Environmental Quality.

Innovations and Additions (IA)

IA focuses on promoting and rewarding true innovations. The core objectives of IA are as follows:

i. Innovation Techniques; and
ii. Innovation Challenges.

Credit Allocation

Credits have been broadly allocated to each assessment criterion by taking into account the other internationally recognised green building assessment tools as well as the sensitivity analysis and the comments received during the stakeholder engagement workshops.

Category Weighting

Having reviewed the local and international assessment schemes and other relevant information, a percentage of weighting for each environmental performance category has been assigned to reflect its importance as follows:

Category	Weighting
IDCM	20%
SS	10%
MW	10%
EU	40%
WU	10%
HWB	10%

Prerequisites

The Applicant must demonstrate that all the pre-requisites are achieved. Otherwise, the project will be graded as “Prerequisite(s) Not Achieved”.

Bonus Credit & Additional Bonus Credit

The bonus credits and additional bonus credits, as applicable in New DCs V1.0, are counted under the corresponding categories. A factor of 1.2 is applied in score calculation for the attainment of bonus credits and additional bonus credits.

Bonus credits are independent from the normal credit(s) under the same credit item. They can be achieved regardless of the success or failure in attaining the normal credit(s). Whereas the additional bonus credits are dependent on the normal credit(s) under the same credit item. The award of normal credit(s) is the prerequisite for attaining the additional bonus credits.

The maximum possible score under each category is 100%.

IA Credit

As in New DCs V1.0, the IA credits are counted towards the total number of credits qualifying for an award classification. A maximum of 10 IA credits could be submitted for achieving a higher score in the assessment.

Determination of Overall Grade

The final certificate grading for projects certified under BEAM Plus New DCs V1.0 is subject to the following conditions:

i. To be announced later.

ii.

iii.

Grade	Minimum Percentage for each Category	Total Score
Platinum	To be announced later.	
Gold		
Silver		
Bronze		

If a project can comply with all the applicable pre-requisites but cannot reach the threshold of Bronze rating, it will be graded as “Pre-requisites Achieved”. In case the project fails to demonstrate compliance with any one of the applicable pre-requisites, it will be graded as “Pre-requisite(s) Not Achieved”.

1.3 Summary of Credits

	Section	Credit Requirement	Extent of Application	Credit
2	**Integrated Design and Construction Management (IDCM)**			**22 + 11 BONUS**
IDCM P1	Sustainability Champions - Project	Prerequisite achieved for demonstrating that an accredited BEAM Professional (BEAM Pro) with a valid credential for BEAM Plus New DCs V1.0 is engaged as the project BEAM Pro of the consultant team. The project BEAM Pro shall: 1) Act as the point of contact with the Hong Kong Green Building Council and the BEAM Society Limited for administrative matters relating to BEAM Plus certification; 2) Participate as one of the key project team members in the design and construction stages, with assistance of the Construction BEAM Pro (and Affiliates, if any) defined under IDCM 5 if any, to oversee the submission materials are in the compliance with relevant requirements of the BEAM Plus Manual. The project BEAM Pro may also assume other roles in the consultant team of the project; 3) Create a BEAM Plus New DCs Certification Checklist including project goals, performance and BEAM Plus target rating; 4) Provide guidance to the project and construction teams regarding BEAM Plus principles, structure, timing, certification process and requirements of credits; and 5) Advise the Client on relevant professionals or parties on respective tasks to address relevant BEAM Plus New Data Centres certification requirements.	All DCs	Required
IDCM P2	Timber Used for Temporary Works	Prerequisite achieved for demonstrating that no virgin forest products are used for temporary works.	All DCs	Required

	Section	Credit Requirement	Extent of Application	Credit
IDCM 1	Sustainability Champions - Design	1 credit for at least two (2) members from at least two (2) applicable core design disciplines shall be an accredited BEAM Professionals with valid credentials for BEAM Plus New DCs V1.0 for Projects intending to achieve a Bronze rating or above. 1 additional BONUS credit for at least one (1) additional member; **or** at least two (2) additional members, different from the disciplines counted in the above credit, shall be an accredited BEAM Professional with valid credentials, or an accredited BEAM Affiliates, respectively.	All DCs	1 + 1 additional BONUS
IDCM 2	Integrated Design Process	(a) Early Consideration(s) of Integrated Building Design Process 1 credit for consideration of the integrated design process regarding whole-system thinking to explore the interrelationships among green building design strategies and systems in the conceptual design stage. 1 additional credit for organising at least one multi-disciplinary design charrette to formulate passive and active design strategies in the conceptual/ schematic design stages. (b) Early Design Consideration of Buildability/ Constructability 1 credit for early design consideration of buildability to ease construction and save on-site materials/ labour before completion of the design development stage. (c) Design Consideration of Operation and Maintenance 1 credit for design consideration of the long-term operation and maintenance needs of the DC and its engineering services.	All DCs	4
IDCM 3	Life Cycle Costing	1 credit for conducting life cycle costing for active systems.	All Active Systems Servicing the Assessed DCs.	1
IDCM 4	Commissioning	2 credits for demonstrating (a) the appointment of commissioning authority (CxA) before tender stage and (b) providing a commissioning plan. 1 credit for providing a commissioning review report before construction as described in part (c). 1 credit for providing commissioning reports as described in part (d).	All DCs	4

	Section	Credit Requirement	Extent of Application	Credit
IDCM 5	Sustainability Champions - Construction	1 credit for at least two (2) accredited BEAM Professionals with valid credentials for BEAM Plus New DCs V1.0 **or** at least one (1) accredited BEAM Professional with valid credentials and two (2) accredited BEAM Affiliates, are engaged by the main/ lead contractor for the project intending to achieve a Bronze rating or above.	All DCs	1
IDCM 6	Measures to Reduce Site Emissions	(a) Environmental Management Plan 1 credit for demonstrating that an Environmental Management Plan has been properly prepared. <u>For Whole Building DC Developments:</u> (b) Minimisation of Air Pollution 1 credit for providing adequate monitoring and mitigation measures to minimise air pollution during construction (demolition and foundation are included, if any). (c) Minimisation of Noise Pollution 1 credit for providing adequate monitoring and mitigation measures to minimise noise pollution during construction (demolition and foundation are included, if any). (d) Minimisation of Water Pollution 1 credit for providing adequate monitoring and mitigation measures to minimise water pollution during construction (demolition and foundation are included, if any). (e) Minimisation of Light Pollution 1 BONUS credit for providing adequate mitigation measures to minimise light pollution during construction (demolition and foundation are included, if any). <u>For DC Developments located in part of building:</u> (a) Environmental Management Plan 1 credit for demonstrating that an Environmental Management Plan has been properly prepared. (b) Minimisation of Construction Dust 1 credit for providing adequate monitoring and mitigation measures to minimise air pollution to host building	All DCs	For Whole Building DC Development: 4+1 BONUS For DC Developments located in part of building: 3

	Section	Credit Requirement	Extent of Application	Credit
		users and neighbouring occupants during construction and fit-out activities. (c) Minimisation of Construction Noise 1 credit for providing adequate monitoring and mitigation measures to minimise noise pollution to host building users and neighbouring occupants during construction and fit-out activities.		
IDCM 7	Construction and Demolition Waste Recycling	(a) Demolition Waste Recycling 1 credit for demonstrating compliance with the Waste Management Plan and the application of proactive waste management provisions during demolition; and recycling at least 15% of demolition waste. 1 additional BONUS credits for 30%. 2 additional BONUS credits for 60%.	IDCM 7a: All DCs requiring demolition which are under the Client's control	2 + 4 additional BONUS
		(b) Construction Waste Recycling 1 credit for demonstrating compliance with the Waste Management Plan and the application of proactive waste management provisions during construction (foundation to be included, if any); and recycling of at least 15% of construction waste (foundation waste to be included, if any). 1 additional BONUS credits for 30%. 2 additional BONUS credits for 60%.	IDCM 7b: All DCs	
IDCM 8	Construction IAQ Management	1 credit for implementing a Construction IAQ Management Plan, undertaking a building 'flush out' or 'bake out', and replacement of all filters prior to occupancy.	All DCs	1
IDCM 9	Building Management Manuals	1 credit for providing a fully documented Operation and Maintenance Manual and Energy Management Manual.	All DCs	1
IDCM 10	Operator Training plus Chemical Storage Mixing Room	1 credit for providing training for operation and maintenance staff; and demonstrating that adequate maintenance facilities are provided for operation and maintenance work.	All DCs	1
IDCM 11	Digital Facility Management Interface	1 BONUS credit for providing a digital interface in addition to the project design metering provision for future facility management team to review the DC operation performance.	All DCs	1 BONUS

	Section	Credit Requirement	Extent of Application	Credit
IDCM 12	Document Management System	1 credit for demonstrating the use of document management systems within the design team. 1 additional BONUS credit for demonstrating the use of document management platform to hand over to the facility management team.	All DCs	1 + 1 additional BONUS
IDCM 13	BIM Integration	(a) Coordinated Use of BIM within Design Team 1 credit for the coordinated use of BIM among the design team. (b) Other Applications of BIM Maximum 3 additional BONUS credit for BIM application on the following aspects: 1) Coordinated Use of BIM within Design and Construction teams; 2) BIM for time; and 3) BIM for Facility Management Use.	All DCs	1 + 1 additional BONUS + 2 BONUS
3	**Sustainable Sites (SS)**			**13+10 BONUS**
SS 1	Green Building Attributes	Maximum 5 credits for an assessed DC that meets the listed performance characteristics.	All DCs	5
SS 2	Noise Control for Building Equipment	1 credit for demonstrating that the level of the intruding noise at the facade of potential noise sensitive receivers is in compliance with the criteria recommended in the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites.	All Building Equipment servicing the Assessed DCs.	1
SS 3	Light Pollution Control	1 credit for demonstrating that obtrusive light from exterior lighting meets the specified performance for the environmental zone in which the DC development is located.	All exterior lighting specified as part of the Assessed DCs.	1
SS 4	Biodiversity Enhancement	(a) Reduction of Ecological Impact 1 BONUS for demonstrating that all identified habitat types on Site are of low or negligible indicative ecological values. **Alternatively**, Demonstrate that all identified habitat types on Site of medium to high indicative ecological value are preserved	SS 4a: Whole Building DC Developments and all sites with existing tree except brownfield sites or sites on reclaimed land	2 BONUS

	Section	Credit Requirement	Extent of Application	Credit
		intact and are either unaffected by the planned development. (b) Enhancement of Biodiversity 1 BONUS for preparing a manual on biodiversity-friendly landscape maintenance, PLUS adopting measures to increase diversity and complexity of planting for enhancing the biodiversity of the site.	SS 4b: Sites with adjacent areas of medium or high ecological value	
SS 5	Urban Heat Island Mitigation	<u>For Site area <1,000m^2</u> (a) Urban Design Guidelines Chapter 11 1 credit for implementing at least 2 site level strategies under Section 11 of Hong Kong Planning Standards and Guidelines Chapter 11 Urban Design Guidelines. <u>For Site area ≥ 1,000m^2</u> (a) Sustainable Building Design Measures 1 credit for providing shade on at least 5% of the site area and at least 50% of non-roof impervious surfaces on the site (parking, walkways, plazas) using light coloured high-albedo materials (albedo of at least 0.4). 1 credit for demonstrating compliance with prescribed requirements of the SBD Guidelines as promulgated in the PNAP APP-152. 1 additional BONUS credit for demonstrating with relevant prescriptive requirements with enhanced performances. (b) Tree Coverage 1 to 2 BONUS credits for demonstrating that at least 10% and 20% or more, respectively, of the total Site Area is provided with tree coverage. (c) Air Ventilation Assessment (AVA) For conducting an AVA by wind tunnel or Computational Fluid Dynamics (CFD) according to the prevailing AVA methodology introduced by the Government demonstrating that better or equivalent ventilation performances than a baseline case: 1 credit for demonstrating annual wind condition.	Whole Building DC Developments	For Site area < 1,000m^2: 1 For Site area ≥ 1,000m^2: 4 + 2 additional BONUS and 2 BONUS

	Section	Credit Requirement	Extent of Application	Credit
		1 credit for demonstrating summer wind condition. (d) Intra Urban Heat Island Study 1 BONUS credit for conducting an Intra Urban Heat Island Study demonstrating that a maximum Intra-Urban Heat Index (difference between T_{urban} and T_{met}) in summer is less than 0.8 °C.		
SS 6	Immediate Neighbourhood Wind Environment	1 credit for demonstrating that no pedestrian areas will be subject to excessive wind velocities caused by amplification due to the site layout design and/or building design.	Whole Building DC Developments	1
SS 7	Outdoor Thermal Comfort	(a) Shaded or Covered Routes 1 BONUS credit where at least one shaded or covered route, connects the site with nearby amenities/site main entrance/transport hub. (b) Passive Open Spaces with Thermal Comfort 1 BONUS credit where 50% or more of the passive open spaces and pedestrian zones achieve thermal comfort. This is demonstrated on a typical summer day at 3:00 pm in Hong Kong.	Whole Building DC Developments with a site area of 1,000m^2 or more.	2 BONUS
SS 8	Stormwater Management	1 credit for demonstrating that adequate stormwater management design measures have been provided to cater the total volume of runoff corresponding to a design rainfall of at least 30mm/event for the site in its post-developed conditions. 1 additional BONUS credit for the measures that are able to cater at least 40mm/event for the site in its post-developed conditions.	Whole Building DC Developments with a site area of 1,000m^2 or more.	1+ 1 additional BONUS
SS 9	Design for Climate Change Adaptation	1 BONUS credit for studying the projected variation in temperature and rainfall and water level rise/storm surge of adjacent water bodies due to climate change and its impact on the development and prepare mitigation proposal to improve the climate resilience of the building.	All DCs	1 BONUS
4	**Materials and Waste (MW)**			**12 + 12 BONUS**
MW P1	Minimum Waste Handling	Prerequisite achieved for meeting minimum provisions of waste recycle facilities for the collection, sorting,	All DCs	Required

	Section	Credit Requirement	Extent of Application	Credit
	Facilities	storage, recycling (recovered material) and disposal (waste).		
MW 1	Building Re-use	1 BONUS credit for the reuse of 20% or more (by mass or volume) of existing structures (sub-structure and superstructure). 2 BONUS credits for 40%. 3 BONUS credits for 90%.	Whole Building DC Developments	3 BONUS
MW 2	Best Practice on Materials Usage	2 credits for demonstrating the adoption of at least four (4) best practices relating to the efficient use of materials as mentioned in the Green Data Centre Practice Guide.	All DCs	2
MW 3	Sustainable Forest Products	1 credit for demonstrating at least 50% of all timber and composite timber products used for DCs are from sustainable sources/ recycled timber. 1 additional BONUS credit for 90%.	All DCs.	1+1 additional BONUS
MW 4	Recycled Materials	1 credit for using recycled materials for one of the building components listed below, maximum up to 1 credit: 1) Outside Surface Works and Structures; 2) Building Façade and Structural Components; and 3) Interior Non-structural Components. 1 additional BONUS credit for compliances with all requirements listed sub-items. 2 additional BONUS credits for achieving 50% or more of all materials used for sub-items are materials with recycled content.	All DCs	1+2 additional BONUS
MW 5	Ozone Depleting Substances	(a) Refrigerants 1 credit for the use of refrigerants with a value less than or equal to the threshold of the combined contribution to ozone depletion and global warming potential using the specified equation. (b) Ozone depleting materials 1 credit for the use of products in the building fabric and services that avoid using ozone depleting substances in their manufacture, composition or use.	All Building Equipment & insulation servicing the Assessed DCs.	2

	Section	Credit Requirement	Extent of Application	Credit
MW 6	Regional Materials	1 credit for the use of regional materials meeting prescribed requirement, which contribute at least 10% of all building materials used in the project. 1 additional BONUS credit for 20%. 2 additional BONUS credits for 50%.	All DCs	1+2 additional BONUS
MW 7	Use of Certified Green Products	(a) Certified Green Products 1 credit for having at least 5% certified green products in one (1) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components). 2 credits for having at least 5% certified green products in two (2) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components). 1 additional BONUS credit for having at least 5% of certified green products under Construction Industry Council (CIC) Green Product Certification, Carbon Labelling Scheme/ HKGBC Green Product Accreditation and Standard (HK G-Pass) in one (1) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components). For exemplary performance, 1 additional BONUS credit for having at least 25%. (b) Rapidly renewable materials 1 BONUS credit for 5% of all building materials/ products of interior non-structural components in the project is rapidly renewable materials. 2 BONUS credit for 25%.	All DCs	2+ 2 additional BONUS; and 2 BONUS
MW 8	Life Cycle Assessment	1 credit for demonstrating the embodied energy in the major elements of the building structure of the DC has been studied and optimised through a Life Cycle Assessment (LCA).	Whole Building DC Developments	1
MW 9	Enhanced Waste Handling Facilities	1 to 2 credits for providing in-house recycling facilities for the storage of at least 3 and 5, listed different recyclables, respectively: 1) IT related waste such as, electronic equipment;	All DCs	2

	Section	Credit Requirement	Extent of Application	Credit
		2) Plastic waste; 3) Metal waste; 4) Glass waste; 5) Paper waste; and 6) Beverage carton.		
5	**Energy Use (EU)**			**35+3 BONUS**
EU P1	Minimum Energy Performance	Demonstrate (a) Performance against the Building Energy Code (BEC) 2018 edition and (b) Maximum Power Usage Effectiveness (PUE) a) Performance against the latest edition of BEC Demonstrate their compliance with the BEC 2018 edition on: 1. Air-conditioning equipment efficiency (full load COP); and 2. Lighting power density for listed space type in the code. (b) Maximum PUE The data centre must have a design PUE at full IT load condition of no more than 2.0.	All DCs	Required
EU 1	Low Carbon Passive Design	Passive designs that can reduce building HVAC load, facilitate natural ventilation and maximise daylight will be rewarded in this credit under either prescriptive path or performance path. Option 1: Prescriptive Path 1 credit for incorporating 1 of the passive design strategies listed below, maximum up to 2 credits: 1) Optimum Spatial Planning 2) External overhang (fix/ movable) 3) Vegetated building envelope 4) Cross Ventilation Provision 5) Daylighting Provision Option 2: Performance Path 3 credits for incorporating any 3 of the passive design strategies listed below: HVAC Load Reduction 1) Built form and orientation 1 credit for reducing building envelope load from a hypothetic case with at least 22.5° difference in orientation with justification by simulation. 2) Optimum spatial planning	All DCs	3

	Section	Credit Requirement	Extent of Application	Credit
		1 credit for demonstrating consideration of optimum spatial planning to enhance energy conservation with justification by simulation. 3) External shading devices 1 credit for the provision of fixed or movable external shading devices, in the form of vertical or horizontal sun shading feature with justification by simulation. 4) Vegetated building envelope 1 credit for the provision of vegetated building envelope with justification by calculation. Natural Ventilation 5) Space layout for natural ventilation 1 credit for demonstrating that space layout is designed to facilitate the utilisation of natural ventilation with justification by simulation. Daylight 6) Space layout for daylight penetration		
EU 2	Reduction of CO_2 Emissions	Predicted Power Usage Effectiveness (PUE) (1-15 Credits + 2 Bonus) Demonstrate and quantify the proposed DC energy performance operating under Hong Kong climatic conditions at 75% of the design IT load and express them in terms of Power Usage Effectiveness (PUE). 1 to 15 credits for exact design PUE value of 1.77 to 1.52 at 75% design IT load. Additional of 2 BONUS credits for design PUE value lower than 1.5 and 1.4, respectively.	All DCs.	15 + 2 BONUS
EU 3	Metering and Monitoring	(a) Fundamental Metering and Monitoring 1 credit for providing energy monitoring system for equipment and systems in spaces. (b)Metering and monitoring for PUE 1 credit for energy metering to provide total facility power and energy usage and total IT equipment power and energy at the output of Power Distribution Units (PDUs) for	All DCs	2 + 1 BONUS

	Section	Credit Requirement	Extent of Application	Credit
		determining instantaneous and average PUE data at Level 2. 1 BONUS credit for providing metering that allows monitoring of individual IT equipments output at data hall racks for determining Level 3 PUE		
EU 4	Cooling System Efficiency	Air-cooled Cooling System 1 to 2 credits for demonstrating the total cooling system efficiency serving data halls is of 0.85 kW/ton and 0.78 kW/ton, respectively. Water-cooled Cooling System 1 to 2 credits for demonstrating the total cooling system efficiency serving data halls is of 0.8 kW/ton and 0.75 kW/ton, respectively.	All DCs	2
EU 5	Air Management System	1 to 2 credits for demonstrating the total air flow efficiency of the air distribution system serving all data hall, from supply to return, is of 0.9 kW/m3/s and 0.8 kW/m3/s, respectively	All DCs	2
EU 6	Renewable and Alternative Energy Systems	(a) Solar Energy Feasibility Study 1 credit for evaluating the building roof's potential in harnessing solar energy. b) Renewable energy application <u>Path 1:</u> 1 credit for offsetting 0.4% energy consumption. 2 credits for offsetting 0.6% energy consumption. 3 credits for offsetting 0.8% energy consumption. <u>Path 2:</u> 1 to 3 credits where the minimum percentage of 40% to 80% of the building footprint is being covered/ used by PV panels respectively and/or other renewable power facility generation with equivalent renewable power output.	All DCs	4
EU 7	Efficient IT Equipment	(a) Use of Efficient UPS 1 credit for demonstrating that the Uninterruptible Power Supplies (UPS) is procured in accordance with certified	EU 7a: All DCs	2

	Section	Credit Requirement	Extent of Application	Credit
		energy efficient products scheme. (b) Use of Efficient IT Equipment 1 credit for demonstrating that the IT Equipment for the running and operating of the DCs of is procured in accordance with certified energy efficient products scheme.	EU 7b: DCs with operational control over the IT Equipment	
EU 8	Best Practices on Energy Use	3 credits for incorporating at least 2 best practices from each of the following aspects as listed in the Green DC Practice Guide published by BEAM Society Limited. 1) Cooling System; 2) Air Flow Management; 3) Operating at Higher Temperature and Humidity; 4) Cooling Management; and 5) Power System. 2 credits for incorporating at least 6 best practices from the following aspects as listed in the Green DC Practice Guide published by BEAM Society Limited: 1) Design of Resilience; 2) Monitoring and Managing Energy Efficiency; 3) IT Equipment Deployment; 4) IT Application System and IT Service Deployment; and 5) Telecommunications and Network Cabling.	All DCs	5
6	**Water Use (WU)**			**12 + 2 BONUS**
WU 1	Annual Water Use	Potable water saving 1 credit for demonstrating that the use of water efficient devices leads to an estimated annual saving of 20%. 2 credits for 25%. 3 credits for 30%.	All DCs	3

	Section	Credit Requirement	Extent of Application	Credit
WU 2	Water Efficient Irrigation	1 to 2 credits for reducing potable water consumption for irrigation from 25% to 50%. 1 additional BONUS credit for reducing potable water consumption for irrigation by 100% in comparison with the baseline.	DCs with permanent greenery and permanent irrigation system under the control of Applicant.	2 + 1 additional BONUS
WU 3	Water Leakage Detection	1 credit for installing water leakage detection systems in all municipal potable water tank rooms and data halls.	All DCs (if water tanks are installed in open areas, water leakage detection systems are required to install in data halls only)	1
WU 4	Cooling Tower Water	1 credit for achieving 7 or more cycles of concentration with acceptable water quality. 2 credits for use of cooling tower water treatment system which can achieve minimum of 10 cycles of concentration of acceptable water quality.	All Cooling tower using potable water as makeup water servicing the Assessed DCs.	2
WU 5	Effluent Discharge to Foul Sewers	1 credit for demonstrating a reduction in annual sewage volumes by 20% or more.	All DCs	1
WU 6	Water Harvesting and Recycling	(a) Harvested Rainwater 1 BONUS credit for harvesting of rainwater that achieve a reduction of 5% or more in the consumption of potable water. (b) Recycled Grey Water 1 BONUS credit for recycling grey water that achieves a reduction of 5% or more in the consumption of potable water. (c) Exemplary Water Recycling 1 BONUS credit where harvested rainwater, recycled grey water or a combination of both lead to a reduction of 10% or more in the consumption of potable water.	All DCs	3 BONUS
WU 7	Smart Water Metering	1 credit for provision of permanent smart water for cooling towers water use and indoor plumbing fixtures and fitting, and at least two (2) of the other water systems, which able to display metered data, treading of water consumption and relevant parameters.	All DCs	1

	Section	Credit Requirement	Extent of Application	Credit
7	**Health and Wellbeing (HWB)**			**15 + 3 BONUS**
HWB P1	Minimum Ventilation Performance	(a) Measure outdoor air pollutants on-site prior to building design to understand the site conditions. (b) Demonstrate the project is in compliance with the minimum ventilation quantity with respective to its designed ventilation mode.	All DCs	Required
HWB 1	Inclusive Design	(a) Universal Accessibility 1 credit for providing at least five (5) applicable enhanced provisions as stipulated in the "Recommended Design Requirements" of BFA 2008. (b) Weather protection and family friendly features 1 BONUS credit for providing prescribed weather protection and at least two (2) family friendly facilities features.	All DCs	1 + 1 BONUS
HWB 2	Enhanced Ventilation	Fresh Air Provision **1) Fresh air provision in normally occupied spaces** 1 credit for demonstrating that all normally occupied spaces in the DC are provided with increased ventilation. **2) Fresh air provision in not normally occupied spaces** 1 credit for demonstrating that all not normally occupied spaces in the DC are provided with adequate ventilation. **3) On-site measurements** 1 additional BONUS credit for conducting on-site measurements to verify the ventilation performance for all normally occupied spaces.	All DCs	2 + 1 additional BONUS
HWB 3	Acoustics and Noise	(a) Data Hall Noise Control 1 credit for demonstrating the internal noise level at data hall areas do not exceed the prescribed limit. (b) Noise Isolation 1 credit for demonstrating airborne noise isolation between spaces fulfils the prescribed criteria. (c) Background Noise 1 credit for demonstrating background noise level at normally occupied areas within the prescribed criteria (including	All DCs	3

	Section	Credit Requirement	Extent of Application	Credit
		traffic noise and external building services equipment that are within the project boundary).		
HWB 4	Indoor Vibration	1 credit for demonstrating vibration levels not exceeding the prescribed criteria.	All DCs	1
HWB 5	Indoor Air Quality	Indoor air quality in occupied spaces **1.1 Path 1** 2 credits for demonstrating compliance with the prescribed limits for Carbon monoxide (CO), Nitrogen dioxide (NO_2), Ozone (O_3), Carbon dioxide (CO_2), Respirable suspended particulates (PM10), Total volatile organic compounds (TVOCs), Formaldehyde (HCHO) and Radon (Rn) in the sampled occupied spaces. 1 credit for demonstrating compliance with the prescribed limits for Airborne bacteria and conduct the Mould assessment in the sampled occupied spaces. **1.2 Path 2** 3 credits for submitting a valid IAQ Certification Scheme (Good Class) certificate issued by the Environmental Protection Department (EPD) covering the whole building. 1 additional BONUS credit for achieving Excellent Class.	All DCs	3 + 1 additional BONUS
HWB 6	Thermal Comfort	(a) Temperature Performance in Data Halls 1 credit for sustaining the air temperature at the design value within ±2.0°C when air side system in data halls is operating at steady state under normal occupied periods. (b) Temperature Performance in Normally Occupied Areas 1 credit for sustaining the air temperature at the design value within ±1.5°C when air side system in normally occupied areas is operating at steady state under normal occupied periods.	All DCs	2

	Section	Credit Requirement	Extent of Application	Credit
HWB 7	Artificial Lighting	(a) Artificial lighting in Data halls 1 credit for achieving the prescribed lighting performance in Data halls. (b) Artificial lighting in normally occupied spaces, not normally occupied spaces and unoccupied spaces 1 credit for achieving the prescribed lighting performance in normally occupied spaces, not normally occupied spaces and unoccupied spaces.	All DCs	2
HWB 8	Biological Contaminations	1 credit for complying with the recommendations given in the Code of Practice for Prevention of Legionnaires' Disease 2016 Edition in respect of Water Supply Systems, HVAC Systems and other Water Features.	The systems are controlled by the Landlord	1
8	**Innovations and Additions (IA)**			**Maximum 10 BONUS**
IA 1	Innovations and Additions	Present evidence of the application of new practices, technologies and/ or techniques that are (1) not described in this manual; or (2) not market mainstream implementation; or (3) multiple aspect achievement; and the associated benefits in addressing sustainability objectives for new buildings.	All DCs.	Maximum 10 BONUS for IA

2	**Integrated Design and Construction Management (IDCM)**	**2.P Prerequisite** **2.1 Integrated Design Process** **2.2 Green Construction Practices** **2.3 Smart Design and Technologies**
	Introduction	This section focuses on the integration design management which maximises the opportunities for integrated and cost-effective green design approaches and construction methodologies; improvement in user's health and wellbeing; smart technologies and innovative approaches for green design and construction.
2.P	**Prerequisite**	**IDCM P1 Sustainability Champions – Project** **IDCM P2 Timber Used for Temporary Works**
	Background	This part sets out the minimum requirements for integrated design management in terms of engaging the Project BEAM Professional (BEAM Pro) to facilitate the certification and non-virgin timber used for temporary works during construction.
2.1	**Integrated Design Process**	**IDCM 1 Sustainability Champions - Design** **IDCM 2 Integrated Design Process** **IDCM 3 Life Cycle Costing** **IDCM 4 Commissioning**
	Background	An integrated process is a comprehensive approach to building systems and equipment design. With the guidance of Project BEAM Pro, the project team looks for synergies among systems and components, the mutual advantages that can help in achieving high levels of building performance for human comfort and environmental benefits. The process should involve rigorous questioning, coordination and challenge to the typical project assumptions. Team members collaborate to enhance the efficiency and effectiveness of every system.
2.2	**Green Construction Practices**	**IDCM 5 Sustainability Champions - Construction** **IDCM 6 Measures to reduce site emissions** **IDCM 7 Construction and Demolition Waste Recycling** **IDCM 8 Construction IAQ Management** **IDCM 9 Building Management Manuals** **IDCM 10 Operator Training plus Chemical Storage and Mixing Room**
	Background	Construction site activities can be the significant source of environmental degradation, unless appropriate steps are taken to reduce the emissions to air, land and water, and to reduce annoyance from construction related noise. It is the responsibility of contractors to do all in their ability to employ appropriate construction methods to reduce air, noise, water and light pollution.
2.3	**Smart Design and Technologies**	**IDCM 11 Digital Facility Management Interface** **IDCM 12 Document Management System** **IDCM 13 BIM Integration**
	Background	To encourage the use of automation, data and behavioural science to enable the building professionals to boost and maintain energy efficiency by optimising equipment and related processes for energy performance and comfort requirements.

2	**Integrated Design and Construction Management**	**2.P**	**Prerequisite**

IDCM P1 Sustainability Champions – Project

Extent of Application All DCs

Objective Facilitate the application of the BEAM Plus New DCs certification process and to ensure the compliance of relevant requirements of the BEAM Plus DCs Manual.

Credits Attainable Prerequisite

Credit Requirement Prerequisite achieved for demonstrating that an accredited BEAM Professional (BEAM Pro) with a valid credential for BEAM Plus New DCs is engaged as the project BEAM Pro of the consultant team.

The project BEAM Pro shall:

1. Act as the point of contact with the Hong Kong Green Building Council and the BEAM Society Limited for administrative matters relating to BEAM Plus certification;
2. Participate as one of the key project team members in the design and construction stages, with the assistance of the Construction BEAM Pro (and Affiliates, if any) defined under IDCM 6 if any, to oversee the submission materials are in compliance with relevant requirements of the BEAM Plus Manual. The project BEAM Pro may also assume other roles in the consultant team of the project;
3. Create a BEAM Plus New DCs Certification Checklist including project goals, performance and BEAM Plus target rating;
4. Provide guidance to the project and construction teams regarding BEAM Plus principles, structure, timing, certification process and requirements of credits; and
5. Advise the Client on relevant professionals or parties on respective tasks to address relevant BEAM Plus New DCs certification requirements.

Assessment

1. Complete the prescribed form with qualification details, appointment information and confirmation of appointment of the project BEAM Pro. The appointed project BEAM Pro should provide valid credentials from appointment to completion of the certification process. If more than 1 project BEAM Pro was employed for the project, the applicant should clearly document the works for each BEAM Pro and how the works are handed over and the timeline for their involvement.
2. Provide a BEAM Plus New DCs Certification Checklist which shall include the following:

   2.1 Determine the BEAM Plus New DCs certification level to pursue (certified, Bronze, Silver, Gold, or Platinum);

   2.2 Select the BEAM Plus credits to meet the targeted certification level;

   2.3 Identify the responsible parties to ensure the BEAM Plus requirements for each prerequisite and selected credits are met; and

   2.4 Changes between PA and FA stage should be recorded, and a summary should be submitted to report the changes in submission.

3. Provide a copy of the meeting minute (date and content of the minute will be reviewed for compliance) showing the participation of the Project BEAM Pro. Confidential or sensitive project information on the minute is not required and should be excluded:

   3.1 Introductory workshop/ meeting
   Highlight the attendance of project BEAM Pro and his/ her section in providing guidance to the project team regarding BEAM Plus principles, structure, timing and certification processes;

   3.2 Kick-off meeting with building main contractor
   Highlight the attendance of BEAM Pro and contractor representative(s). Indicate the coordination with construction BEAM Pro (and Affiliates, if any) as defined under IDCM 6, if any. Highlight the key BEAM Plus requirements during the construction stage; and

   3.3 One review meeting minute
   Highlight the attendance of BEAM Pro and the section of providing guidance on BEAM Plus requirements to the contractors during construction.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_P1_00	BEAM Plus New DCs submission template for IDCM P1	✓	✓
IDCM_P1_01	Prescribed form [IDCM-P1-1_Form_r1] on details of Project BEAM Pro, appointment information and confirmation of appointment	✓	✓
IDCM_P1_02	BEAM Plus New DCs Certification Checklist	✓	✓
IDCM_P1_03	A copy of the meeting minute of introductory workshop/ meeting	✓	-
IDCM_P1_04	A copy of the meeting minute of kick-off meeting with main building contractor/ Construction BEAM Pro	✓*	✓
IDCM_P1_05	A copy of the meeting minute of review meeting with contractor	✓*	✓
* Evidences of compliance with prerequisite requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

Remarks

(a) Additional Information

Hong Kong Green Building Council publishes the latest registers of BEAM Professionals and BEAM Affiliates on its website.

[ONLINE] Available at:
https://www.practitioner.hkgbc.org.hk/beam-professional
[Accessed Aug 2019]

(b) Related Credits

IDCM 1 Sustainability Champions – Design
The related credit encourages the engagement of Design BEAM Pro(s) and/ or Affiliates engaged by respective core design disciplines to integrate BEAM standards and practices into the planning, design and construction of the data centre.

IDCM 2 Integrative Design Process
The related credit encourages early consideration of integrative building design process, buildability and operational issues to support holistic and cost-effective outcomes of building performance, human health and environmental benefits.

IDCM 5 Sustainability Champions – Construction
The related credit encourages the engagement of BEAM Pros and/ or Affiliates engaged by contractors during construction to work collaboratively with the project BEAM Pro to monitor progress against targeted construction-related BEAM Plus requirements.

2	**Integrated Design and Construction Management**	**2.P**	**Prerequisite**

IDCM P2 Timber Used for Temporary Works

Extent of Application All DCs

Objective Encourage the well-managed use of timber.

Credits Attainable Prerequisite

Credit Requirement Prerequisite achieved for demonstrating that no virgin forest products are used for temporary works.

Assessment

1. Timber used for all temporary works (falsework, formworks and hoarding works) shall originate from sustainable forestry or re-used existing material, unless exceptional circumstances occur.
2. Sustainable timber shall be certified by the Forest Stewardship Council (FSC) [1], the American Forest and Paper Association (AFPA) [2]or Programme for the Endorsement of Forest Certification (PEFC) [3] or "known licensed sources" [4].
3. Monthly summary tables which demonstrates prerequisite requirement shall be prepared and declared by contractor
4. In PA, provide extracts of tender documents (e.g. specifications) highlighting the clause precluding the use of virgin timber in all temporary works if no construction works have commenced.
5. Provide records if construction (demolition and foundation to be included, if any) has commenced before the submission of PA.
6. Provide a declaration letter by contractor confirming that no virgin forest products are used for temporary works if records cannot be provided for assessment.

1 Forest Stewardship Council. [ONLINE] Available at: http://www.fsc.org/ [Accessed August 2019]

2 American Forest and Paper Association. [ONLINE] Available at: http://www.afandpa.org/ [Accessed August 2019]

3 Programme for the Endorsement of Forest Certification. [ONLINE] Available at: https://www.pefc.org/ [Accessed Aug 2019]

4 Architectural Services Department, General Specifications for Building 2017, Section 13, Carpentry and Joinery. [ONLINE] Available at: https://www.archsd.gov.hk/media/291197/gs2017.pdf [Accessed August 2019]

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_P2_00	BEAM Plus New DCs submission template for IDCM P2	✓	✓
IDCM_P2_01	IDCM-P2-1_Form_r1	✓	✓
IDCM_P2_02	Specifications precluding the use of virgin timber [or] Declaration letter by contractor	✓ ✓*	- ✓**
IDCM P2_03	Monthly Summary tables with contractor endorsement	-	✓
IDCM P2_04	Timber Product Compliance Certificate	-	✓
* Evidences of compliance with prerequisite requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. ** Declaration is required when monthly record is not completed for assessment.			

Remarks

(a) Additional Information

WWF, Guide to Responsible Purchasing of Forest Products. [ONLINE] Available at: http://assets.wwf.org.uk/downloads/responsible_purchasing.pdf [Accessed Aug 2019]

Buildings Department, PNAP ADV-5 Tropical Hardwood Timber, gives guidance for alternatives to the use of hardwoods in order to reduce the amount of tropical hardwood timber used in building projects. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV005.pdf [Accessed Aug 2019]

Works Bureau Technical Circular (WBTC) No. 19/2001, "Metallic *Site* Hoardings and Signboards" establishes the revised policy requiring the use of metallic *site* hoardings and signboards in order to reduce the amount of timber used on construction *sites*. This Circular supersedes WBTC 19/99 and shall be read in conjunction with WBTC 32/92 on "The Use of Tropical Hardwood on Construction *Sites*" to reduce the amount of hardwood timber used on construction *sites*. [ONLINE] Available at: https://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/153/1/wb1901.pdf [Accessed Aug 2019]

(b) Related Credits

None

2 Integrated Design and Construction Management

2.1 Integrated Design Process

IDCM 1 Sustainability Champions – Design

Extent of Application All DCs

Objective Encourage the engagement of BEAM Professionals and/ or Affiliates to integrate BEAM Plus standards and practices into the planning and design of the building.

Credits Attainable 1 + 1 additional BONUS

Credit Requirement 1 credit for at least two (2) members from at least two (2) applicable core design disciplines shall be accredited BEAM Professionals with valid credentials for BEAM Plus New DCs V1.0 for Projects intending to achieve a Bronze rating or above.

1 additional BONUS credit for at least one (1) additional member; **or** at least two (2) additional members, different from the disciplines counted in the above credit, shall be an accredited BEAM Professional with valid credentials, **or** an accredited BEAM Affiliates, respectively.

Assessment The Design BEAM Pro(s) and BEAM Affiliates shall:

1. Be engaged in the applicable core design disciplines from project inception to completion of detailed design and specifications stage of the Project. Core design disciplines shall be justified by the specific nature of the Project. The following disciplines, if they are engaged in the Project, shall form the core design disciplines:

    1.1 Project management;
    1.2 Facility management;
    1.3 Architectural;
    1.4 Structural/ civil engineering;
    1.5 Building services engineering;
    1.6 Surveying;
    1.7 DC Operators;
    1.8 Sustainability / Environmental;
    1.9 Interior designer; and
    1.10 Other as proposed and justified by the specific nature of the Project.

    The Design BEAM Pro(s) and BEAM Affiliates may also assume other roles in the consultant team of the Project.

2. Participate in introductory workshop/ meeting as required under IDCM P1.

3. Participate in *multi-disciplinary design charrette* as required under IDCM 2, if applicable.

3.1. Complete the prescribed form with qualification details, appointment information and confirmation of appointment of the Design BEAM Pro(s) and BEAM Affiliates (if any).

The appointed Design BEAM Pro(s) and BEAM Affiliates (if any) should maintain his/ her accreditation and credential during his/ her appointment.

3.2. Provide a copy of the following meeting minutes (confidential/sensitive project information is not required and should be excluded) showing the participation of the Design BEAM Pro in an introductory workshop/ meeting as required under IDCM P1 and a *multi-disciplinary design charrette* as required under IDCM 2 (if applicable).

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_01_00	BEAM Plus New DCs submission template for IDCM 1	✓	✓
IDCM_01_01	Prescribed form [IDCM-01-1_Form_r2] with detail information of the Design BEAM Pros (and Design Affiliates, if any)	✓	✓
IDCM_01_02	A copy of the meeting minute of introductory workshop/ meeting	✓	-
IDCM_01_03	A copy of the meeting minute of multi-disciplinary design charrette (if any) under IDCM 2	✓	-

Remarks

(a) Additional information

Hong Kong Green Building Council publishes the latest registers of BEAM Professionals and BEAM Affiliates on its website. [ONLINE] Available at: https://practitioner2.hkgbc.org.hk/index.php?r=Beam/Directory [Accessed Aug 2019].

(b) Related credits

IDCM P1 Sustainability Champions - Project
The related prerequisite encourages the engagement of BEAM Pro to facilitate the application for the BEAM Plus certification process and to ensure the compliance of relevant requirements of the BEAM Plus.

IDCM 2 Integrative Design Process
The related credit encourages early considerations for integrative building design process, buildability and operational issues to support holistic and cost-effective outcomes of building performance, human health and environmental benefits.

IDCM 5 Sustainability Champions – Construction
The related credit encourages the engagement of BEAM Pro(s) and/ or Affiliates engaged by contractors during construction to work collaboratively with the Project BEAM Professional to monitor progress towards the targeted construction-related BEAM Plus requirements.

2 Integrated Design and Construction Management

2.1 Integrated Design Process

IDCM 2 Integrated Design Process

Extent of Application All DCs

Objective Encourage early consideration of the integrated building design process, buildability and operational issues to support holistic and cost-effective outcomes of DC performance, human health and environmental benefits.

Credits Attainable 4

Credit Requirement

(a) Early Considerations for Integrated Building Design Process

1 credit for consideration of the integrated design process regarding whole-system thinking to explore the interrelationships among green building design strategies and systems in the conceptual design stage.

1 additional credit for organising at least one multi-disciplinary design charrette to formulate passive and active design strategies in the conceptual/ schematic design stages.

(b) Early Design Consideration of Buildability/ Constructability

1 credit for early design consideration of buildability to ease construction and save on-site materials/ labour before completion of the design development stage.

(c) Design Consideration for Operation and Maintenance

1 credit for design consideration of the long-term operation and maintenance needs of the DC and its engineering services.

Assessment

(a) Early Considerations for Integrated Building Design

1. <u>Exploration of interrelationships among green building design strategies and systems</u>

   Provide a design review report in comparing **preliminary** sustainable design benefits for at least one (1) baseline and one alternative (1) design option for each issue.

   The report should at least have the sections below for each identified issue:

   1.1 Executive Summary;

   1.2 Project Program

   1.3 Workshop arranged for integrated design process (with date of workshop, number or arrangement of attendances)

   1.4 Selected consideration, each with:

   A baseline with the same development potentials as the design options. The design should conform to the statutory requirements such as Buildings Ordinance and Town Planning Ordinance.

An alternative design option with graphical support at concept stage level and board brush calculation in supporting the argument.

1.5 Conclusion

One or multiple design options is demonstrated to address at least two (2) issues of each of the following considerations:

Considerations	Issues
Site planning and outdoor environmental quality	- Building permeability/ air ventilation/ thermal comfort; - Landscaping/ *site* coverage with greenery; - Neighbourhood daylight access; - Ecological value; - Climate resilience.
Built form/ *orientation* and energy use/ generation	- Cooling load reduction; - Lighting load reduction; - Natural ventilation potential; - Renewable energy opportunities.
Building envelope attributes[1] and energy use	- Cooling load reduction/OTTV estimation; - Lighting load reduction; - Natural ventilation potential.
Note: 1. Building envelope attributes refer to: - insulation values; - window-to-wall ratios; - glazing characteristics; - shading; - window operability.	

Strategies addressing multiple consideration and issues are acceptable.

The sustainable design benefits for respective considerations shall be demonstrated in design appraisal by either:

i. Qualitative assessment report making reference to the Urban Design Guidelines of the Hong Kong Planning Standards and Guidelines Chapter 11 as appropriate:

   a) Identify good design features;

   b) Identify obvious problematic areas and propose some mitigation measures;

   c) Define “focus” and methodologies of any further study in the schematic or design development stages;

ii. Spreadsheet calculations; or

iii. “Simple box” environmental/ energy modelling (simplified massing model that may not include detail of systems)

2. Multi-disciplinary design charrette

Provide evidence that at least one multi-disciplinary design charrette has been held before the completion of schematic design stage.

The charrette shall, at minimum, address the following issues:

2.1. Participants:
- 2.1.1. Developer/ owner representative;
- 2.1.2. User representative (if users are known in design stage);
- 2.1.3. Operation and maintenance team representative (if identified in schematic design stage);
- 2.1.4. Members from core design disciplines as defined in
- 2.1.5. IDCM 1;

2.2. Introduce fundamentals of integrated design process [1]:
- 2.2.1. Well-defined vision, goals and objectives;
- 2.2.2. Collaborative team and open communication;
- 2.2.3. Whole-system thinking and innovative synthesis, and
- 2.2.4. Iterative process and feedback cycles;

2.3. Review and agree on following principal design strategies:
- 2.3.1. Key stakeholders' values, aspirations and requirements;
- 2.3.2. Functional programming;
- 2.3.3. Site planning and outdoor environmental quality
- 2.3.4. Built form and orientation;
- 2.3.5. Building envelope attributes;
- 2.3.6. Key active building systems for energy saving/ generation;
- 2.3.7. Other strategies to be proposed by the Applicant.

(b) Early Design Consideration of Buildability/ Constructability

1. Demonstrate early consideration of buildability to ease construction and save on-site materials/ labour before the completion of the design development stage, either by:

1.1. engaging a construction management consultant;

1.2. design optimisation of voids and complex form; or

1 BC Green Building Roundtable. Roadmap for the Integrated Design Process. [ONLINE] Available at: http://www.greenspacencr.org/events/IDProadmap.pdf [Accessed Aug 2019].

1.3. adopting at least 75% of design measures on the 3S concept (standardisation, simplification and single integrated element) as promulgated in the Development Bureau's Guidelines [2].

1.4. Alternative standard could be proposed.

2. For part (b) item 1.1, provide evidence demonstrating that recommendations/ inputs by the construction management consultant/contractor have been reviewed/ adopted. This shall include the following:

2.1. Appointment letter of the construction management consultant or the contractors;

2.2. Correspondence or any of the meeting minute(s) (confidential/sensitive project information is not required and shall be excluded) demonstrating that the design has been reviewed and recommendations have been suggested; and

2.3. The recommendations have been adopted.

3. For part (b) item 1.2, provide evidence demonstrating that design of high voids and complex forms, if any, have been optimised:

3.1. Percentage of high voids to total building height is below 15%; and

3.2. Complexity of tower-built form in terms of tilting, tapering, twisting or free form has been optimised to fulfil both requirements:

Height of building	Maximum offset of the building measuring against the ground floor plate or any typical floor plate	Maximum percentage of total number of floors with offsets measured against the total number of floors of the building
< 45m	4m	35%
45m < 90m	3m	25%
90m <135m	2m	15%
≥ 135m	1m	5%

4. For part (b) 1.3, provide report with completed prescribed form to demonstrate implementation of at least 75% of listed 3S concept measures.

4.1. Provide extracts of tender documents, contract conditions and/ or specifications highlighting the clause requiring the contractors to carry out 3S concept measures, if construction (demolition and foundation to be included, if any) has not yet commence at PA stage.

2 Development Bureau- Guidelines for Enhancement of Productivity of Skilled Workers in Public Works Projects.[ONLINE] Available at: https://www.devb.gov.hk/filemanager/en/content_29/Guidelines_Enhancement_of_Productivity_(Mar_2013)_English.pdf. [Accessed August 2019].

(c) Design Consideration for Operation and Maintenance

1. Provide evidence that the design has considered the long-term operation and maintenance needs for the building and its engineering services by providing at least 5 of the following features:

   i. Building Management System (BMS);

   ii. Davit arm/ gondola system;

   iii. External pipe duct or pipe duct in communal areas;

   iv. Fall arrest system;

   v. Maintenance platform for building services installations;

   vi. Maintenance workshop for facility management;

   vii. Movable working platform for maintenance;

   viii. Access and safety provision for external air-conditioning unit at height without use of scaffolding;

   ix. Others, to be proposed by the Applicant with justification.

Submittals

(a) Early Considerations for Integrative Building Design

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_02_00	BEAM Plus New DCs submission template for IDCM 2	✓	✓
IDCM_02_01	IDCM-02-1_Form	✓	✓
IDCM_02a_02	Design review report on preliminary sustainable design benefits	✓	-
IDCM_02b_03	*Multi-disciplinary design charrette* report (if applicable)	✓	-

Submittals

(b) Early Design Consideration of Buildability/ Constructability

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_02_00	BEAM Plus New DCs submission template for IDCM 2	✓	✓
IDCM_02_01	IDCM-02-1_Form	✓	✓
IDCM_02b_02	For (1), Appointment letter of the construction management consultant or contractors Correspondence or any of the meeting minute(s) with construction management consultant or contractors. Report on adoption of construction management consultant's (or contractors') recommendations	✓ ✓ ✓	- - -
IDCM_02b_03	For (2), design report demonstrating optimisation of *high void*s and complex forms	✓	-
IDCM_02b_04	For (3), report with completed prescribed form to demonstrate compliance with 3s concept measures. **[or]** Extracts of tender documents (e.g. specifications) specifying the requirements for 3s concept measures implementation (if applicable)	✓* ✓	✓ -
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

(c) **Design Consideration for Operation and Maintenance**

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_02_00	BEAM Plus New DCs submission template for IDCM 2	✓	✓
IDCM_02_01	IDCM-02-1_Form	✓	✓
IDCM_02c_02	Design report demonstrating the adoption of O&M features	✓	✓
IDCM_02c_03	Dated photo records of the completed O&M features	-	✓

Remarks

(a) Additional Information

For IDCM 2a

Buildings Department – PNAP APP-152, *Sustainable Building Design Guidelines*. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/APP/APP152.pdf [Accessed Aug 2019].

Buildings Department – Codes of Practice and Design Manuals, Code of Practice for Overall Thermal Transfer Value in Buildings 1995. [ONLINE] Available at:

https://www.bd.gov.hk/doc/en/resources/codes-and-references/code-and-design-manuals/OTTV1995_e.pdf [Accessed Aug 2019].

Buildings Department – PNAP APP-156, Design and Construction Requirements for Energy Efficiency of *Residential Buildings*. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/APP/APP156.pdf [Accessed Aug 2019].

For IDCM 2c

Buildings Department – PNAP ADV-14, Facilities for External Inspection and Maintenance of Buildings. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV014.pdf [Accessed Aug 2019].

Buildings Department – Appendix A2 of PNAP ADV-33, Essential Information in Plan Submissions. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV033.pdf [Accessed Aug 2019].

Buildings Department – Circular Letter dated 23 December 2016, Guidelines for Designing Access and Safety Provisions for the Maintenance and Repair (M&R) of External Air Conditioners (ACs) at Height. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/circular/CL_GDASP2016e.pdf [Accessed Aug 2019].

(b) Related Credits

IDCM 3 Life Cycle Costing
The related credit encourages the use of life cycle costing to facilitate an investigation of potential design options, specifications, operation and maintenance

SS 1 Green Building Attributes
The related credit encourages building development to preserve or expand urban greenery and encourages building development which is sensitive to the needs of neighbours in terms of preserving daylight and views.

SS 4 Biodiversity
The related credit encourages strategies to preserve and/or enhance the ecological value of the *site* in terms of habitat and biodiversity.

SS 5 Urban Heat Island Mitigation
The related credit encourages higher overall *site* coverage of greenery and stipulates minimum *site* coverage of greenery in the *Primary Zone* (the 15m vertical zone of a *site* along the abutting street level).

SS 6 Immediate Neighbourhood Wind Environment
The credit encourages improvement in wind environments around and adjacent to the buildings and adequate considerations of wind amplification, and where appropriate, suitable mitigation measures are provided.

SS 7 Outdoor Thermal Comfort
The related credit considers the positive effect of shading by trees and the surrounding ground surface temperatures of greenery within the *site*.

EU 1 Low Carbon Passive Design
The related credit encourages passive building design allowing buildings to respond to the local climate; reducing the reliance on active servicing for human comfort.

EU 6 Renewable and Alternative Energy Systems
The related credit encourages the wider application of renewable energy sources in buildings.

2 Integrated Design and Construction Management

2.1 Integrated Design Process

IDCM 3 Life Cycle Costing

Extent of Application	All Active Systems Servicing the Assessed DC
Objective	Encourage the use of life cycle costing to facilitate investigation of potential design options, specifications, operation and maintenance.
Credits Attainable	1
Credit Requirement	1 credit for conducting life cycle costing for active systems.
Assessment	Conduct life cycle costing analysis with design options for each of the below active system, if present in the project construction scope: 1. Hot water system; 2. Interior lighting system; and 3. Air-conditioning system. The life cycle costing exercise can be non-discounted and should include the following costs: 1. Acquisition; 2. Operation (utilities); and 3. Maintenance (replacements, planned maintenance and management costs). While developing design options, the applicant should consider different configurations and specifications, for example, initial costs, number of equipment units involved, equipment efficiency and lifespan, etc. Indicate cost of each design option of active system over 20, 30, 40 and 50 years and highlight which design option will have the lowest life cycle cost at the 50th year. Prepare a life cycle costing report including all the assumptions made and the results of life cycle costing. Substantiate the costs with catalogues, suppliers' recommendations, quotes Cost approximations suggested by Quantitative Surveyor are also accepted. No professional life cycle costing software is required for this study. Note that the costing exercise imposes no obligation for implementation but encourages consideration of the costs of systems throughout their life cycle. The life cycle costing report should include at least the below items with a minimum of 8 A4 pages: 1. Executive Summary 2. Project Description with Construction scope 3. System options to be considered 4. Life cycle costing and analysis

5. Conclusion

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_03_00	BEAM Plus New DCs submission template for IDCM 3	✓	✓
IDCM_03_01	Life cycle costing report	✓	✓

Remarks

(a) Additional Information

ISO 15686-5:2008 Buildings & constructed assets – Service life planning – Part 5: Life cycle costing

(b) Related Credits

None

2 Integrated Design and Construction Management

2.2 Integrated Design Process

IDCM 4 Commissioning

Extent of Application All DCs

Objective Ensure the building systems perform as design specified and DCs operate as design intended.

Credits Attainable 4

Credit Requirement 2 credits for demonstrating (a) the appointment of commissioning authority (CxA) before tender stage and (b) providing a commissioning plan.

1 credit for providing a commissioning review report before construction as described in part (c).

1 credit for providing commissioning reports as described in part (d).

Assessment

(a) Engage Commissioning Authority (CxA) – (a) + (b): 2 credits

1. Identify a Chartered Engineer, Registered Professional Engineer, Member of HKIE (relevant discipline), ASHRAE BCxP as the CxA.

2. The CxA should have the proper experience and credentials including adequate expertise in the commissioning of electrical and mechanical systems, equipment and components to develop and implement effective commissioning.

3. The CxA should have direct experience with at least two similar projects and must have been involved before the start of schematic design stage to countercheck that the systems will meet the design intents.

4. The CxA must not be responsible for any aspect of the project design or construction management or supervision for the subject DC.

5. The CxA must not be an employee of the design firm.

6. The CxA must not be an employee of, or contracted through, a contractor or construction manager dealing with construction contracts. For design and build projects, the owner should directly employ the CxA.

7. The CxA may be a qualified employee or consultant of the owner.

8. Reporting of all conditions and findings must be immediate and directly from the CxA to the Client. The CxA shall be responsible for:

    1.1 Review and approval of commissioning specifications;

    1.2 The development of a commissioning plan;

    1.3 Facilitate and ultimately oversee the commissioning process for all systems to be commissioned; and

1.4 Document whether systems, equipment and components are functioning in accordance with the design intent and in accordance with the construction documents.

(b) Develop Commissioning Plan

1. Establish a preliminary commissioning plan for the CxA to outline the scope of commissioning and systems to be tested.

2. Project roles and responsibilities, the commissioning team's project directory, and schedule of commissioning activities should all be included in the commissioning plan.

3. The Commissioning plan is a living document that is updated throughout the life of the project and will become the basis for the final commissioning report.

4. The Commissioning plan should include the following content:
   - 4.1 Goals and objectives;
   - 4.2 General project information;
   - 4.3 Systems to be commissioned;
   - 4.4 Description of the Commissioning team, including team members, roles and responsibility;
   - 4.5 Description of the Commissioning team's communication protocol, coordination, meetings and management;
   - 4.6 Development of system (if applicable) functional test procedures for the following:
     - i. HVAC&R systems and associated controls;
     - ii. Light and daylighting controls;
     - iii. Hot water systems;
     - iv. Lift and escalator systems; and
     - v. Renewable energy systems;
   - 4.7 Verification of system performance;
   - 4.8 Reporting deficiencies and the resolution process; and
   - 4.9 Acceptance of the building systems.

(c) Commissioning Review Report

1. Before construction begins, develop commissioning requirements based on the systems included in the design and incorporate them into the construction documents.

2. Commissioning specifications informing the contractors and/ or sub-contractors of their roles and responsibilities throughout the commissioning process.

3. Before construction begins, review and document whether the system is designed in accordance to the design intent as acknowledged by the project owner.

(d) Commissioning Report

1 After all commissioning tasks except seasonally deferred commissioning have been completed, the commissioning report(s) with all the approved checklists and endorsement from CxA shall be provided.

2 The Commissioning report should include the following content:

2.1 Executive summary of commissioning process and results, system deficiencies identified and resolutions, outstanding issues identified;

2.2 List of participants and their respective roles;

2.3 Brief building description;

2.4 Commissioning process scope;

2.5 Design review log;

2.6 Installation verification checklist;

2.7 List of systems commissioned;

2.8 Equipment documentation;

2.9 Functional performance tests including date and time of test, individuals present during testing, visual inspection observations, sensor checks, device checks, operating mode tests and results;

2.10 List of outstanding commissioning issues and any testing that is scheduled on a later date; and

2.11 All outstanding deficiencies identified during or as a result of commissioning activities should be listed and highlighted.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_04_00	BEAM Plus New DCs submission template for IDCM 4.	✓	✓
IDCM_04_01	Specification on the scope of services of CxA.	✓	✓
IDCM_04_02	Organisation Chart of the project team with CxA's involvement and a brief description of the commissioning tasks.	✓	✓
IDCM_04_03	CV of CxA to demonstrate adequate expertise of the CxA.	✓	✓
IDCM_04_04	Commissioning Plan meeting the requirements with endorsement by CxA.	✓	✓
IDCM_04_05	Commissioning specifications detailing the commissioning requirements for each system and equipment.	✓	✓
IDCM_04_06	Endorsed commissioning review report to demonstrate all tasks in part (c)	-	✓
IDCM_04_07	Endorsed commissioning report to demonstrate all commissioning tasks fulfilling part (d)	-	✓

Remarks

(a) Additional information

The Chartered Institution of Building Services Engineers (CIBSE) – Air distribution systems. CIBSE. Commissioning Code A. [ONLINE] Available at:http://www.cibse.org/ [Accessed August 2019].

The Chartered Institution of Building Services Engineers (CIBSE) – Water distribution systems. CIBSE Commissioning Code W.

The Chartered Institution of Building Services Engineers (CIBSE) – Automatic controls. CIBSE Commissioning Code C.

Building Services Research and Information Association (BSRIA) – Commissioning air systems. Application procedures for buildings. [ONLINE] Available at: https://www.bsria.co.uk/ [Accessed Aug 2019].

American Society of Heating, Air-conditioning, and Refrigerating Engineers (ASHRAE) – Standard and Guidelines on Commissioning Essentials. [ONLINE] Available at: http://www.ashrae.org/ [Accessed August 2019].

Architectural Services Department, Building Services Branch – Testing and Commissioning Procedure. [ONLINE] Available at: https://www.archsd.gov.hk/en/publications-publicity/testing-commissioning-procedure.aspx. [Accessed August 2019].

(b) Related Credits

None

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 5 Sustainability Champions – Construction

Extent of Application All DCs

Objective Encourage the engagement of BEAM Professionals and/or Affiliates by contractors during construction to work collaboratively with the project BEAM Professional to monitor progress towards the targeted construction-related BEAM Plus requirements.

Credits Attainable 1

Credit Requirement 1 credit for at least two (2) accredited BEAM Professionals with valid credentials for BEAM Plus New DCs V1.0 **or** at least one (1) accredited BEAM Professional with valid credentials for BEAM Plus New DCs V1.0 and two (2) accredited BEAM Affiliates, are engaged by the main/ lead contractor for the project intending to achieve a Bronze rating or above.

Assessment

1. The Construction BEAM Pro(s) and BEAM Affiliates shall:

    1.1 Be engaged by main/ lead contractor of superstructure from commencement of the respective contract (i.e. if applicable project scope covers foundation and superstructure, a Construction BEAM Pro shall be engaged at foundation stage) to completion of the certification process.

    1.2 If more than one construction BEAM Pros are engaged during the construction stages, supporting documents should be provided to document the hand-over.

    1.3 Collaborate with the project BEAM Pro to monitor the progress towards the targeted construction-related BEAM Plus requirements as defined in the BEAM Plus New DCs certification checklist.

    1.4 Participate in the kick-off meeting and at least 1 review meeting as required under IDCM P1.

    1.5 Check and ensure that the construction-related submission materials comply with requirements of attempted credits in the BEAM Plus Manual. The Construction BEAM Pro(s) and BEAM Affiliates may also assume other roles in the construction team of the project.

2. Complete the prescribed form with qualification details, appointment information and confirmation of the appointment of the Construction BEAM Affiliates, if any, and the BEAM Pro(s).
   The appointed Construction BEAM Affiliates, if any, and BEAM Pro(s) should maintain his/ her accreditation and credentials during his/her appointment.

   Provide copies of relevant contract documents highlighting the clause requiring the main/ lead constructor to engage related Construction BEAM Pro(s) and BEAM Affiliates, if construction has not yet commenced at PA stage.

3. Provide meeting minutes (confidential/sensitive project information is not required and should be excluded) showing the participation of the

Construction BEAM Pros (and Design Affiliates, if any) in the kick-off meeting and at least one review meeting as required under IDCM P1, which shows the checking and compliance efforts by Construction BEAM Pro(s) and BEAM Affiliate(s) (if any).

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_05_00	BEAM Plus New DCs submission template for IDCM 5	✓	✓
IDCM_05_01	Prescribed form [IDCM-06-1_Form_r1] on details of Construction BEAM Affiliates if any, and BEAM Pro(s), appointment information and confirmation of appointment	✓*	✓
IDCM_05_02	Contractor documents requiring engagement of Construction BEAM Pro(s) and BEAM Affiliates (if applicable)	✓	-
IDCM_05_03	A copy of the Meeting minute of kick-off meeting with the Project BEAM Pro	✓*	✓
IDCM_05_04	Any of the Meeting minute(s) of review meeting with the Project BEAM Pro	✓*	✓
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

Remarks

(a) Additional Information

Hong Kong Green Building Council publishes the latest registers of BEAM Professionals and BEAM Affiliates on its website. [ONLINE] Available at:
https://practitioner2.hkgbc.org.hk/index.php?r=Beam/Directory [Accessed Aug 2019].

(b) Related Credits

IDCM P1 Sustainability Champions - Project
The related prerequisite encourages the engagement of BEAM Professionals to facilitate the application for the BEAM Plus certification process and to ensure the compliance of relevant requirements of the BEAM Plus.

IDCM 1 Sustainability Champions – Design
The related credit encourages the engagement of BEAM Pros and/ or Affiliates engaged by respective core design disciplines to integrate BEAM Plus standards and practices into the planning, design and construction of the building.

Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 6 Measures to Reduce Site Emissions

Extent of Application All DCs

Objective Encourage a high standard of environmental management and minimise pollution (air, noise, water discharge and light) during the demolition (if any), construction of buildings and the infrastructure serving buildings.

Credits Attainable For whole building DC developments: 4 + 1 BONUS
For DC developments located in part of building: 3

Credit Requirement

For whole building DC developments

(a) Environmental Management Plan

1 credit for demonstrating that an Environmental Management Plan (EMP) has been properly prepared.

(b) Minimisation of Air Pollution

1 credit for providing adequate monitoring and mitigation measures to minimise air pollution during construction (demolition and foundation are included, if any).

(c) Minimisation of Noise Pollution

1 credit for providing adequate monitoring and mitigation measures to minimise noise pollution during construction (demolition and foundation are included, if any).

(d) Minimisation of Water Pollution

1 credit for providing adequate monitoring and mitigation measures to minimise water pollution during construction (demolition and foundation are included, if any).

(e) Minimisation of Light Pollution

1 BONUS for providing adequate mitigation measures to minimise light pollution during construction (demolition and foundation are included, if any).

Note:

Partial credit shall be awarded for individual construction stage (i.e. demolition, foundation and *superstructure* in a default ratio of 1:1:3). The Applicant may submit justification and propose an alternative ratio based on the relative pollution control extent and resource demand in various construction stages. For a project that covers all 3 stages, the partial credit attainable for demolition, foundation and *superstructure* are 0.2, 0.2 and 0.6 respectively. Similarly, for a project where demolition is not required or not under the Client's control, the partial credit attainable for foundation and *superstructure* are 0.25 and 0.75 respectively.

All applicable stages must be included in the partial credit calculation.

For DC developments located in part of building

(a) Construction Management Plan

1 credit for demonstrating that an EMP has been properly prepared.

(b) Minimisation of Construction Dust

1 credit for providing adequate monitoring and mitigation measures to minimise air pollution to host building users and neighbouring occupants during construction and fit-out activities.

(c) Minimisation of Construction Noise

1 credit for providing adequate monitoring and mitigation measures to minimise air pollution to host building users and neighbouring occupants during construction and fit-out activities.

Assessment

For whole building DC developments

(a) Environmental Management Plan

1. An EMP shall be prepared to address potential significant environmental aspects and impacts, to propose appropriate mitigation measures, to include environmental monitoring and auditing plans and to propose a waste management system. Reference shall be made to all of the following:

   1.1. Environment, Transport and Works Bureau (ETWB)'s Technical Circular (Works) 19/2005, Appendix C [1];

   1.2. Hong Kong Construction Association (HKCA)'s Best Practice Guide for Environmental Protection on Construction Sites, Section 3.2.3 [2];

   1.3. Environmental Protection Department (EPD)'s Environmental Monitoring and Audit - Guidelines for Development Projects in Hong Kong, Appendix D2 [3] (further clarify the requirement is required by EIA?)

   1.4. Buildings Department, PNAP ADV-19, Construction and Demolition Waste [4]

   1.5. Project Administration Handbook for Civil Engineering Works, Section 4.1.3, Construction and Demolition Materials [5]

2. For a project that is subject to EPD's scrutiny, environmental measurement points agreed by EPD shall be adopted.

3. Provide EMP(s) of construction (demolition and foundation to be included, if any) prepared by contractors and reviewed/ endorsed by Construction BEAM Pro (or Construction BEAM Affiliate) defined under IDCM 5 or Project BEAM Pro defined under IDCM P1. If the EMP is reviewed/ endorsed by the

1 Environment, Transport and Works Bureau (ETWB). Technical Circular (Works) 19/2005, Appendix C. [ONLINE] Available at: http://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/19/1/C-2005-19-0-1.pdf. [Accessed August 2019].

2 Hong Kong Construction Association (HKCA). Best Practice Guide for Environmental Protection on Construction Sites, 3.2.3. [ONLINE] Available at: http://www.hkca.com.hk/uploads/eversioin_docs/e33f38c5128a824b4f7cb18b7b5ab751.pdf. [Accessed August 2019].

3 Environmental Protection Department (EPD). Environmental Monitoring and Audit - Guidelines for Development Projects in Hong Kong Appendix D2. [ONLINE] Available at: http://www.epd.gov.hk/eia/hb/materials/images/AppendixD2.pdf. [Accessed August 2019].

4 Buildings Department, PNAP ADV-19, Construction and Demolition Waste. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV019.pdf. [Accessed August 2019].

5 Project Administration Handbook for Civil Engineering Works, Section 4.1.3, Construction and Demolition Materials [ONLINE] Available at https://www.cedd.gov.hk/filemanager/eng/content_80/PAH%202018%20Chapter%204%20Rev%2001%20HL%20-%20190718.pdf [Accessed Aug 2019].

construction BEAM Pro/ Affiliate as defined under IDCM 5, supporting documents for IDCM 5 need to be appended to IDCM_6_01.

4. Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring contractors to prepare EMP(s), if no construction stage has commenced before the submission of PA stage

5. Provide endorsed EMP(s), if any construction stage has commenced before the submission of PA.

(b) Minimisation of Air Pollution

1. Proactive dust control provisions shall be referred to Good Housekeeping Checklist in Appendix 4.1 of Hong Kong Construction Association's Best Practice Guide for Environmental Protection on Construction Sites [6]. Checklist of dust control provisions is provided in the prescribed form.

2. Provide monthly environmental management report(s) to demonstrate the following:

   2.1. Implementation of monitoring and mitigation measures to minimise air pollution as defined in EMP under IDCM 6 (a);

   2.2. There are no convictions or complaints about air emissions from site, that have been upheld by the Environmental Protection Department or police leading to the issue of a fine or prosecution;

   2.3. Implementation of proactive dust control provisions with the completed prescribed forms; and

   2.4. Total Suspended Particulates (TSP) levels are satisfactory according to IDCM 6 (a), Assessment 1) 1.3.

   2.5. For project compliance with EPD's Environmental Impact Assessment monitoring in construction work, no additional work is required to demonstrate the monthly compliance. Environmental Monitoring and Audit are NOT required.

   2.6. Measurement of 24-hour TSP levels is NOT required.

   The report(s) should be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 6 or the project BEAM Pro as defined under IDCM P1.

3. Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring the contractors to provide monthly environmental management report(s) if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage.

(c) Minimisation of Noise Pollution

1. Proactive noise control provisions shall refer to section 6.9 of Hong Kong Construction Association's Best Practice Guide for Environmental Protection

6 Hong Kong Construction Association – Best Practice Guide for Environmental Protection on Construction Sites. [ONLINE] Available at: http://www.hkca.com.hk/uploads/eversioin_docs/e33f38c5128a824b4f7cb18b7b5ab751.pdf. [Accessed August 2019].

on Construction Sites. Checklist of noise control provisions are provided in the prescribed forms.

2. Provide baseline monitoring measurements for point(s) as prescribed in submitted Environmental Management Plan in IDCM 6 (a).

3. Provide extracts of tender documents, contract conditions and/ or specifications highlighting the clause requiring the contractors to provide baseline monitoring measures if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage

4. Provide monthly environmental management report(s) to demonstrate the following:

   4.1. Implementation of monitoring and mitigation measures to minimize noise pollution as defined in the Environmental Management Plan (EMP) under IDCM 6 (a);

   4.2. There are no convictions or complaints about noise emissions from site, that have been upheld by the Environmental Protection Department or Police leading to the issue of a fine or prosecution;

   4.3. Implementation of proactive noise control provisions with the completed prescribed form; and

   4.4. Noise levels that complied with the noise level limitation according to IDCM 6 (a), Assessment 1) 1.3.

   The report(s) shall be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 5 or the project BEAM Pro as defined under IDCM P1.

5. Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring the contractors to provide monthly environmental management report(s) if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage.

(d) Minimisation of Water Pollution

1. Proactive wastewater management provisions shall be referred to Environmental Protection Department's Practice Note for Professional Persons on Construction Site Drainage [7]. Checklist of wastewater management provisions is provided in the prescribed forms.

2. Provide monitoring measurements fulfilling permit requirement as prescribed in IDCM 6 (a), Assessment 1) 1.3.

3. Provide extracts of tender documents, contract conditions and/ or specifications highlighting the clause requiring the contractors to provide baseline monitoring measurements if construction has not yet commenced at the PA stage

4. Provide monthly environmental management report(s) to demonstrate the following:

7 Environmental Protection Department – Practice Note for Professional Persons ProPECC PN 1/94. Construction Site Drainage. [ONLINE] Available at: http://www.epd.gov.hk/epd/sites/default/files/epd/english/resources_pub/publications/files/pn94_1.pdf .[Accessed August 2019].

4.1. Implementation of monitoring and mitigation measures to minimise water pollution as defined in Environmental Management Plan (EMP) under IDCM 6 (a);

4.2. There are no convictions or complaints about water pollution from site, that have been upheld by the Environmental Protection Department or Police leading to the issue of a fine or prosecution;

4.3. Implementation of proactive wastewater control provisions with completed prescribed form; and

4.4. Wastewater discharge qualities fulfilling permit requirement according to IDCM 6 (a), Assessment 1) 1.3.

4.5. The report(s) shall be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 6 or the project BEAM Pro as defined under IDCM P1.

5. Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring the contractors to provide monthly environmental management report(s) if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage.

(e) Minimisation of Light Pollution

1. Provide evidence demonstrating that external light control measures have been implemented during construction (demolition and foundation are included, if any). External light control measures shall include all of the following:

1.1 Operating hours for light

1.1.1 Switch off external lighting (essential light and feature light not included) when not needed or after operating hours.

1.1.2 Switch off feature lighting (e.g. hoarding lighting) after 11p.m.

1.1.3 Maintain only essential light (e.g. lighting for safety and security) at the acceptable level as required.

1.2 Automatic controls for lighting

1.2.1 Incorporate automatic control (e.g. timer switch) to switch off the external lighting when not needed or after operating hours.

1.3 Lighting nuisance control measures

1.3.1 Position and aim the lighting at hoarding properly to avoid overspill of light to the outside area being lit up.
1.3.2 For lighting up vertical structures (e.g. signs & hoarding), direct the beam to the structures and avoid overspill of light.
1.3.3 Provide lighting with appropriate shields, baffles, louvers and cut-off features to prevent light overspill to nearby residence and into the sky, and glare from the light source.

1.4 Prevention of glare to road users

1.4.1 Ensure the external lighting along site boundary is appropriately positioned, aimed or shielded so that illumination of nearby roads will not be adversely affected.

2. Provide extracts of tender documents (e.g. specification) highlighting the clause requiring the contractors to provide monthly environmental management report(s) if construction (demolition and foundation to be included, if any) has not yet commence at PA stage.

For DC developments located in part of building

(a) Environmental Management Plan

1 An *Environmental Management Plan (EMP)* shall be prepared to address potential significant environmental aspects and impacts, to propose appropriate mitigation measures, to include environmental monitoring and auditing plans and to propose a waste management system. Reference shall be made to all of the following:

1.1 Environment, Transport and Works Bureau (ETWB)'s Technical Circular (Works) 19/2005, Appendix C [8];

1.2 Hong Kong Construction Association (HKCA)'s Best Practice Guide for Environmental Protection on Construction Sites, Section 3.2.3 [9];

1.3 Environmental Protection Department (EPD)'s Environmental Monitoring and Audit - Guidelines for Development Projects in Hong Kong, Appendix D2 [10]

1.4 Buildings Department, PNAP ADV-19, Construction and Demolition Waste [11]

1.5 Project Administration Handbook for Civil Engineering Works, Section 4.1.3, Construction and Demolition Materials [12].

2 Provide EMP(s) of fit-out works construction prepared by contractors and reviewed/ endorsed by Construction BEAM Pro (or Construction BEAM Affiliate) defined under IDCM 5 or Project BEAM Pro defined under IDCM P1. If the EMP is reviewed/ endorsed by the construction BEAM Pro/ Affiliate as defined under IDCM 5, supporting documents for IDCM 5 need to be appended to IDCM_6_01.

3 Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring contractors to prepare EMP(s), if no construction stage has commenced before the submission of PA stage

8 Environment, Transport and Works Bureau (ETWB). Technical Circular (Works) 19/2005, Appendix C. [ONLINE] Available at: http://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/19/1/C-2005-19-0-1.pdf. [Accessed August 2019].

9 Hong Kong Construction Association (HKCA). Best Practice Guide for Environmental Protection on Construction Sites, 3.2.3. [ONLINE] Available at: http://www.hkca.com.hk/uploads/eversioin_docs/e33f38c5128a824b4f7cb18b7b5ab751.pdf. [Accessed August 2019].

10 Environmental Protection Department (EPD). Environmental Monitoring and Audit - Guidelines for Development Projects in Hong Kong Appendix D2. [ONLINE] Available at: http://www.epd.gov.hk/eia/hb/materials/images/AppendixD2.pdf. [Accessed August 2019].

11 Buildings Department, PNAP ADV-19, Construction and Demolition Waste. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV019.pdf. [Accessed August 2019].

12 Project Administration Handbook for Civil Engineering Works, Section 4.1.3, Construction and Demolition Materials [ONLINE] Available at https://www.cedd.gov.hk/filemanager/eng/content_80/PAH%202018%20Chapter%204%20Rev%2001%20HL%20-%20190718.pdf [Accessed Aug 2019].

4 Provide endorsed EMP(s), if any construction stage has commenced before the submission of PA.

(b) Minimisation of Construction Dust

1 Proactive dust control provisions shall be referred to Good Housekeeping Checklist in Appendix 4.1 of Hong Kong Construction Association's Best Practice Guide for Environmental Protection on Construction Sites [13]. Checklist of dust control provisions is provided in the prescribed form.

2 Provide monthly environmental management report(s) to demonstrate the following:

2.1 Implementation of monitoring and mitigation measures to minimise air pollution as defined in Environmental Management Plan (EMP) under IDCM 6 (a);

2.2 There are no convictions or complaints about air emissions from site, that have been upheld by the Environmental Protection Department, Building Management Office (BMO) or police leading to the issue of a fine or prosecution; and

2.3 Implementation of proactive dust control provisions with the completed prescribed forms.

3 The report(s) should be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 6 or the project BEAM Pro as defined under IDCM P1.

4 Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring the contractors to provide monthly environmental management report(s) if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage.

(c) Minimisation of Noise Pollution

1 Proactive noise control provisions shall refer to section 6.9 of Hong Kong Construction Association's Best Practice Guide for Environmental Protection on Construction Sites. Checklist of noise control provisions are provided in the prescribed forms.

2 Provide extracts of tender documents, contract conditions and/ or specifications highlighting the clause requiring the contractors to provide baseline monitoring measures if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage

3 Provide monthly environmental management report(s) to demonstrate the following:

4.1 Implementation of monitoring and mitigation measures to minimize noise pollution as defined in the *Environmental Management Plan (EMP)* under IDCM 6 (a);

13 Hong Kong Construction Association – Best Practice Guide for Environmental Protection on Construction Sites. [ONLINE] Available at: http://www.hkca.com.hk/uploads/eversioin_docs/e33f38c5128a824b4f7cb18b7b5ab751.pdf. [Accessed August 2019].

4.2 There are no convictions or complaints about noise emissions from site, that have been upheld by the Environmental Protection Department, BMO or Police leading to the issue of a fine or prosecution; and

4.3 Implementation of proactive noise control provisions with the completed prescribed form.

4 The report(s) shall be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 5 or the project BEAM Pro as defined under IDCM P1.

5 Provide extracts of tender documents (e.g. specifications) highlighting the clause requiring the contractors to provide monthly environmental management report(s) if construction (demolition and foundation to be included, if any) has not yet commenced at PA stage.

Submittals

For whole building DC developments

(a) Environmental Management Plan

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06_01	Specification requiring EMP(s) **[or]** EMP(s) of construction (demolition and foundation to be included, if any)	✓ ✓* #	- ✓
* Evidences of compliance with prerequisite requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. # Append supporting document for IDCM 5 if the EMP is reviewed/ endorsed by the defined construction BEAM Pro/ Affiliate.			

(b) Minimisation of Air Pollution

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06_01	IDCM-06-2_Form_r1	✓	✓
IDCM_06b_02	A total of 3^ monthly environmental management reports at a minimum with at least 1 report for each of the construction stages. **[or]**	✓*	✓

	Extracts of tender documents (e.g. specifications) specifying the requirements of Monthly environmental management report(s) (if applicable)	✓	-
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. ^ If there are less than 3 construction stages, a minimum total of 3 quarterly reports should still be submitted. In the case of more than 3 construction stages, extra no. of quarterly report(s) covering the extra stage(s) should be submitted.			

(c) Minimisation of Noise Pollution

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06_01	IDCM-06-3_Form_r1	✓	✓
IDCM_06c_02	A total of 3^ monthly environmental management reports at a minimum with at least 1 report for each of the construction stages. **[or]** Extracts of tender documents (e.g. specifications) specifying the requirements of Monthly environmental management report(s) (if applicable)	✓* ✓	✓ -
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. ^ If there are less than 3 construction stages, a minimum total of 3 quarterly reports should still be submitted. In the case of more than 3 construction stages, extra no. of quarterly report(s) covering the extra stage(s) should be submitted.			

(d) Minimisation of Water Pollution

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06d_01	A total of 3^ monthly environmental management reports at a minimum with	✓*	✓

	at least 1 report for each of the construction stages. **[or]**		
	Extracts of tender documents (e.g. specifications) specifying the requirements of Monthly environmental management report(s) (if applicable)	✓	-
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. ^ If there are less than 3 construction stages, a minimum total of 3 quarterly reports should still be submitted. In the case of more than 3 construction stages, extra no. of quarterly report(s) covering the extra stage(s) should be submitted.			

(e) Minimisation of Light Pollution

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06_01	IDCM-06-4_Form_r1	✓	✓
IDCM_06e_02	Evidence demonstrating the implementation of external light control measures **[or]** Extracts of tender documents (e.g. specifications) specifying the requirements of external light control measures (if applicable)	✓* ✓	✓ -
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

<u>For DC developments located in part of building</u>

(a) Environmental Management Plan

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓

IDCM_06_01	Specification requiring EMP(s) **[or]** EMP(s) of construction (demolition and foundation to be included, if any)	✓ ✓* #	- ✓
* Evidences of compliance with prerequisite requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. # Append supporting document for IDCM 5 if the EMP is reviewed/ endorsed by the defined construction BEAM Pro/ Affiliate.			

(b) Minimisation of Construction Dust

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06_01	IDCM-06-2_Form_r1	✓	✓
IDCM_06b_02	A total of 3^ monthly environmental management reports at a minimum with at least 1 report for each of the construction stages. **[or]** Extracts of tender documents (e.g. specifications) specifying the requirements of Monthly environmental management report(s) (if applicable)	✓* ✓	✓ -
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. ^ If there are less than 3 construction stages, a minimum total of 3 quarterly reports should still be submitted. In the case of more than 3 construction stages, extra no. of quarterly report(s) covering the extra stage(s) should be submitted.			

(c) Minimisation of Noise Pollution

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_06_00	BEAM Plus New DCs submission template for IDCM 6	✓	✓
IDCM_06_01	IDCM-06-3_Form_r1	✓	✓

IDCM_06c_02	A total of 3^ monthly environmental management reports at a minimum with at least 1 report for each of the construction stages. **[or]** Extracts of tender documents (e.g. specifications) specifying the requirements of Monthly environmental management report(s) (if applicable)	✓* ✓	✓ -
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA. ^ If there are less than 3 construction stages, a minimum total of 3 quarterly reports should still be submitted. In the case of more than 3 construction stages, extra no. of quarterly report(s) covering the extra stage(s) should be submitted.			

Remarks

(a) Additional Information

Environmental Protection Department, Recommended Pollution Control Clauses for Construction Contracts. [ONLINE] Available at: http://www.epd.gov.hk/epd/english/environmentinhk/eia_planning/guide_ref/rpc.html. [Accessed August 2019].

Environmental Protection Department, Quality Powered Mechanical Equipment (QPME) system. [ONLINE] Available at: http://www.epd.gov.hk/epd/english/environmentinhk/noise/qpme/index.html. [Accessed August 2019.

Buildings Department, PNRC-17, Control of Environmental Nuisance from Construction Sites. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnrc/Pnrc17.pdf. [Accessed August 2019]

Development Bureau (ETWB)'s Technical Circular (Works) 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials. [ONLINE] Available at: http://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/308/1/C-2010-06-01.pdf.[Accessed August 2019].

Buildings Department – PNAP ADV-4, Control of Environmental Nuisance from Construction Sites. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV004.pdf [Accessed Aug 2019].

Environmental Protection Department, guidelines & references: Air – [ONLINE] Available at: http://www.epd.gov.hk/epd/english/environmentinhk/air/guide_ref/air_guidelines.html [Accessed August 2019]

Noise –[ONLINE] Available at: https://www.epd.gov.hk/epd/english/environmentinhk/noise/noisemaincontent.html [Accessed August 2019]

https://www.epd.gov.hk/epd/misc/construction_noise/contents/index.php/en/index.html [Accessed August 2019]

Environmental Bureau. Guidelines on Industry Best Practices for External Lighting Installations. [ONLINE] Available at: http://www.enb.gov.hk/sites/default/files/en/node78/guidelines_ex_lighting_install_eng.pdf [Accessed August 2019]

(b) Related Credits

IDCM 7 Construction and Demolition Waste Recycling
The related credit encourages best practices in the management of construction resources consumption, including waste reduction.

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 7 Construction and Demolition Waste Recycling

Extent of Application

IDCM 7a – All DCs requiring demolition which are under the Client's control.

IDCM 7b – All DCs

Objective

Encourage best practices in the management of construction resource consumption, including waste reduction.

Credits Attainable

2 + 4 additional BONUS

Credit Requirement

(a) Demolition Waste Recycling

1 credit for demonstrating compliance with the Waste Management Plan and the application of proactive waste management provisions during demolition; and recycling at least 15% of demolition waste.

1 additional BONUS credits for 30%.

2 additional BONUS credits for 60%.

(b) Construction Waste Recycling

1 credit for demonstrating compliance with the Waste Management Plan and the application of proactive waste management provisions during construction (foundation to be included, if any); and recycling at least 15% of construction waste (foundation waste to be included, if any).

1 additional BONUS credits for 30%.

2 additional BONUS credits for 60%.

Assessment Proactive waste management provisions shall be referred to the Good Housekeeping Checklist in Appendix 8.2 of Hong Kong Construction Association's Best Practice Guide for Environmental Protection on Construction Sites [1]. Checklist of waste management provisions is provided in the prescribed form.

(a) Demolition Waste Recycling

1 Provide a Construction and Demolition Material Management Plan (C&DMMP). Reference shall be made to Civil Engineering and Development

Department (CEDD)'s Project Administration Handbook, Chapter 4, Paragraph 4.1.3 [2].

2 Provide monthly waste management report(s) to demonstrate the implementation of the following:

2.1 The Waste Management Plan (WMP) as defined in Environmental Management Plan (EMP) under IDCM 6 (a); and

2.2 Proactive waste management provisions and the completed prescribed form.

3 Provide copy(ies) of the monthly waste and recycling report(s) that include the following:

3.1 Waste flow tables (see prescribed form);

3.2 All waste and recycling records; and

3.3 Collection organisation/ recycler information.

4 Provide a summary of the percentage of demolition waste recycled (either by weight or by volume) prepared and declared by contractor, Demolition waste (including broken concrete and excavated materials) that is diverted from Government public fill reception facilities and reused/ recycled in other projects/ facilities shall be included.

5 Provide extracts of tender documents, contract conditions and/ or specifications highlighting the clause requiring the contractors to carry out waste management measures and recycle *demolition waste*.

(b) *Construction Waste* Recycling

1 Provide a Construction and Demolition Material Management Plan (C&DMMP). Reference shall be made to Civil Engineering and Development Department (CEDD)'s Project Administration Handbook, Chapter 4, Paragraph 4.1.3 [2].

1 Hong Kong Construction Association – Best Practice Guide for Environmental Protection on Construction Sites. [ONLINE] Available at: http://www.hkca.com.hk/uploads/eversioin_docs/e33f38c5128a824b4f7cb18b7b5ab751.pdf. [Accessed August 2019].

2 Civil Engineering and Development Department (CEDD)'s Project Administration Handbook, Chapter 4, Paragraph 4.1.3. [ONLINE] Available at: https://www.cedd.gov.hk/filemanager/eng/content_80/PAH%202018%20Chapter%204%20Rev%2001%20clean%20-%20190718.pdf. [Accessed August 2019].

2 Provide monthly waste management report(s) to demonstrate the implementation of the following:

2.1 The Waste Management Plan (WMP) as defined in Environmental Management Plan (EMP) under IDCM 6 (a); and

2.2 Proactive waste management provisions with the completed prescribed form.

Monthly waste management report(s) shall be prepared from the commencement of construction (foundation to be included, if any) to the completion of all construction activities.

3 Provide copy(ies) of the monthly waste and recycling report(s) that include the following:

3.1 Waste flow table (see prescribed form);

3.2 All waste and recycling records; and

3.3 Collection organisation/ recycler information.

4 Provide a summary of the percentage of construction waste recycled (either by weight or by volume) prepared and declared by contractor. Construction waste (including broken concrete and excavated materials) that is diverted from Government public fill reception facilities and reused/ recycled in other projects/ facilities shall be included.

5 Provide extracts of tender documents, contract conditions and/ or specifications highlighting the clause requiring the contractors to carry out waste management measures and recycle construction waste (foundation waste is to be included, if any) if construction (foundation is to be included, if any) has not yet commenced at PA stage.

Submittals **(a) Demolition Waste Recycling**

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_07_00	BEAM Plus New DCs submission template for IDCM 7	✓	✓
IDCM_07_00	IDCM-07-1_Form_r1	✓	✓
IDCM_07a_02	Endorsed Demolition Waste Management Plan	✓	✓
IDCM_07a_03	Extracts of tender documents (e.g. specifications) specifying the requirements of waste management measures (if applicable) **[or]**	✓	-
IDCM_07a_04	Any 3 monthly waste management reports.	✓*	✓
IDCM_07a_05	Monthly summary of the waste and recycling reports.	✓*	✓

IDCM_07a_06	Summary of the percentage of *demolition waste* recycled	✓*	✓
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

(b) *Construction Waste* Recycling

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_07_00	BEAM Plus New DCs submission template for IDCM 7	✓	✓
IDCM_07_01	IDCM-07-1_Form_r1	✓	✓
IDCM_07b_02	Endorsed *Construction Waste* Management Plan	✓	✓
IDCM_07b_03	Extracts of tender documents (e.g. specifications) specifying the requirements of waste management measures (if applicable) **[or]**	✓	-
IDCM_07b_04	Any 3 monthly waste management reports.	✓*	✓
IDCM_07b_05	Monthly summary of the waste and recycling reports.	✓*	✓
IDCM_07b_06	Summary of the percentage of *construction waste* recycled	✓*	✓
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

Remarks

(a) Additional Information

Buildings Department – PNAP ADV-19, *Construction* and *Demolition Waste*. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV019.pdf_ [Accessed Aug 2019].

Development Bureau's Technical Circular (Works) No. 6/2010, Trip Ticket System for Disposal of Construction & Demolition Materials". [ONLINE] Available at: https://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/308/1/C-2010-06-01.pdf [Accessed August 2019].

Environmental Protection Department publishes the latest information of waste collectors and recyclers on its website. [ONLINE] Available at:http://www.epd.gov.hk/epd/english/environmentinhk/waste/guide_ref/guide_ref_dwc.html. [Accessed August 2019].

(b) Related Credits

IDCM 6a *Environmental Management Plan*
This credit encourages a high standard of environmental management and a waste management system for the sorting, recycling and the proper disposal of materials during construction (demolition and foundation are to be included, if any).

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 8 Construction IAQ Management

Extent of Application All DCs

Objective Ensure that project materials and ventilation systems are not contaminated by construction activities.

Credits Attainable 1

Credit Requirement 1 credit for implementing a Construction IAQ Management Plan, undertaking a building 'flush out' or 'bake out', and replacement of all filters prior to occupancy.

Assessment

1. Provide a Construction IAQ Management Plan that includes the following:

    1.1. An overview of tasks to be executed;

    1.2. A list of reference documents, including environmental legislation and guidelines;

    1.3. A list of participants in the process and their responsibilities;

    1.4. A plan for management, communication and documentation;

    1.5. Construction IAQ management plan control measures [1] on: HVAC protection, source control, pathway interruption, housekeeping, scheduling;

    1.6. Monitoring and auditing of implementation;

    1.7. Expected written work products should include checklists and worksheets; and

    1.8. A schedule of activities.

2. Provide copy(ies) of the monthly report(s) demonstrating the effective implementation of the Construction IAQ Management Plan during the indoor construction period. A master programme shall also be included.

    The report(s) shall be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 5 or Project BEAM Pro as defined under IDCM P1.

    Provide extracts of tender documents (e.g. specifications) highlighting the clause which requires the contractors to carry out considerate measures, if indoor construction has not yet commenced at PA stage.

1 Sheet Metal & Air Conditioning Contractors' National Association (SMACNA). ANSI/SMACNA 008•2008 Guidelines for Occupied Buildings Under Construction. Chapter 3. [ONLINE] Available at: https://www.smacna.org/store/browse-by-topic/indoor-environmental-air-quality [Accessed August 2019]

3. Provide a report to demonstrate:

   3.1. Technical information for the filtration media used during construction and prior to occupancy;

   3.2. Details of building flush-out procedures including actual dates of the flush-out;

   3.3. The filtration media used had a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ANSI/ASHRAE 52.2-2012 [2] or equivalent performance specification;

   3.4. A flush-out with new filtration media is being carried out after the completion of construction and prior to occupancy;

   3.5. Flushing duration as defined by calculation of the fresh air required to attain the IAQ certification 'good' class requirement;

   3.6. No construction work done in the vicinity of the space during the flushing out; and

   3.7. The space was protected against any recontamination after flushing out.

   The report shall be reviewed and endorsed by the Construction BEAM Pro (or BEAM Affiliate) as defined under IDCM 5 or Project BEAM Pro as defined under IDCM P1.

   Provide extracts of tender documents (e.g. specifications) highlighting the clause which requires the contractors to carry out considerate measures, if indoor construction has not yet commenced at PA stage.

2 American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) – ANSI/ASHRAE Standard 52.2-2012. Method of Testing General Ventilation Air-cleaning Devices for Removal Efficiency by Particle Size. ONLINE] Available at: www.ashrae.org [Accessed Aug 2019]

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_08_00	BEAM Plus New DCs submission template for IDCM 8	✓	✓
IDCM_08_01	Construction IAQ Management Plan for indoor construction within the *site*	✓	✓
IDCM_08_02	Any 3 monthly report(s) on the implementation of the Construction IAQ Management Plan during indoor construction period **[or]** Extracts of tender documents, (e.g. specifications) specifying the requirements for the implementation of the Construction IAQ Management Plan (if applicable)	✓* ✓	✓ -
IDCM_08_03	Report on filter replacement and flush out **[or]** Extracts of tender documents (e.g. specifications) specifying the requirements for filter replacement and flush out (if applicable)	✓* ✓	✓ -
* Evidences of compliance with credit requirements for construction works carried out prior to PA (first submission) shall be submitted in PA.			

Remarks

(a) Additional Information

None

(b) Related Credits

None.

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 9 Building Management Manuals

Extent of Application All DCs

Objective Encourage the provision of a fully documented operation and maintenance manual to enable DC operators to implement the design intent and a fully documented energy management manual containing instructions that enables systems to operate at a high level of energy efficiency.

Credits Attainable 1

Credit Requirement 1 credit for providing a fully documented Operation and Maintenance Manual and Energy Management Manual.

Assessment

1. Building Operation and Maintenance Manual (O&M Manual)

1.1. The O&M Manual shall include all of the following:

1.1.1. the design intent;

1.1.2. the basis of design; and

1.1.3. full sequences of operation for all equipment and systems, including HVAC&R systems and associated controls, light and daylighting controls, hot water systems and renewable energy systems; all of which must meet the legal requirements and industry wide standards.

1.2. The description of the **design intent** shall include all of the following:

1.2.1. space temperature and humidity criteria

1.2.2. levels operator and/ or occupant control over HVAC systems;

1.2.3. ventilation requirements and related indoor air quality criteria

1.2.4. performance criteria related to energy efficiency;

1.2.5. environmental responsiveness of the facility;

1.2.6. and commissioning criteria.

1.3. The **basis of design** shall include all of the following:

1.3.1. details of occupancy;

1.3.2. space activity and any process requirements;

1.3.3. applicable regulations, codes, and standards;

1.3.4. design assumptions;

1.3.5. performance standards and benchmarks; and

1.3.6. control system appropriate for the skill of the operation and maintenance staff.

1.4. The operation and maintenance manual must include for each piece of equipment and each system:

1.4.1. the name and contact information of the manufacturer or vendor and installing contractor;

1.4.2. submittal data; and

1.4.3. operation and maintenance instructions with the models and features for the subject *site* clearly marked.

1.5. The manual shall include only data for equipment that is actually installed, and include the following:

1.5.1. instructions for installation, maintenance, replacement, start-up;

1.5.2. special maintenance requirements and sources for replacement parts/ equipment;

1.5.3. parts list and details of any special tooling requirements;

1.5.4. performance data; and

1.5.5. warranty information.

1.6. The manual shall include an as-built documentation package for controls covering all of the following:

1.6.1. control drawings and schematics;

1.6.2. normal operation;

1.6.3. shutdown;

1.6.4. unoccupied operation;

1.6.5. seasonal changeover;

1.6.6. manual operation;

1.6.7. controls set-up and programming;

1.6.8. troubleshooting;

1.6.9. alarms; and

1.6.10. final sequences of operation.

2. Energy Management Manual (EMM)

2.1. The EMM for all energy-related systems shall include the following:

2.1.1. Descriptions of the final design intent and basis of design, including brief descriptions of each system;

2.1.2. Final sequences of operation for all equipment;

2.1.3. Procedures for seasonal start-up and shutdown, manual and restart operation;

2.1.4. As-built control drawings;

2.1.5. For all energy-saving features and strategies, rationale description, operating instructions, and caveats about their function and maintenance relative to energy use;

2.1.6. Recommendations and brief method for appropriate accounting of energy use of the whole building;

2.1.7. Specifications of re-calibration frequency of sensors and actuators by type and use;

2.1.8. Recommendations for continuous commissioning or recommended frequency for re-commissioning by equipment type, with reference to tests conducted during initial commissioning;

2.1.9. Recommendations regarding seasonal operational issues affecting energy use;

2.1.10. List of all user-adjustable set points and reset schedules, with a discussion of the purpose of each and the range of reasonable adjustments with energy implications;

2.1.11. Schedules of frequency of reviewing the various set points and reset schedules to ensure that they are still near optimum;

2.1.12. List of time-of-day schedules and a frequency of reviewing them for relevancy and efficiency;

2.1.13. Guidelines for establishing and tracking benchmarks for building energy use and primary plant equipment efficiencies;

2.1.14. Guidelines for ensuring that future renovations and equipment upgrades will not result in decreased energy efficiency and will maintain the design intent;

2.1.15. List of diagnostic tools, with a description of their use, that will assist facility staff of the building in operating equipment more efficiently;

2.1.16. A copy of the commissioning report; and

2.1.17. Index of all commissioning documents with notation of their location.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_09_00	BEAM Plus New DCs submission template for IDCM 9	✓	✓
IDCM_09_01	Owner's requirements/ specification on provision of O&M Manual for all systems.	✓	✓
IDCM_09_02	Operation and maintenance manual adequately cover the major energy consuming building services systems and equipment where the manual includes the details given in the assessment criteria.	-	✓
IDCM_09_03	Owner's requirements/ specification on the provision of Energy Management Manual for energy-related systems.	✓	✓
IDCM_09_04	A dedicated Energy Management Manual meeting the requirements as stipulated in the assessment criteria.	-	✓

Remarks

(a) Additional **Information**

American Society of Heating, Air-conditioning, and Refrigerating Engineers (ASHRAE) – Preparation of Operating and Maintenance Documentation for Building Systems. ASHRAE Guideline 4. Atlanta. [ONLINE] Available at: https://www.ashrae.org/ [Accessed August 2019]

J H Armstrong. Building Services Research and Information Association (BSRIA) – Operating and Maintenance Manuals for Building Services Installations. Application Guide 1/87. Dec. 1990. [ONLINE] Available at: https://www.bsria.co.uk/ [Accessed August 2019].

(b) Related Credits

None

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 10 Operator Training plus Chemical Storage Room

Extent of Application All DCs

Objective Encourage the provision of training for operation and maintenance staff to the minimum specified and demonstrate adequate maintenance facilities are provided for opeartion and maintenance work.

Credits Attainable 1

Credit Requirement 1 credit for providing training for operation and maintenance staff to the minimum specified; and demonstrating that adequate maintenance facilities are provided for operation and maintenance work.

Assessment

(a) Operator Training

1. The training program should be carried out by the appointed Facilities Management Team or client representatives.

2. The training program shall cover as a minimum the items listed below:

   2.1 General purpose of each building system including basic theory of operation, capabilities and limitations, and modes of control and sequences of operation;

   2.2 Review of control drawings and schematics;

   2.3 Procedures for start-up, shutdown, seasonal changeover, normal operation, unoccupied operation and manual operation;

   2.4 Controls set-up and programming;

   2.5 Troubleshooting;

   2.6 Alarms;

   2.7 Interactions with other systems;

   2.8 Operational monitoring and record keeping requirements, and the use of data for analysing system performance;

   2.9 Adjustments and optimising methods for energy conservation;

   2.10 Any relevant health and safety issues;

   2.11 Inspection, service, and maintenance requirements for each system, including any need for specialised services;

   2.12 Sources for replacement parts/ equipment; and

   2.13 Any tenant interaction issues.

3. The demonstration portion of the training program shall include the following:

   3.1 Typical operation examples of each system;

3.2 Start-up and shutdown procedures;

3.3 Operation under all specified modes of control and sequences of operation;

3.4 Procedures under emergency or abnormal conditions; and

3.5 Procedures for effective operational monitoring.

4. Verify that the training of the DC's operation and maintenance staff was undertaken for all commissioned systems and major equipment, using the operation and maintenance manual, and the energy management manual as the basis for the training.

5. Demonstrate that the provided operation and maintenance facilities are adequate.

6. A permanent room for training is not necessary. Evidence of carrying out operator training (e.g. record of attendance) is required.

(b) Chemical Storage Room

1. A centralised chemical storage and mixing room for each individual building on the site (i.e. janitor and central storage area) should be provided where buildings include provision of housekeeping and chemical products that create odour during their mixing processes. Chemical products include HVAC and cleaning relates (e.g. refrigerants, cleansing chemicals) for all building's future operation and maintenance items and equipment.

2. No size requirement for the chemical storage room.

3. Submit details in the form of drawings and a report with ventilation calculation to demonstrate the following chemical storage areas provision:

3.1 A drainage point and a water supply point;

3.2 An exhaust route for ventilation system to vent out (e.g. exhaust route to centralised exhaust riser) and maintain negative pressure with respect to adjacent spaces when the doors to the room are closed;

3.3 A separate area with self-closing and lockable door; and

3.4 Full height-partitions.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_10_00	BEAM Plus New DCs submission template for IDCM 10	✓	✓
IDCM_10_01	Owner's requirements/ specification on the provision of Training Report(s) and records of operation and maintenance facilities.	✓	✓
IDCM_10_02	Copies of Training program (e.g. PowerPoint presentation, training manual, etc.) which cover the items listed.	-	✓
IDCM_10_03	Evidences of operator training (e.g. sample record of attendance) verifying that training of the building's operation and maintenance staff was undertaken for all commissioned systems and major equipment, using the operation and maintenance manual, and the energy management manual as the basis for the training.	-	✓
IDCM_10_04	Drawing(s) to show the required drainage point, water supply points are implemented	✓	✓
IDCM_10_05	Drawing(s) and ventilation calculations demonstrating that chemical storage and mixing areas are equipped with the required provisions.	✓	✓
IDCM_12_06	Drawing(s) to show the chemical storage and mixing room doors and partitions provision	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

None

2 Integrated Design and Construction Management

2.3 Smart Design and Technologies

IDCM 11 Digital Facility Management Interface

Extent of Application All DCs

Objective Encourage provision of digital interfaces to enable future facility management teams to review the DC operation performance

Credits Attainable 1 BONUS

Credit Requirement 1 BONUS credit for providing a digital interface in addition to the project design metering provision for future facility management team to review the DC operation performance.

Assessment Develop and implement a digital interface for future facility management team to review data collected by the electricity metering system installed in the building. The assessment focuses on the interface provision for providing vision regarding operation characteristics. This is for future implementation of first class (Cat I) energy management opportunities (EMOs), with reference to the Code of Practice for Building Energy Audit 2015 [1]. Metering system design and hardware quality is not assessed in this credit.

The interface should be a provisional media, providing the information below for the future facility management team to review the building operation. The format and media used for the interface is not restricted provided the credit objectives are achieved by meeting the requirements below:

1. Providing charts and summaries for **hourly** data collected. **Minimum** data required should refer to below table:

System (if applicable)	**Data point for Performance Auditing**
Outdoor Condition	• Air Temperature (°C) • Humidity (RH) • Daylight (Lux)
Data Centre Facility	• Total PUE of the data centre facility • PUE of individual data hall • PDU Electricity Consumption (kW and kWh)
Building	• Total Energy Use Intensity (kWh/m2) [Daily, Monthly & Annual] • Total HVAC Energy Use Intensity (kWh/m2) [Daily, Monthly & Annual]

1 Electrical and Mechanical Services Department – Code of Practice for Building Energy Audit 2015. [ONLINE] Available at: http://www.beeo.emsd.gov.hk/en/pee/EAC_2015.pdf. [Accessed August 2019].

		• Total Lighting Energy Use Intensity (kWh/m2) [Daily, Monthly & Annual]
HVAC System	Each Equipment in HVAC (Water Side) - Chillers - Heat pumps - Pumps - Heat Rejection	• Electricity (kW and kWh) • Operation Hour • Supply & Return Water temperature (^oC) • Water Flow rate (m^3/s)
	Each Equipment in HVAC (Water Side) - Absorption Chiller - Boiler	• Fuel (kW and kWh) • Operation Hour • Supply & Return Water temperature (^oC) • Water Flow rate (m^3/s)
	Each Equipment in HVAC (Air Side) - Primary Air/ Air Handling Unit Fans - Ventilation Fans - CRAC/ CRAH	• Electricity (kW and kWh) • Operation Hour • Each service Zone temperature (^oC) • Supply & Return Air temperature (^oC) • Flow rate (m3/s)
	VRV and Unitary System	• Electricity (kW and kWh)
	Exhaust System - Carpark Exhaust Ventilation - Toilet Exhaust Ventilation (>5kW each)	• Electricity (kW and kWh) • Operation Hour • CO / NOx concentration level (if applicable)
Lift and Escalators System	Each Lift and Escalators	• Electricity (kW and kWh)

2. Keeping inventories and records of the identified systems, including manuals, technical brochures indicating their configurations and characteristics.
3. Enabling a trend of total building electricity use reporting for the last 12 months.
4. Enabling a trend of total electricity costs reporting for the last 12 months.

5. As-built drawing and system schematic that shows the layouts of energy consuming equipment and systems, and drawings showing the layout of the building.
6. Providing Operation and Maintenance programmes that include the timing of major alterations, additions or replacements for the building.

Achievement of EU 5 is not required as the basic requirement in assessing this credit.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_11_00	BEAM Plus New DCs submission template for IDCM 11	✓	✓
IDCM_11_01	Specifications of monitoring system for future facility management team	✓	✓
IDCM_11_02	Schematics of interface demonstrating compliance with the requirements	✓	✓
IDCM_11_03	Test and commissioning records	-	✓
IDCM_11_04	Operation manual	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

This credit may act as a platform gathering and processing the data collected in EU 5 Metering and Monitoring.

In conjunction with IDCM 2c Early Consideration Of Operational Issues, it is recommended to consult the facility management team while specifying the document management system.

2 Integrated Design and Construction Management

2.3 Smart Design and Technologies

IDCM 12 Document Management System

Extent of Application All DCs

Objective Encourage tidy and digital documentation throughout the design and construction process for the ease of handing over to DC facility management teams.

Credits Attainable 1 + 1 BONUS

Credit Requirement

1 credit for demonstrating the use of document management systems within the design team.

1 additional BONUS credit for demonstrating the use of document management platform by the DC owner or DC management company.

Assessment

1. Demonstrate coordinated use of Design Team Document Management among design teams which shall include the following members:
    - 1.1 Project Owner;
    - 1.2 Architects / project designers;
    - 1.3 MEP engineers;
    - 1.4 Structural engineers
    - 1.5 Quantity Surveyors; and
    - 1.6 Contractors.
2. Provide specifications of the document management system including:
    - 2.1. Naming rules for the digital documents to follow;
    - 2.2. Filing rules, in the form of hierarchy, for the digital documents to follow; and
    - 2.3. File format of digital documents.
3. The document management system should perform the following functions:
    - 3.1. Storage of documents;
    - 3.2. Spare storage for future documents;
    - 3.3. Allow update of existing documents;
    - 3.4. Accessible online;
    - 3.5. Support multiple users access and different level of access rights;
    - 3.6. Alarms and notifications; and
    - 3.7. Security protection by passwords.
4. The document management system should store the following documents:

4.1. Project timeline / programme;

4.2. Meeting minutes;

4.3. All documents submitted to government bodies; and

4.4. Material submissions from contractors.

5. Provide specifications of the document management platform by the DC owner/ DC management company including:

5.1. Naming rules for the digital documents to follow;

5.2. Filing rules, in the form of hierarchy, for the digital documents to follow; and

5.3. File format of digital documents.

6. The document management system should perform the following functions:

6.1. Storage of documents;

6.2. Spare storage for future documents;

6.3. Allow update of existing documents;

6.4. Accessible online;

6.5. Support multiple users access and different level of access rights;

6.6. Alarms and notifications; and

6.7. Security protection by passwords.

7. The document management system should store all documents specified in IDCM 9 – 11 in addition to the following:

7.1. Approved drawings by all government departments;

7.2. All documents submitted to government bodies;

7.3. As-built drawings;

7.4. Waste management manual;

7.5. Water management manual;

7.6. Warranty of building equipment;

7.7. Tenant fitting out guide;

7.8. Tenancy green guide; and

7.9. Tenant feedback procedures notes and records.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_12_00	BEAM Plus New DCs submission template for IDCM 12	✓	✓
IDCM_12_01	Specifications of document management system	✓	-
IDCM_12_02	Evidence (e.g. screenshots) to demonstrate the use of document management system (reference to EB)(check the document with IT)	-	✓
IDCM_12_03	Specifications of document management system	✓	-
IDCM_12_04	Evidence to demonstrate the platform will be used by building owner/ building management company.	-	✓

Remarks

(a) Additional Information

Hong Kong Green Building Council – Hong Kong Green Office Guide. [ONLINE] Available at: https://www.hkgbc.org.hk/eng/engagement/guidebooks/green-office-guide/index.jsp [Accessed Aug 2019].

Hong Kong Green Building Council – Hong Kong Green School Guide. [ONLINE] Available at: https://www.hkgbc.org.hk/eng/engagement/guidebooks/green-school-guide/index.jsp [Accessed Aug 2019].

Hong Kong Green Building Council – Hong Kong Green Shop Guide. [ONLINE] Available at: https://www.hkgbc.org.hk/eng/engagement/guidebooks/green-shop-guide/index.jsp [Accessed Aug 2019].

Hong Kong Green Building Council – Green Tenancy Driver For Office Buildings. [ONLINE] Available at: https://www.hkgbc.org.hk/eng/engagement/guidebooks/green-tenancy-driver/index.jsp [Accessed Aug 2019].

The Hong Kong Institute of Surveyors - Green Property Management Practices. [ONLINE] Available at: http://www.hkis.org.hk/ufiles/gpmp2015.pdf. [Accessed August 2019].

(b) Related Credits

In conjunction with IDCM 2c Early Consideration Of Operational Issues, it is recommended to consult the facility management team while specifying the document management system.

2 Integrated Design and Construction Management

2.3 Smart Design and Technologies

IDCM 13 BIM Integration

Extent of Application All DCs

Objective Encourage the design team to discuss and work through the design platform and deliver holistic solution using Building Information Modelling (BIM)

Credits Attainable 1 + 3 additional BONUS

Credit Requirement

(a) Coordinated Use of BIM within Design Teams
1 credit for the coordinated use of BIM among the design team.

(b) Other Applications of BIM
Maximum 3 additional BONUS credits for BIM application on the following aspects:

1) Coordinated Use of BIM within Design and Construction teams;
2) BIM for time; and
3) BIM for Facility Management Use.

Assessment

(a) Coordinated Use of BIM within Design Teams

1. Prepare a project execution plan including the following content:
   - 1.1 Project BIM objectives;
   - 1.2 Model Level of Development (LOD);
   - 1.3 Methods of communication;
   - 1.4 Project BIM standards; and
   - 1.5 Model/Data validation protocols.
2. Demonstrate coordinated use of BIM among design teams which shall include the following members:
   - 2.1 Architects/project designers;
   - 2.2 MEP engineers; and
   - 2.3 Structural engineers.
3. Demonstrate the use of BIM performing the following functions:
   - 3.1 Coordinate spatial design;
   - 3.2 Clash detection; and
   - 3.3 Building performance simulation.

4. The BIM model should be at least LOD 300 as defined in The American Institute of Architects (AIA) Project Building Information Modelling Protocol Form [1] for builder and MEP elements.

(b) Other Applications of BIM

1. Coordinated Use of BIM within Design and Construction teams

   1.1. In addition to requirements in a), provide one representing document (e.g. crashes report) to demonstrate use of BIM among design teams and the contractors

2. BIM for Time

   2.1. Demonstrate the use of BIM in performing the following functions:

   i. Report real time on-site construction activity;

   ii. Review construction progress against the construction programme;

   iii. Prepare cost and quantity schedules; and

   iv. Track project budget.

3. BIM for Facility Management Use

   3.1. Update the BIM model to the as-built condition including fixtures, finishes and equipment data.

   3.2. Demonstrate that the BIM will be handed over to the facility management team for facility management use.

Submittals

a) **Coordinated Use of BIM within Design Teams**

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_13a_00	BEAM Plus New DCs submission template for IDCM 13a	✓	✓
IDCM_13a_01	Project execution plan	✓	✓
IDCM_13a_02	Specifications of BIM software	✓	-
IDCM_13a_03	Project-specific documents demonstrating the performance of functions	✓	✓

1 The American Institute of Architects (AIA) - The American G202™ – 2013, Project Building Information Modelling Protocol Form [ONLINE] Available at: https://www.aiacontracts.org/ [Accessed August 2019]

(b) Other Applications of BIM

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
IDCM_13b_00	BEAM Plus New DCs submission template for IDCM 13b	✓	✓
IDCM_13b_01	Project execution plan	✓	✓
IDCM_13b_02	Specifications of BIM software	✓	-
IDCM_13b_03	Project-specific representing document demonstrating the coordination among design team and construction team	✓	✓
IDCM_13b_04	BEAM Plus New DCs submission template for IDCM 13c	✓	✓
IDCM_13b_05	Project execution plan	✓	✓
IDCM_13b_06	Specifications of BIM software	✓	-
IDCM_13b_07	Project-specific documents demonstrating the use of BIM which performs the function requirements	✓	✓
IDCM_13b_08	BEAM Plus New DCs submission template for IDCM 13d	✓	✓
IDCM_13b_09	Specifications of an as-built BIM model to be provided by contractor	✓	-
IDCM_13b_10	Specifications of handing over the as-built BIM model to facility management	✓	-
IDCM_13b_11	Evidence of handing over the as-built BIM model to facility management	-	✓

Remarks

(a) Additional Information

Housing Authority - Building Information Modelling. [ONLINE] Available at: http://www.housingauthority.gov.hk/en/business-partnerships/resources/building-information-modelling/. [Accessed August 2019].

Buildings Department - Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers ADV-34. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV034.pdf. [Accessed Aug 2019].

(b) Related Credits

The use of BIM is a valuable add-on to IDCM 2 Integrative Design Process as it facilitates integrative design by strengthening the coordination within the project team.

3 Sustainable Site

3.1 Neighbourhood Integration
3.2 Ecologically Responsible Design
3.3 Bioclimatic Design
3.4 Climate Resilience and Adaptability

Introduction

This section focuses on the planning and design to harness the sustainable design potentials of a site for its occupants and neighbours, preserve/ enhance its ecological capacity, optimize its microclimate and create better climate resilience. Site attributes and scale of development have been taken account of in the formulation of the assessment criteria.

Site locations/ Site planning and design strategies in the following aspects will be assessed for their sustainable design quality and performances:

i. Building disposition, orientation and form;
ii. Spatial relationship of the building(s) to the immediate built and natural environment;
iii. Relationship of the building(s) to the site topography and ground conditions;
iv. Overall massing of the proposed development;
v. Site coverage of greenery, choice of plant species, tree coverage/ preservation;
vi. View factors and ambient forces;
vii. Balance of built-up and landscaped/ open area;
viii. Environmental enhancement to the surroundings of the site; and
ix. Master landscaping strategy; and
x. Conservation and protection of archaeological remains, historic buildings and monuments.

3.1 Neighbourhood Integration

SS 1 Green Building Attributes
SS 2 Noise Control for Building Equipment

Background

Integration with the neighbourhood is addressed in terms of greenery coverage on site, pedestrian-oriented transport, adequacy of local amenities, sustainable urban design, daylight access for neighbouring sensitive receivers and reduction of noise from building services equipment to neighbours.

The planning and design issues which affect the environmental performance of a site and master layout planning should include:

i. Disposition of individual buildings within the site;
ii. Spatial relationship of the building(s) to the immediate built and natural environment;
iii. Relationship of the building(s) to the site topography and ground conditions;
iv. Overall massing of the proposed development;
v. Built form of the buildings;
vi. Orientation of buildings in relationship to view factors and ambient forces;
vii. Balance of built-up and landscaped/ open area;
viii. Environmental enhancement to the surroundings of the site;
ix. Master landscaping strategy; and
x. Conservation and protection of archaeological remains, historic buildings and monuments.

Tall buildings can cause substantial overshadowing of neighbouring developments and amenities, affecting both direct and indirect sunlight and light from the sky. Noise emissions from equipment on and around buildings contributes to noise pollution with potential impacts on neighbouring properties. It is the responsibility of the project team to alleviate adverse effect on neighbouring properties by good design and proper installation and maintenance.

3.2 Ecologically Responsible Design

SS 3 Light Pollution Control
SS 4 Biodiversity

Background

Habitat conservation is the most effective means to minimise development impacts on the natural environment and endangered species (if any). If an area of high biodiversity is identified in the *site*, it is encouraged to formulate management strategies to protect habitats and any rare or endangered species within the land under ownership.

Light pollution may be regarded as waste light from lighting schemes that produces glare, obscures the night sky, adversely effects nocturnal ecosystems and may intrude on neighbouring properties.

3.3 Bioclimatic Design

SS 5 Urban Heat Island Mitigation
SS 6 Immediate Neighbourhood Wind Environment
SS 7 Outdoor Thermal Comfort

Background

The use of non-reflective external surfaces contributes to localised elevated temperatures created when solar heat gains are absorbed and then radiated back to the surroundings. The effect may be local to pedestrian and recreational areas and contribute to urban heat islands.

Site planning, building design and landscaping strategies can enhance a *site*'s microclimate. Elevated temperatures can be mitigated through the choice of finishes on buildings and horizontal hard surfaces that reflect heat, the application of shading or planted vegetation, and the enhancement of building permeability.

3.4 Climate Resilience and Adaptability

SS 8 Stormwater Management
SS 9 Design for Climate Change Adaptation

3 3 Sustainable Site 3.1 Neighbourhood Integration

SS 1 Green Building Attributes

Extent of Application All DCs

Objective To encourage the data centres to employ best practices in design and/or construction in order to enhance green performance.

Credits Attainable 5

Credit Requirement Maximum 5 credits for an assessed DC that meets the listed performance characteristics, 1 credit for each sub-item:

i. Planting provisions in terms of viability and site coverage of greenery of at least 20% of the site;
ii. Achieving Accessibility Index of 15 or more for all buildings of a development;
iii. Achieving 50% or more of the applicable pedestrian-oriented transport planning measures;
iv. Providing cycling parking facilities within the Site;
v. Providing EV charging-enabling facilities for all carparking spaces (including visitor car parks);
vi. Preparing a site design appraisal report demonstrating a proactive approach to achieve a people-oriented and place-making approach for sustainable site planning, and at least 30% of applicable sustainable urbanism measures are achieved;
vii. Demonstrating that a proper heritage impact assessment mechanism and its recommendations have been implemented;
viii. Demonstrating that designs for which the access to daylight of neighbouring sensitive buildings is maintained to the prescribed levels; and
ix. At least 5 different amenities are located within 800m walking distance from building main entrance

Assessment

1. For items i. to viii, the assessment criteria are made reference from the relevant items in SS P1 and SS 1 to SS 4 of BEAM Plus New Building Version 2.0.

2. For item ix, the building amenities shall include the following:

   2.1. Restaurants/ cafes/ food & beverage outlets;

   2.2. Vending machines for snacks and drinks;

   2.3. Banks or Automated Teller Machines (ATM);

   2.4. Medical/ health facilities (including dental clinic);

   2.5. Place for worship;

   2.6. Active recreational facilities or open spaces; and

   2.7. Passive recreational facilities or open spaces

3. Prepare technical report detailing the following:

   3.1. List of each claimed sub-items;

3.2. Summary table showing the quantities and locations of the facilities/ services with description;
3.3. Calculation/ technical reports;
3.4. Equipment catalogues and technical sheets;
3.5. Layouts/ building services drawings to indicate the facilities/ installations; and
3.6. As-fitted drawings; and
3.7. Record photographs.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_01_00	BEAM Plus New DCs submission template for SS 1	✓	✓
SS_01_01	Technical report summarising the provision of green features.	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

3 Sustainable *Site* **3.1 Neighbourhood Integration**

SS 2 Noise Control for Building Equipment

Extent of Application All Building Equipment servicing the Assessed DC.

Objective Encourage proactive design techniques to reduce the nuisance caused to the neighbours by noise from building services equipment.

Credits Attainable 1

Credit Requirement 1 credit for demonstrating that the level of the intruding noise at the facade of potential noise sensitive receivers is in compliance with the criteria recommended in the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction *Sites* [1].

Assessment

1. Provide evidence in a form of detailed analysis, appropriate calculations or measurements to demonstrate that the levels of the intruding noise at the facades of existing or potential noise sensitive receivers comply with the following assessment criteria:

    1.1 Provide a background noise measurement report with detailed monitoring records to support the ANL requirements of day time and night time and background noise.

    1.2 On the basis of promoting good environmental design assessment, existing uses and land uses under statutory plans of Town Planning Ordinance should be examined to identify existing or potential noise sensitive developments. Where there is a piece of vacant land and no available information to verify its use, it should be assumed that it will become a noise sensitive receiver.

    1.3 Ideally, assessment should be made at the facade on the noise sensitive receiver. Under circumstances that access to the noise sensitive development is not granted for measurement, calculation or a combination of measurement at a nearby location with calculation adjustment is permitted.

    1.4 The noise assessments shall be conducted in accordance with the Technical Memorandum [1].

    1.5 Noise sensitive receivers should follow the Technical Memorandum. Only buildings external to the *site* boundary are assessed.

    1.6 The major noise sources include chillers, water cooling towers, fans (duct type and centrifugal) and ducts [2]. Only equipment provided by the developer/owner is assessed.

    1.7 All fixed noise sources should be located and designed so that when assessed in accordance with the Technical Memorandum, the level of the intruding noise at the facade of the nearest sensitive receiver should be at least 5 dB(A) below the appropriate ANL shown in Table 2 of the Technical Memorandum or, in the case of

1 Environmental Protection Department - Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites. [ONLINE] Available at: https://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/noise/guide_ref/files/tm_nondomestic.pdf

[Accessed Aug 2019]

the background being 5 dB(A) lower than the ANL, should not be higher than the background, in accordance with paragraph 4.2.13, Chapter 9 of the Hong Kong Planning Standards and Guidelines [2]. Applicant are required to justify the selected Area Sensitivity Rating (ASR).

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_02_00	BEAM Plus New DCs submission template for SS 2	✓	✓
SS_02_01	Layout plans indicating the location of the major noise sources and NSR's location and corresponding distance	✓	✓
SS_02_02	Noise Prediction/ assessment report	✓	✓
SS_02_03	Equipment catalogue showing the sound power level of equipment	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

2 EPD - Good Practices on Ventilation System Noise Control (April 2006)

3 Hong Kong Planning Standards and Guidelines, Chapter 9 Environment [ONLINE] Available at: https://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/pdf/ch9.pdf [Accessed Aug 2019]

3 Sustainable *Site* **3.2 Ecologically Responsible Design**

SS 3 Light Pollution Control

Extent of Application All Exterior lighting specified as part of the Assessed DC.

Objective Ensure that the exterior lighting and building design do not create unwanted and unnecessary light pollution.

Credits Attainable 1

Credit Requirement **Control of Obtrusive Artificial Light**

1 credit for demonstrating that the obtrusive light from exterior lighting meets the specified performance for the environmental zone in which the building development is located.

Assessment **Control of Obtrusive Artificial Light**

1. Provide a scaled map showing the immediate neighbourhood of the *Site* highlighting the surrounding buildings included in the assessment. Only buildings outside the *site* boundary are assessed.

2. Provide a schedule of all exterior lighting fixtures, including their quantities, locations and model references and compile supplier information on the performance of the light fixtures used for modelling studies.

3. Provide the exterior lighting layout plan showing types and locations of all exterior lighting fixtures.

4. Demonstrate that the relevant recommendations in the HKSAR Government's Guidelines on Industry Best Practices for External Lighting are complied with [1].

5. Meet the obtrusive light control requirements, using either the calculation method or backlight-uplight-glare (BUG) method when all installed luminaires' BUG rating information is available. If partial exterior luminaires are not BUG rated, hybrid approach (Calculation method & BUG method) could be used to show the credit compliance.

<u>Calculation Method</u>

1. Demonstrate that the exterior lighting design complies within the maximum figure for each parameter (sky glow, light into windows, source intensity, and building luminance), taken from Table 1 and Table 2 in ILP Guidance Notes [2]. Provide justification of environmental zone, note that it is a district-scale consideration.
2. Prepare a light pollution calculation report for modelling studies to demonstrate compliance of the above criteria, including:

    2.1 Assumptions adopted;

    2.2 Screen capture of input parameters;

1 Environment Bureau. Guidelines on Industry Best Practices for External Lighting. [ONLINE] Available at: http://www.enb.gov.hk/sites/default/files/en/node78/guidelines_ex_lighting_install_eng.pdf [Accessed August 2019]

2 The Institution of Lighting Professionals. Guidance notes for the reduction of obtrusive light, GN01:2011 https://www.theilp.org.uk/documents/obtrusive-light/ [Accessed August 2019]

2.3 Screen capture of modelled buildings;

2.4 Results highlighting compliance of credit requirements.

BUG Method

3. Demonstrate that the specific light source installed in the luminaire do not exceed the luminaire uplight, backlight and glare ratings, taken from IES TM-15-11 – Addendum A[3], based on mounting location and distance from the property line (assessment boundary). Provide justification of Model Lighting Ordinance (MLO)[4] lighting zone, note that it is a district-scale consideration,

4. Define assessment boundary on layout

5. BUG values are typically published by product manufacturers. If published BUG data do not address the design position of the luminaire (or are not available at all), ratings can be calculated by reviewing a luminaire's photometric test data and zonal lumen distribution and comparing the data with maximum zonal lumens for backlight, uplight, and glare established in IES TM-15-11, Addendum A. Software calculation for BUG rating is acceptable to reflect the compliance.

6. Prepare a BUG method report to demonstrate compliance of the above criteria, including:

   6.1 Highlighting manufacturer BUG rating information for installed luminaires

   6.2 Software calculation (if applicable) for the BUG rating with all assumption adopted, screen capture of input parameters and results of BUG rating.

Hybrid Method

7. Assessment requirements combined Calculation Method and BUG Method.

* Exemptions from this credit assessment

8. The following exterior lighting is exempted from the requirements, provided it is controlled separately from the non-exempt lighting:

   8.1 Specialised signal, directional, and marker lighting for transportation.

   8.2 Lighting for theatrical purposes for stage, film, and video performances.

Submittals

Control of Obtrusive Artificial Light

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_03_00	BEAM Plus New DCs submission template for SS 3	✓	✓

3 Backlight, Uplight, and Glare (BUG) Ratings - IES TM-15-11 – Addendum A, https://ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf [Accessed August 2019]

4 Illuminating Engineering Society and International Dark-Sky Association (IES/ IDA) Model Lighting Ordinance User Guides, http://darksky.org/wp-content/uploads/bsk-pdf-manager/16_MLO_FINAL_JUNE2011.PDF [Accessed August 2019]

SS_03_01	Scaled map showing immediate neighbourhood of the *site* for assessment	✓	✓
SS_03_02	External lighting layout plans	✓	✓
SS_03_03	Schedule of exterior lighting fixtures and lighting catalogues on performance data	✓	✓
SS_03_04	Light pollution calculation report **[and/ or]**	✓	✓
	BUG method report	✓	✓
SS_03_05	Report on the compliance of Guidelines on Industry Best Practices for External Lighting	✓	✓

Remarks

(a) Additional Information

International Dark-sky Association. Information Resource. [ONLINE] Available at: http://www.darksky.org/resources. [Accessed August 2019]

International Commission on Illumination. Guidelines for Minimising Sky Glow. Technical Report CIE 126: 1997.

(b) Related Credits

None

3 Sustainable Site **3.2 Ecologically Responsible Design**

SS 4 Biodiversity Enhancement

Extent of Application All whole building DC developments site with tree except brownfield or sites on reclaimed land for SS 4a
All whole building DC developments site with adjacent areas of medium or high ecological value for SS 4b

Objective Preserve and/ or enhance the biodiversity of the site.

Credits Attainable 2 BONUS

Credit Requirement

(a) Reduction of Ecological Impact

Credit	Requirement
1 BONUS	All identified habitat types on Site are of low or negligible indicative ecological values **OR** All identified habitat types on Site of medium to high indicative ecological value are preserved intact and are either unaffected by the planned development

(b) Enhancement of Biodiversity

1 BONUS for preparing a manual on biodiversity-friendly landscape maintenance, **PLUS** adopting measures to increase diversity and complexity of planting for enhancing the biodiversity of the site.

Assessment

(a) Reduction of Ecological Impact

1. Provide a habitat map of the *Site* to identify the locations, dimensions and areas of all existing habitat types within the *Site* and determine their corresponding indicative ecological value. The mapping of habitat types, their definition and ecological value identification shall make reference to Terrestrial Habitat Mapping and Ranking Based on Conservation Value[1]. Types of habitats and their indicative ecological values are summarised below:

Ecological Value	Habitat Types
High Value	Fung Shui Forest; Montane Forest; Lowland Forest; Mixed Shrubland; Freshwater/ Backish Wetland; Natural Watercourse; Seagrass Bed; and Intertidal Mudflat.
Medium Value	Shrubby Grassland (including Baeckea Shrubland) Plantation or Plantation/ Mixed Forest; Fishpond/ Gei Wai; Sandy Shore; Rocky Shore; and Cultivation.

1 Sustainable Development Unit, Environment Bureau, HKSAR. 2009. Terrestrial Habitat Mapping and Ranking Based on Conservation Value.

Low Value	Bare Rock or Soil; Grassland; Modified Watercourse; Artificial Rocky/ Hard Shoreline; Golf Course/ Urban Park; and Quarry
Negligible Value	Rural industrial storage/ containers; Landfill; and Others.

2. Provide an ecological impact reduction report to demonstrate one of the following is achieved:

2.1 All identified habitat types on Site are of low or negligible indicative ecological value; **OR**

2.2 All identified habitat types on Site of medium to high indicative ecological value are preserved intact and are either unaffected or enhanced by the planned development.

(b) Enhancement of Biodiversity

1 Prepare a Biodiversity-friendly Landscape Maintenance Manual including the sections below:

1.1 Design objectives of biodiversity enhancement

1.2 Maintenance requirement

1.3 Waste minimisation

2 Prepare a Biodiversity enhancement report to indicate the measures to be implemented:

2.1 Increase diversity and complexity of planting

2.2 Provide planting plans and demonstrate plant species type, characteristics of the species chosen (tree/ shrub/ herb/ climber), nativeness (native/ exotic), quantity and location.

2.2.1 Demonstrate the planting scheme incorporated **ALL** elements below:

i. Chosen diverse plant species. Reference to 10;20-30 rule for planting. [2]

ii. Increase complexity of vegetation structure and provide habitats for wildlife by mixing vegetation with varied heights. [3]; and

iii. Use >50% native or adaptive species.

3 The biodiversity enhancement report should be endorsed by qualified landscape architect or ecologist. Measures identified as not applicable (N/A) for specific project, or alternative measures proposed other than those listed for compliance is acceptable with justification.

2 Development Bureau, HKSAR, 2018 Street Tree Selection Guide “Chapter 9 – Complementary Vegetation Community Mix”

3 Development Bureau, HKSAR, 2018 Street Tree Selection Guide “Chapter 9 – Complementary Vegetation Community Mix”

Submittals

(a) Reduction of Ecological Impact

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_04_00	BEAM Plus New DCs submission template for SS 4	✓	✓
SS_04a_01	Habitat mapping report (*Site*) with scaled and dimensioned drawings and photographic records of the existing *site* conditions for habitat types identified in the *Site*	✓	✓
SS_04a_02	Ecological impact reduction report on interconnectivity with adjacent areas of ecological value	✓	✓

(b) Enhancement of Biodiversity

Supporting Documents *Please provide below softcopies with filename prefix as indicated on leftmost column.*		**PA**	**FA**
SS_04_00	BEAM Plus New DCs submission template for SS 4	✓	✓
SS_04b_01	Biodiversity-friendly landscape maintenance Manual	✓	✓
SS_04b_02	Biodiversity enhancement report	✓	✓

Remarks

(a) Additional Information

Development Bureau HKSAR Government, 'A Comprehensive Street Tree Management Plan for Hong Kong', Annex IV: Encouraging Biodiversity in the Urban Landscape through Planting Appropriate Tree Species in Hong Kong.

Development Bureau. Greening, Landscape and Tree Management Office (GLMTS) 2010, Guiding principles on use of native plant species in public works projects.

Beck T, Principles of ecological landscape design. Island Press, Washington, Covelo, London.

MacArthur R.H. and Wilson E.O., The theory of island biogeography, Princeton University Press, New Jersey, USA.

(b) Related Credits

SS 1 Green Building Attributes
The related credits require site coverage of greenery and provisions for viability of planting, for example, the minimum soil volumes and depths for all plant areas. In addition, it also encourages the shading of main pedestrian paths.

SS 5 Urban Heat Island Mitigation
The related credit encourages higher overall site coverage of greenery.

SS 7 Outdoor Thermal Comfort
The related credit considers the positive effect of shading by trees and the surrounding ground surface temperatures of greenery within the site.

SS 8 Stormwater Management
The related credit considers softscape provided with the site for infiltration and detention in stormwater management.

WU 2 Water Efficient Irrigation
The related credit considers water efficient irrigation for greenery provided within the site.

3 Sustainable *Site* **3.3 Bioclimatic Design**

SS 5 Urban Heat Island Mitigation

Extent of Application Whole Building DC Developments

Objective Encourage DCs design to adopt measures to mitigate urban heat effect.

Credits Attainable For *Site* area < 1000m^2: 1

For *Site* area ≥ 1000m^2: 4 + 2 additional BONUS + 4 BONUS

Credit Requirement For *Site* area <1000m^2

(a) Urban Design Guidelines Chapter 11
1 credit for implementing at least 2 *site* level strategies under Section 11 of Hong Kong Planning Standards and Guidelines Chapter 11 Urban Design Guidelines.

For *Site* area ≥ 1000m^2

(a) Sustainable Building Design Measures

1. 1 credit for providing shade on at least 5% of the *site* area and at least 50% of non-roof impervious surfaces on the *site* (parking, walkways, plazas) using light coloured high-*albedo* materials (*albedo* of at least 0.4).

2. 1 credit for demonstrating compliance with prescribed requirements of the SBD Guidelines as promulgated in the PNAP APP-152; and 1 additional BONUS credit for demonstrating with relevant prescriptive requirements with enhanced performances.

(b) Tree Coverage

1 to 2 BONUS credits for demonstrating that at least 10% and 20% or more, respectively, of the total Site Area is provided with tree coverage.

(c) Air Ventilation Assessment (AVA)

For conducting an AVA by *wind tunnel* or *Computational Fluid Dynamics (CFD)* according to the prevailing AVA methodology introduced by the Government demonstrating that better or equivalent ventilation performances than a baseline case:

1 Credit for demonstrating annual wind condition.

1 Credit for demonstrating summer wind condition.

(d) Intra Urban Heat Island Study

2 BONUS for conducting an Intra Urban Heat Island Study demonstrating that a maximum *Intra-Urban Heat Index* (difference between T_{urban} and T_{met}) in summer is less than 0.8 °C.

Assessment For *Site* area <1000m^2

1 Demonstrate the site planning comply with 2 strategies under Section 11 of Hong Kong Planning Standards and Guidelines Chapter 11 Urban Design Guidelines with:

1.1 Mark up on layout plan for the implemented strategies

1.2 Description on the implemented strategies

For *Site* area ≥ 1000m^2

(a) Sustainable Building Design Measures

1 Non-roof Impervious Surfaces Requirements

Demonstrate that shade is provided on at least 5% of the *site* area and at least 50% of non-roof impervious surfaces on the *site* (parking, walkways, plazas) using light coloured high-*albedo* materials (*albedo* of at least 0.4). (Podium roof no matter whether it is accessible or not will not be counted as non-roof surfaces).

2 Sustainable Building Design (SBD) Guidelines Requirements

Provide evidences in the form of scaled drawings and calculations to demonstrate compliance with relevant prescriptive requirements of the SBD Guidelines as promulgated in the PNAP APP-152 [1].

Roof materials with Solar Reflectance Index (SRI) of 78 or above is acceptable as an alternative to vegetated roof.

Provide a summary of overall site coverage of greenery (method of measurement and calculation of site coverage of greenery except otherwise stated below shall be in accordance with Buildings Department PNAP APP-152):

i. Covered greenery areas above the *primary zone* (measured from 45^o projected line taken from the edge of building) in communal areas accessible to public, occupiers or visitors shall be counted (50% reduction factor applies).

ii. Planters along the perimeter of an inaccessible roof above the *primary zone* but within 15m vertical zone from communal areas accessible to public, occupiers or visitors shall be counted (50% reduction factor applies).

iii. Vertical greening within 15m vertical zone from communal areas accessible to public, occupiers or visitors shall be counted (no reduction factor applies but vertical frames with a height more than 7.5m are not accountable for vertical greening provided by climbing or weeping plants).

3 Enhanced Performances of Sustainable Building Design Guidelines

Further to requirements stated in SS 5a (2), provide evidence demonstrate compliance with the followings:

3.1 Sustainable Soft Landscape Requirements
Provide the landscape plans for the *site* and detail the landscape treatment of the development including the planting and hard finishes of all landscaped areas, slopes and retaining structures, showing:

i. Planting plans with the character and planting densities for all softworks elements;

ii. Tree planting locations;

1 Buildings Department - PNAP APP-152 Sustainable Building Design Guidelines

iii. Details of the species;

a) Live load calculation of roof (if planting is provided on the roof), and

b) Maintenance plan for the greenery.

3.2 Demonstrate how soft landscaping has addressed the guidelines and recommendations provided in the Hong Kong Planning Standards and Guidelines Chapter 4 Section 2 Greenery, appropriate to the type and scale of the building development and the immediate surroundings.

3.3 Demonstrate that at least 50% of the plant species used for trees, shrubs and grass/ ground covers respectively in terms of quantities are drought-tolerant to minimise watering requirements.

3.4 Demonstrate that the species, density and topsoil comply with the General Specification for Building Section 25: Landscape, or at least equal equivalent.

3.5 Minimum Separating Distance and Permeability:

Height (H) of the tallest building	Minimum P of buildings in each assessment zone on two projection planes			
	Site area < 20,000m^2 and with Lp < 60m	*Site* area < 20,000m^2 and with Lp $\geqslant$ 60m	*Site* area $\geqslant$ 20,000m^2	
	Each Plane	Each Plane	Plane 1	Plane 2
H $\leqslant$ 60m	20%	25%	25%	30%
H > 60m	20%	25%	25%	40%

3.6 Minimum Site Coverage of Greenery:

Site Area	*Site* Coverage of Greenery	
	Primary zone	Overall
< 20,000 m^2	12.5%	30%
$\geqslant$ 20,000 m^2	17.5%	40%

(b) Tree Coverage

1 Submit plan drawing or calculation for tree coverage showing the estimated crown spread 10 years after the landscape installation:

2 Tree coverage is defined as the combined plan area under all tree canopies, projected perpendicularly onto the ground/ floor surface, within the Site, where tree canopies are drawn at their estimated spread 10 years after the landscape installation.

3 Evidences for tree diameters prediction shall be provided with reference to examples of existing trees of that species planted in similar conditions in Hong Kong. In order not to overestimate tree crown diameter, the largest dimension permitted in the calculation shall be 12m in diameter for large wide spreading trees.

4 EVA shall be excluded from the total *site* are for the purpose of tree coverage calculation.

(c) Air Ventilation Assessment (AVA)

Between site velocity ratio (SVR) or local velocity ratio (LVR), show that one of these two ratios increases or remain the same in the optimal option compared to the base case, while the other ratio is not reduced.

The annual wind rose (wind probability table) at 400 – 600m of the site should be used. The annual or summer prevailing wind used in the simulation should have an accumulated percentage occurrence of 75% (accumulation starts in the order from the highest occurrence to the lowest). The baseline scheme should meet Design Requirements (1) and (2) of Building Separation under the SBD Guidelines.

Demonstrate credit compliance by following one of the below routes:

Compliance Route 1: CFD Simulation

1 Submit an air ventilation assessment report. The report shall also include simulation assumptions and screen capture of project building, surrounding building and terrain of the 3D model.

2 The site velocity ratio (SVR) and local velocity ratio (LVR) of all test points should be reported.

3 The modelling methodology should adopt prevailing AVA methodology introduced by the government [2], unless specified below.

4 A software validation report from the software developer should be provided to ensure the accuracy of simulation by the software.

5 The below requirements should be fulfilled in the CFD simulation:

5.1 Surrounding buildings and terrain shall be included in the model based on the GIS information from Lands Department, the Government of HKSAR;

5.2 The surrounding area shall be at least, 2H (H being the building height (m) of the tallest building on the project *site*) or 200m away from the project *site* boundary, whichever is larger;

5.3 The terrain area shall be in a size of at least, 10H (H being the building height (m) of the tallest building on the project *site*) or 1000m × 1000m, whichever is larger, with the project placed in the centre;

5.4 For practical reasons, the geometry can be simplified to block.

6 Wind data, such as wind frequency, wind rose, wind profile should be adopted from the appropriate and reliable sources, such as simulated site wind data based on appropriate mathematical models, such as RAMS from PlanD [3] or experimental site wind data from wind tunnel test.

7 If wind profile is not provided from the above sources, applicant can refine the ground roughness and model the wind profile using power law or log law for each wind direction, based on:

2 Technical Circular No.1/06 Annex A - Technical Guide for Air Ventilation Assessment for Developments in Hong Kong, HPLB & ETWB, the Government of HKSAR

3 RAMS wind data. [ONLINE] Available at: http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html [Accessed August 2019]

$$\text{Power Law } \left(\frac{U_z}{U_g}\right) = \left(\frac{Z_z}{Z_g}\right)^{\alpha} \qquad \text{Log Law } U_z = \frac{u_*}{\kappa}\ln\left(\frac{Z}{Z_0}\right)$$

U_z Wind speed at height z from ground
U_G wind speed at reference height (top of wind boundary layer)
Z_z height z from ground
Z_G reference height (top of the wind boundary layer)
α power law exponent
k von Karman constant = 0.4
Z_0 roughness length
u_* friction velocity
Z height z from ground, same as Z_z in power law

Terrain crossed by approaching wind	A	Z_G	Z_0
Sea and open space	≈ 0.15	≈ 300	≈ 0.1
Suburban or mid-rise	≈ 0.35	≈ 400	≈ 1
City centre or high-rise	≈ 0.50	≈ 500	≈ 3

8 These coefficients serve as reference only [4]. Applicant should justify the suitability of coefficients for the project.

9 Detailed Study shall be carried out if it is required under the Technical Circular No. 1/06 of Housing, Planning and Lands Bureau (HPLB) and Environment, Transport and Works Bureau (ETWB). The Detailed Study can carry out by wind tunnel test or CFD under all 16 prevailing wind conditions.

10 The simulation report should be endorsed by a locally qualified professional with 3 years of relevant experience in CFD simulation.

Compliance Route 2: *Wind Tunnel* Test

1. Demonstrate compliance by submitting a wind tunnel test report.

2. The technical standards pertaining to the execution of the current boundary layer wind tunnel studies conform to the guidelines outlined within the Hong Kong Wind Loading Code and are fully in-line with the guidelines of the Air Ventilation Assessment Technical Circular No. 1/06 for developments in Hong Kong.

3. The wind tunnel facilities should comply with the requirements of internationally recognised guides such as the guidelines of the American Society of Civil Engineers (ASCE) Manual of Practice No.67 for Wind Tunnel Studies and the Quality Assurance Manual, AWES-QAM-1-2001 by the Australasian Wind Engineering Society (AWES).

4. The wind profile can be created by the Power Law or the Log Law with appropriate coefficients.

4 Feasibility Study for Establishment of Air Ventilation Assessment System Final Report, Department of Architecture, Chinese University of Hong Kong, Nov 2005

Test Point Locations and Focus Areas for Both Routes

1. The assessment area shall be at least, 1H (H being the building height (m) of the tallest building on the project site) or 100m away from the project site boundary, whichever is larger.

2. Test point shall be placed 2m above pedestrian level within the assessment area.

3. Perimeter test points are positioned on the project site boundary. Typically, about 30 perimeter test points well-spaced out and located will suffice.

4. Overall test points are evenly distributed and positioned in the open spaces, on the streets where pedestrians frequently access. For areas that are not open to the public can be exempted. For practical reasons, around 50 test points may be adequate for typical development sites.

(d) Intra Urban Heat Island Study

1. Provide an Intra-urban Heat Island Study report demonstrating that a maximum Intra-Urban Heat Index (difference between T_{urban} and T_{met}) in summer is less than 0.8 °C through Urban Heat Island Intensity calculation.

2. Temperature calculation shall be carried out for 10 consecutive days, the 10th day temperature profile between 08:00 to 18:00 hours shall be used for current assessment

3. The calculation should use the maximum temperature difference of T_{urban} and T_{met} between 08:00 to 18:00 hours to represent the Intra Urban Heat Index for the Site, where

$$\text{Intra Urban Heat Index} = \text{Max}\left[T(t)_{urban} - T(t)_{met} \right] < 0.8$$

$T(t)_{urban}$ = the predicting urban air temperature at the *Site*
$T(t)_{met}$ = the meteorological air temperature

4. In the report, provide a brief summary of the adopted methodology to calculate the Intra-Urban Heat Index.

5. Assess an individual Intra-Urban Heat Index within the Site and report under appropriate area breakdown with the maximum area of 10 ha.

6. The Intra-Urban Heat Island effect of a project is the contribution to the energy balance at a certain time, which can be quantified by Intra-Urban Heat Index. The Intra-Urban Heat Index here shall be defined by the maximum temperature difference of $T(t)_{urban}$ and $T(t)_{met}$ in the corresponding hour between 08:00 to 18:00 hours on a typical summer day. The detailed calculation methodology shall refer to relevant literature [5,6,7 and 8].

5 Santamouris M. 2001, 'On the impact of urban climate on the energy consumption of buildings', Solar Energy, vol. 70, pp. 201-216.

6 Oke TR. 1988, 'The urban energy balance', Progress in Physical Geography, vol.12, pp. 471-508.

7 Shashua-Bar, L. Hoffman, M. E. 2002, 'The Green CTTC model for predicting the air temperature in small urban wooded sites', Building and Environment, vol. 37, pp. 1279 –1288.

8 Elnahas, M. M., Willimanson, T. J. 1997, 'An improvement of the CTTC model for predicting urban air temperatures', Energy and Building, vol. 25, pp. 41–49.

7. In order to capture Intra-Urban Heat Island effect of the Project precisely, the proposed methodology shall address the air temperature changes due to the Intra-Urban Heat Island Effect.

8. The report shall contain detailed considerations of all the factors listed below:

    8.1 Radiation heat gain/ loss from/ to the environment;

        8.1.1 Direct and diffused solar radiation on surface;

        8.1.2 Shading effect from buildings/ trees;

        8.1.3 Radiant heat loss from urban fabric to the surrounding; and

        8.1.4 Effect of Absorptivity/ Emissivity of surfaces.

    8.2 Thermal storage effect of urban fabric;

        8.2.1 Thermal capacity in participating ground layer, building and tree surface etc.

    8.3 Wind environment;

        8.3.1 Convective heat transfer within urban cluster;

        8.3.2 CFD technique shall be used to assess the ventilation of the Project (refer to section below);

    8.4 Evaporative heat transfer;

        8.4.1 Greenery evapotranspiration;

        8.4.2 Evaporative heat transfer from water features; and

        8.4.3 Evaporative heat transfer from ground surface.

9. Calculation of $T(t)_{met}$ shall refer to reference environmental condition detailed in “Reference Environmental Conditions for Intra-Urban Heat Index Calculation” table.

10. The Applicant should use reference environmental condition in “Reference Environmental Conditions for *Intra-Urban Heat Index* Calculation” table except near ground wind velocity on Project *Site* to calculate $T(t)_{urban}$.

11. In order to calculate $T(t)_{urban}$, the wind environment of the Project shall be derived from CFD using *wind tunnel* data or RAMS data as stipulated in AVA Technical Circular and Technical Guide [9].

9 Housing, Planning and Lands Bureau, and Environment, Transport and Works Bureau 2006, Technical Circular No. 1/06: Air Ventilation Assessments. [ONLINE] Available at: https://www.devb.gov.hk/filemanager/en/content_679/hplb-etwb-tc-01-06.pdf [Accessed August 2019]

12. Reference Environmental Conditions [10] for Intra-Urban Heat Index Calculation

Hours	Air Temperature, T_a (°C)	Relative Humidity, RH (%)	Global Horizontal Irradiance, GHI (W/m^2)	Diffuse Horizontal Irradiance, DHI (W/m^2)	Near Ground Wind Velocity at the Weather Station, (m/s)
1	28.5	83	0	0	0.5
2	28.3	84	0	0	0.4
3	28.1	85	0	0	0.4
4	28.0	85	0	0	0.4
5	27.8	86	0	0	0.4
6	27.7	87	0	0	0.4
7	27.8	86	0	0	0.4
8	28.1	84	154	93	0.4
9	28.5	82	298	161	0.6
10	29.0	79	449	216	0.7
11	29.8	76	573	259	0.8
12	30.3	74	622	272	0.8
13	30.7	73	638	285	0.9
14	30.9	72	602	287	0.9
15	31.0	72	525	254	0.9
16	31.0	72	429	210	0.8
17	30.5	73	290	154	0.7
18	29.9	75	141	89	0.7
19	29.5	77	0	0	0.6
20	29.3	78	0	0	0.6
21	29.1	80	0	0	0.5
22	29.0	80	0	0	0.5
23	28.9	81	0	0	0.5
24	28.7	82	0	0	0.5

13. The Intra-urban Heat Island Study report should be endorsed by a locally qualified professional with 3 years of relevant experience in urban heat island study.

Submittals

(a) Sustainable Building Design Measures

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_05_00	BEAM Plus New DCs submission template for SS 5	✓	✓

10 HKO (Averaged data from 2009 to 2013)

For SS 5(1), please provide the followings:		***PA***	***FA***
SS_05a_01	Scale drawings and calculations to demonstrate compliance with the relevant prescriptive requirements of the light coloured high-*albedo* materials on non-roof impervious surfaces.	✓	✓
SS_05a_02	Reference material catalogues/test reports showing *albedo* values to demonstrate the design intent for the proposed types and finishes of the surface materials regarding the *albedo* requirements of the materials.	✓	-
SS_05a_03	A schedule of external materials, their proposed finishes treatments, and *albedo* requirements of the materials.	✓	-
SS_05a_04	Tender specifications on the *albedo* requirements of the materials	✓	-
For SS 5a(2)& (3), please provide the followings:		***PA***	***FA***
SS_05a_05	Scaled drawings and calculations to demonstrate compliance with relevant prescriptive requirements of the SBD Guidelines (for SS 5a(ii) and/ or (iii) only)	✓	✓
For SS 5a(3), please provide the followings:		***PA***	***FA***
SS_05a_06	Landscape plans, sections planting schedules and extracts of relevant supporting documents showing soft landscape layout, plan density, topsoil of all planted areas for trees, shrubs and grass/groundcover and demonstrating the use of drought-tolerant plant species	✓	✓
SS_05a_07	Live load calculation of roof (if planting is provided on the roof)	✓	✓
SS_05a_08	Maintenance plan of the greenery	-	✓
SS_05a_09	Dated photos of the as-built soft landscape works	-	✓

(b) Tree Coverage

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_05_00	BEAM Plus New DCs submission template for SS 5	✓	✓
SS_05b_01	Landscape plans, sections planting schedules and extracts of relevant supporting documents showing the soft landscape layout of all planted areas for trees, live load calculation of roof (if planting is provided on the roof) and maintenance plan.	✓	✓
SS_05b_02	Summary for the total and breakdowns of tree coverage areas and evidence for tree diameters prediction	✓	✓
SS_05b_03	Live load calculation of roof (if tree planting is provided on the roof)	✓	✓
SS_05b_04	Maintenance plan of the trees	-	✓
SS_05b_05	Dated photos of the as-built soft landscape works	-	✓

(c) Air Ventilation Assessment (AVA)

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_05_00	BEAM Plus New DCs submission template for SS 5	✓	✓
For compliance route 1, please provide the followings:		*PA*	*FA*
SS_05c_01	*Air Ventilation Assessment Report*	✓	✓
SS_05c_02	Validation Report of the simulation software	✓	✓
SS_05c_03	CV of the professional as described in credit requirement	✓	✓
For compliance route 2, please provide the followings:		*PA*	*FA*
SS_05c_04	*Wind Tunnel* Test Report	✓	✓

(d) Intra Urban Heat Island Study

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_05_00	BEAM Plus New DCs submission template for SS 5	✓	✓
SS_05d_01	Intra-urban Heat Island Study report	✓	✓
SS_05d_02	CV of the professional as per requirements in the assessment	✓	✓
SS_05d_03	Landscape plans, sections planting schedules and extracts of relevant supporting documents showing soft landscape layout of all planted areas for trees	✓	✓
SS_05d_04	Summary for the total and breakdowns of tree coverage areas and evidence for tree diameters prediction	✓	✓
SS_05d_05	Validation Report of the simulation software	✓	✓
SS_05d_06	Dated photos of the as-built soft landscape works	-	✓

Remarks

(a) Additional Information

Hong Kong Herbarium on Hong Kong plant species. [ONLINE] Available at: http://www.herbarium.gov.hk/Search_Form.aspx [Accessed 5 July 2017]

Planning Standards and Guidelines Chapter 4 Section 2 Greenery.
General Specification for Building Section 25: Landscape.
Buildings Department- PNAP APP-152 *Sustainable Building Design Guidelines*

(b) Related Credits

SS 1 Green Building Attributes
The related credit requires *site* coverage of greenery and minimum provisions for viability of planting, for example, the minimum soil volumes and depths for all plant areas; and encourages the shading of main pedestrian paths by trees.

SS 4 Biodiversity
The related credit encourages strategies to preserve and/ or enhance the ecological value of the *site* in terms of habitat and biodiversity.

SS 7 Outdoor Thermal Comfort
The related credit considers the positive effect of shading by trees and the surrounding ground surface temperatures of greenery within the site.

SS 8 Stormwater Management
The related credit considers softscape provided with the *site* for infiltration and detention in stormwater management.

WU 2 Water Efficient Irrigation
The related credit considers water efficient irrigation for greenery provided within the *site*.

3 Sustainable *Site* **3.3 Bioclimatic design**

SS 6 Immediate Neighbourhood Wind Environment

Extent of Application Whole Building DC Developments

Objective Ensure the wind environment around and adjacent to buildings has been adequately considered regarding wind amplification and, where appropriate, suitable mitigation measures are provided.

Credits Attainable 1

Credit Requirement 1 credit for demonstrating that no pedestrian areas will be subject to excessive wind velocities caused by amplification due to the *site* layout design and/ or building design.

Assessment

1. Demonstrate that no test point reported exceeds a frequency weighted wind speed of 4m/s for the annual prevailing wind condition unless it is demonstrated that the excess of 4m/s is not caused by the proposed building.

2. The annual wind rose (wind probability table) at 400 – 600m of the *site* should be used. The annual prevailing wind used in the simulation should have an accumulated percentage occurrence of over 75% (accumulation starts in the order from the highest occurrence to the lowest).

3. Demonstrate credit compliance by following one of the below routes:

Compliance Route 1: *CFD* Simulation

1. Submit a wind environment report. The report shall also include simulation assumptions and screen captures of the project building, surrounding buildings and terrain of the 3D model.

2. A software validation report from the software developer should be provided to ensure the accuracy of simulation by the software.

3. The below requirements should be fulfilled in the *CFD* simulation:

   3.1 Surrounding buildings and terrain shall be included in the model based on the GIS information from Lands Department, the Government of HKSAR.

   3.2 The surrounding area shall be at least, 2H (H being the building height (m) of the tallest building on the project *site*) or 200m away from the project *site* boundary, whichever is larger.

   3.3 The terrain area shall be in a size of at least, 10H (H being the building height (m) of the tallest building on the project *site*) or 1000m × 1000m, whichever is larger, with the project placed in the centre.

   3.4 For practical reasons, the geometry can be simplified to blocks.

4. Wind data, such as wind frequency, wind rose, wind profile should be adopted from appropriate and reliable sources, such as simulated *site* wind data based on appropriate mathematical models (e.g. RAMS

from Planning Department, the Government of HKSAR [1]) or experimental *site* wind data from *wind tunnel* test.

5. If the wind profile is not provided from the above sources, applicant can refine the ground roughness and model the wind profile using power law or log law for each wind direction, based on:

$$\text{Power Law } \left(\frac{U_z}{U_g}\right) = \left(\frac{Z_z}{Z_g}\right)^{\alpha} \qquad \text{Log Law } U_z = \frac{u_*}{\kappa}\ln\left(\frac{Z}{Z_0}\right)$$

U_z	Wind speed at height z from ground
U_G	wind speed at reference height (top of wind boundary layer)
Z_z	height z from ground
Z_G	reference height (top of the wind boundary layer)
α	power law exponent
k	von Karman constant = 0.4
Z_0	roughness length
u_*	friction velocity
Z	height z from ground, same as Z_z in power law

Terrain crossed by approaching wind	**α**	**Z_G**	**Z_0**
Sea and open space	≈ 0.15	≈ 300	≈ 0.1
Suburban or mid-rise	≈ 0.35	≈ 400	≈ 1
City centre or high-rise	≈ 0.50	≈ 500	≈ 3

6. These coefficients serve as reference only [2]. Applicant should justify the suitability of coefficients for the project.

7. Detailed Study shall be carried out if it is required under the Technical Circular No. 1/06 of Housing, Planning and Lands Bureau (HPLB) and Environment, Transport and Works Bureau (ETWB). The Detailed Study can carry out by *wind tunnel* test or *CFD* under all 16 prevailing wind conditions.

8. The simulation report should be endorsed by a locally qualified professional with 3 years of relevant experience in *CFD* simulation.

Compliance Route 2: Wind Tunnel Test

1. Demonstrate compliance by submitting a wind tunnel test report.

2. The technical standards pertaining to the execution of the current boundary layer wind tunnel studies conform to the guidelines outlined within the Hong Kong Wind Loading Code and are fully in-line with the guidelines of the Air Ventilation Assessment Technical Circular No. 1/06 for developments in Hong Kong.

3. The wind tunnel facilities should comply with the requirements of internationally recognised guides such as the guidelines of the American Society of Civil Engineers (ASCE) Manual of Practice No.67 for Wind Tunnel Studies and the Quality Assurance Manual, AWES-QAM-1-2001 by the Australasian Wind Engineering Society (AWES).

1 RAMS wind data. [ONLINE] Available at: http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html [Accessed August 2019]

2 Feasibility Study for Establishment of Air Ventilation Assessment System Final Report, Department of Architecture, Chinese University of Hong Kong, Nov 2005

4. The wind profile can be created by the Power Law or the Log Law with appropriate coefficients.

Test Point Locations for Both Routes

1. The assessment area shall be at least, 1H (H being the building height (m) of the tallest building on the project *site*) or 100m away from the project *site* boundary, whichever is larger.

2. Test points shall be placed 2m above pedestrian level within the assessment area.

3. Perimeter test points are positioned on the project *site* boundary. Typically, about 30 perimeter test points which are well-spaced out and well located will suffice.

4. Overall test points are evenly distributed and positioned in the open spaces, on the streets where pedestrians frequently access. For areas that are not open to the public can be exempted. For practical reasons, around 50 test points may be adequate for typical development *sites*.

5. Additional test points shall be placed in outdoor recreational areas, open spaces and pedestrian paths within the project *site*.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_06_00	BEAM Plus New DCs submission template for SS 6	✓	✓
For compliance route 1, please provide the followings:		*PA*	*FA*
SS_06_01	Wind Environment Report	✓	✓
SS_06_02	Validation Report of the simulation software	✓	✓
SS_06_03	CV of the professional as per requirements in the assessment	✓	✓
For compliance route 2, please provide the followings:		*PA*	*FA*
SS_06_04	*Wind Tunnel* Test Report	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

3 Sustainable *Site* **3.3 Bioclimatic Design**

SS 7 Outdoor Thermal Comfort

Extent of Application Whole Building Data Centre Development with a *site* area of 1,000 m^2 or more.

Objective Ensure adequate thermal comfort of outdoor environment within the *Site*

Credits Attainable 2 BONUS

Credit Requirement

(a) Shaded or Covered Routes

1 BONUS is awarded where at least one shaded or covered route, connecting the *site* with nearby amenities/ *site* main entrance/ transport hub.

(b) Passive Open Spaces with Thermal Comfort

1 BONUS is awarded where 50% or more of the passive open spaces and pedestrian zones achieve thermal comfort. This is demonstrated on a typical summer day at 3:00 pm in Hong Kong.

Assessment

(a) Shaded or Covered Routes

1. Demonstrate at least one pedestrian route within the site from a notional building entry point to neighbourhood amenities/ site main entrance/ transport hub with shade or cover. The provision of shade or cover is confined to the site boundary.

2. The shape of shade or cover can be justified by daylight simulation software considering building self-shading and shading by exterior buildings and trees at the summer solstice at 9:00 am and 3:00 pm in Hong Kong.

(b) Passive Open Spaces with Thermal Comfort

1. This credit applies to passive open space(s) [1] and pedestrian zone(s) within the Site Area. A pedestrian zone includes covered, but not enclosed areas such as covered walkways and covered sitting areas.

2. Submit an outdoor thermal comfort report demonstrating anticipated thermal comfort. The report should include the following:

   2.1. Scale drawing(s) depicting the building disposition; and

   2.2. Input data, picture of the 3D model, simulation assumptions

3. Relevant input data should be justified by applicant.

4. The report should be endorsed by a locally qualified professional who has 3 years of relevant experience in outdoor thermal comfort study.

5. The assessment should be based on the following approaches:

   5.1. All passive open spaces and pedestrian routes, hereafter referred to as the Focus Areas, within the *Site* should be included

1 Planning Department – Hong Kong Planning Standards and Guidelines Chapter 4 : Recreation, Open Space and Greening

in the assessment. A demarcation plan of the Focus Areas should be provided in the report

5.2. The climatic conditions of a typical summer day should make reference to the environmental conditions in Table "Reference Environmental Conditions" below, which are based on a 5-year average from 2009 to 2013

5.3. A brief summary of the selected thermal comfort calculation methodology, together with the selected method's recommended thermal comfort range, should be clearly stated in the report.

6. Reference Environmental Conditions [2]

Time	Global Horizontal Irradiance, GHI (W/m^2)	Direct Normal Irradiance, DNI (W/m^2)	Diffuse Horizontal Irradiance, DHI (W/m^2)	Air Temp., T_a (°C)	Relative Humidity, RH (%)
3PM	525	340	254	31.0	72

7. Demonstrate credit compliance by following one of the below routes:

Compliance Route 1: Thermal Sensation Index (TSI)

TSI [3] can be established using the following formula:

$$TSI = 1.7 + 0.1118 \times T_a + 0.0019 \times SR - 0.322 \times WS - 0.0073 \times RH + 0.0054 \times ST$$

Where,

T_a = air temperature (°C)

SR = horizontal solar radiation (W/m^2)

WS = wind speed (m/s)

RH = relatively humidity (%)

ST = surrounding ground surface temperature (°C)

TSI should be based on the following:

1. Refer to reference environmental conditions shown in Table above, which outlines solar irradiation, air temperature, and relatively humidity to assess outdoor thermal comfort;

2. Surrounding ground surface temperature (ST) of Air Temperature plus 3°C, (i.e. Ta + 3°C) should be used in the TSI equation;

3. Wind environment of the Site shall use Computational Fluid Dynamics (CFD) technique to assess air velocity (m/s) of the Project. The methodology of using CFD in outdoor urban scale studies shall refer

2 HKO (Averaged data from 2009 to 2013)

3 Givoni, B., M. Noguchi, H. Saaroni,O, Pocher, Y., Yaacov, N. Feller and S. Becker 2003, Outdoor comfort research issues, Energy and Buildings vol. 33, pp. 77-86.

to *Air Ventilation Assessment* (AVA) Technical Circular and Technical Guide [4];

4. Thermal comfort assessment shall consider the effect of shading from immediate surroundings, for example, trees, shading devices, self-shading from buildings; and

5. The calculations should be based on an area breakdown in the range between 1m^2 and 100m^2.

Where it is demonstrated that 50% or more of the passive open spaces and pedestrian zones, in terms of area, have achieved thermally acceptable range on **a typical summer day at 3:00 pm**, the credit will be awarded.

TSI	Thermal Sensation	
1	Cold	Too cold
2	Slightly Cold	
3	**Acceptably cool**	**Thermally acceptable range**
4	**Neutral**	
5	**Acceptably warm**	
6	Slightly Hot	Too hot
7	Hot	

Compliance route 2: Physiological Equivalent Temperature (PET)

PET [5] should be used to assess the outdoor thermal comfort. Mean radiant temperature, T_r (Air Temperature plus 3°C, (i.e. Ta + 3°C) shall be used.

Thermal Perception	TPC for subtropical region	Range of thermal comfort
Very cold	< 14	Too cold
Cold	≥ 14 to < 18	
Cool	≥ 18 to < 22	
Slightly cool	**≥ 22 to < 36**	**Range of thermal comfort**
Neutral	**≥ 26 to < 30**	
Slightly warm	**≥ 30 to < 34**	
Warm	≥ 34 to < 38	Too hot
Hot	≥ 38 to < 42	
Very hot	≥ 42	

Where it is demonstrated that 50% or more of the passive open spaces and pedestrian zones, in terms of area, have achieved the range of thermal comfort **on a typical summer day at 3:00 pm**, the credit will be awarded.

Alternative Route

1. The study may elect any widely accepted methodology to demonstrate that the thermal comfort is in accordance with the credit requirement.

4 Housing, Planning and Lands Bureau, and Environment, Transport and Works Bureau 2006, Technical Circular No. 1/06: air ventilation assessments

5 Hoppe, P. 1999, 'The physiological equivalent temperature—A universal index for the biometeorological assessment of the thermal environment', International Journal of Biometeorology, vol. 43, pp. 71–75.

2. Should any method other than the Thermal Sensation Index (TSI) or Thermal Physiological Equivalent Temperature (PET) be chosen to demonstrate thermal comfort in outdoor spaces (e.g. or equivalent indicator/ index for thermal comfort level), supplementary information on methodology, calculation and/ or simulation results should be supplied. The onus is placed on the Applicant to demonstrate the appropriateness of the chosen methodology and relevant precedent(s) where the elected methodology was used and accepted by professionals in the field.

Submittals

(a) Shaded or Covered Routes

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_7_00	BEAM Plus New DCs submission template for SS 7	✓	✓
SS_7a_01	*Site* plan highlighting at least one shaded or covered pedestrian route	✓	✓
SS_7a_02	Schematics of shades or cover	✓	✓
SS_7a_03	Daylight simulation results to justify shape of shades/cover (if applicable)	✓	✓

(b) Passive Open Spaces with Thermal Comfort

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_7_00	BEAM Plus New DCs submission template for SS 7	✓	✓
SS_7b_01	Outdoor thermal comfort report	✓	✓
SS_7b_01	CV of professional as described in credit requirement	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

3 Sustainable *Site* **3.4 Climate Resilience and Adaptability**

SS 8 Stormwater Management

Extent of Application Whole Building Data Centre Development with a *site* area of 1,000 m^2 or more.

Objective Encourage a high standard of stormwater management to reduce risk of flooding and promote groundwater recharge.

Credits Attainable 1 + 1 additional BONUS

Credit Requirement 1 credit for demonstrating that adequate stormwater management design measures have been provided to cater the total volume of runoff for one hour corresponding to a design rainfall of at least 30mm/event for the site in its post-developed conditions.

1 additional BONUS credit for the adopted measures that are able to cater at least 40mm/event for the site in its post-developed conditions.

Assessment

1. Calculate the stormwater detention storage volume on site required to cater the total volume of runoff for one hour using the following formula:

   $V = 10 \times H \times \sum_{\varphi} \times A / 10000$

   V: Stormwater storage volume on site required (in m^3)

   H: Rainfall intensity (30mm or 40mm for the credit/ bonus respectively) per event

   φ: *Runoff coefficient*s of various surfaces/ substrates (please refer to the following table)

   A: Areas of various surfaces/ substrates (in m^2)

Surfaces/ substrates	***Runoff coefficients***
Water bodies	1
Flat roof/ road/ hardscape with impervious construction	0.85
Flat roof covered with pebbles	0.65
Green roof (soil depth of at least 300mm)	0.35
Earth-covered (soil depth not more than 500mm) basement	0.35
Pervious paving and construction (maximum slope of porous pavement surface to a gradient of 1:20; the minimum *permeability coefficient* under 15℃ for	0.25

permeable paving / construction should be 1.0 x 10-2 cm/s)	
At-grade softscape	0.15
Earth-covered (soil depth more than 500mm) basement	0.15

Note:

1) The above information has made reference to the design guides for stormwater management/runoff control GB50014 and DB11/685 of PRC.

2) Alternative *runoff coefficients* may be proposed and justified by the Applicant which is subject to approval.

2. Calculate the volume of various designed stormwater management facilities such as detention tanks, sunken plaza/ wet ponds/ reservoirs, *bioretention facilities*, rainwater storage cisterns/ modules, etc.

3. Demonstrate adequate stormwater management measures to meet the credit requirements have been provided by a stormwater management report with a summary of volume/ area calculations, layout drawings and photographic records.

4. Stormwater detention volume will be discharged either by gravity or pumping.

5. It is required to empty the tank within a day to ensure the detention volume is daily available for potential storm event.

6. Stormwater in detention volume will be discharge after 1 hour of rainstorm.

7. For any detention facility with discharge mechanisms, control system is required for discharging the stormwater in order to maintain the daily designed detention volume.

8. Handover the facilities with operation and maintenance checklist as stated in Appendix 9 – 9.4

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_8_00	BEAM Plus New DCs submission template for SS 8	✓	✓
SS_8_01	Report for stormwater management with a summary of volume/ area calculations, layout drawings and typical construction details/sections of infiltration measures	✓	✓

SS_8_02	Catalogue and test report of the pervious hardscape material	-	✓

Remarks

(a) Additional Information

Sponge City Construction Technical Guide by Ministry of Housing and Urban-Rural Development of PRC

Managing Peak Runoff at Source [ONLINE] Available at:

https://www.pub.gov.sg/Documents/detentionTank.pdf [Accessed 5 July 2017]

Pervious Pavement [ONLINE] Available at:

http://www.asphaltpavement.org/index.php [Accessed 5 July 2017]

Water Permeable Brick (JCT 945 – 2005)

(b) Related Credits

SS 1 Green Building Attributes

The related credit requires site coverage of greenery and minimum provisions for viability of planting, for example, the minimum soil volumes and depths for all plant areas; and encourages the shading of main pedestrian paths by trees.

SS 4 Biodiversity

The related credit encourages preservation/enhancement of existing habitat within the *site*.

SS 7 Outdoor Thermal Comfort

The related credit considers the positive effect of shading by trees and the surrounding ground surface temperatures of greenery within the *site*.

WU 6 Water Harvesting and Recycling

The related credit considers harvesting of rainwater provided within the *site*. Stormwater collected under SS11 could only be discharged

3 Sustainable *Site* **3.4 Climate Resilience and Adaptability**

SS 9 Design for Climate Change Adaptation

Extent of Application Whole Building Data Centre Development

Objective Encourage reviewing the impact of the projected climate change scenarios on the development and consider strategies to improve climate resilience.

Credits Attainable 1 BONUS

Credit Requirement 1 BONUS for studying the projected variation in temperature and rainfall and water level rise/ storm surge of adjacent water bodies due to climate change and its impact on the development and prepare mitigation proposal to improve the climate resilience of the building.

Assessment

1. Refer to the projected annual rainfall and changes in annual temperature under the medium-low scenario (mean value) [1] and water level rise/ storm surge of adjacent water bodies, suggest 3 negative issues caused by the projected variations which will have impacts on the building such as its structure, facade, outdoor area or building services system.

2. Prepare a climate resilience proposal including at least 1 strategy for each of the above-mentioned negative issue. The strategies should be supported by preliminary design description and expected outcome on resolving the respective negative issue. If necessary, assume a building life cycle of 50-years to outline the possible benefits. No simulations are required for the first BONUS credit. Additional BONUS is granted if applicant demonstrated that the design is cost effective.

3. Note that no obligation is required to implement the proposal.

4. Relevant measures that have been implemented in the design in other credits may be included to demonstrate compliance for this credit.

   Climate Resilience proposal should include a minimum of 10 A4 pages with sections below:

   i. Description of project annual climate change
   ii. Impact Identification
   iii. Proposal of the Climate Resilience Strategies
   iv. Effectiveness of the proposed strategies
   v. Cost effectiveness (for additional BONUS)

1 Hong Kong Observatory - Climate Projections for Hong Kong. [ONLINE] Available at: http://www.hko.gov.hk/climate_change/future_climate_e.htm [Accessed August 2019]

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
SS_9_00	BEAM Plus New DCs submission template for SS 9	✓	✓
SS_9_01	Climate resilience proposal	✓	✓

Remarks

(a) Additional Information

GovHK – Global Environment Climate Change. [ONLINE] Available at: http://www.gov.hk/en/residents/environment/global/climate.htm [Accessed August 2019]

Environment Bureau - Hong Kong Climate Change Report 2015. [ONLINE] Available at: http://www.enb.gov.hk/sites/default/files/pdf/ClimateChangeEng.pdf [Accessed August 2019]

EPD – Climate Change. [ONLINE] Available at: http://www.epd.gov.hk/epd/english/climate_change/ [Accessed August 2019]

Hong Kong Observatory - Climate Projections for Hong Kong. [ONLINE] Available at: http://www.hko.gov.hk/climate_change/future_climate_e.htm [Accessed August 2019]

(b) Related Credits

None

4 Materials and Waste

4.P Prerequisite
4.1 Use of Materials
4.2 Selection of Materials
4.3 Waste Reduction

Introduction

In construction, operation, maintenance and fitting-out of buildings; environmentally-sustainable natural resources should be used as materials to a significant extent. Practical considerations should include extracted raw materials, emissions and embodied energy. There are opportunities to reduce environmental impacts through improved design, choice of materials, and installation methods. The following are of concern:

- Pollutants arising from manufacturing, transportation and operation; and
- Waste generated and recycled

There are opportunities to reduce the use of materials through modular designs allowing off-site prefabrication, lean construction methods, etc.; and to reduce waste from a life cycle perspective, including provisions of appropriately designed waste facilities for waste recycling/ recovery/ *reuse*.

4.P Prerequisite

MW P1 Minimum Waste Handling Facilities

Background

This part sets out the minimum requirement for materials aspects in terms of the provision of waste handling facilities.

4.1 Use of Materials

MW 1 Building Re-use
MW 2 Best Practice on Materials Usage

Background

Efficiency in the use of materials can be significantly improved through *reuse* of building elements, such as foundations, main structures, facades, etc. Best practices on material usage such as flexibility in design allows for change in the use of layout of the premises within a building development; high standards of design detailing permit off-site prefabrication of major building components allow for deconstruction, and improves durability and longevity of buildings.

4.2 Selection of Materials

MW 3 Sustainable Forest Products
MW 4 Recycled Materials
MW 5 Ozone Depleting Substances
MW 6 *Regional Materials*
MW 7 Use of Green Products
MW 8 Life Cycle Assessment

Background

The selection of materials that are environmentally sustainable, have significant recycled content, or otherwise have relatively low environmental impacts and result in lower *embodied energy*, should be considered at the earliest stages of planning and design of building developments, and carried over to the fitting-out and subsequent redecoration.

4.3 Waste Reduction

MW 9 Enhanced Waste Handling Facilities

Background

Well-managed facilities for the recycling of solid waste encourage recycling and result in reductions in the disposal at landfill *sites*. Buildings should be designed with the provision of facilities for effective on-site sorting, collection, and recycling/ reusing of waste.

4 Materials and Waste

4.P Prerequisite

MW P1 Minimum Waste Handling Facilities

Extent of Application

All DCs.

Objective

Reduce waste generation at source, reduce pressure on landfill *sites* and help to preserve *non-renewable resources* by promoting recycling of waste materials

Credits Attainable

Prerequisite

Credit Requirement

Prerequisite achieved for meeting minimum provisions of waste recycle facilities for the collection, sorting, storage, recycling (recovered material) and disposal (waste).

Assessment

For Whole Building DC Developments

The assessment shall take into account how a system of waste collection, storage, sorting, recycling and disposal can be managed for the buildings, with consideration given to the adequacy of space provisions on individual floors, within the building as a whole, and at local/ estate level. There should be opportunities for the management of different waste types, such as organic, non-recyclable and recyclable waste. Easy access to the facilities shall be provided for cleaning staff, contractors, building users and waste recycling and collection companies.

(a) Recycle & Waste Management Strategy Plan

Provide proposal to:

1. Identify and estimate the quantities of expected waste streams (organic, recyclable and non-recyclable) of the development;

2. Demonstrate compliance with the space requirement of waste recycling facilities (for waste storage, sorting and recycling) as listed in (b);

3. Demonstrate storage for recycling of, as a minimum, materials listed in (c); and

4. Demonstrate management plan, accessibility and hygiene. It includes the outlines of how the municipal solid waste disposal rate can be reduced by the waste management hierarchy - prevention, *reuse*, recycling, recovery and disposal; what is the collection and separation methodology of waste and recyclables; and how the building users dispose refuses and recyclables and janitorial staffs collect and deliver to refuse storage and material recovery chambers (RS&MRC) & Refuse Chutes.

(b) Waste Recycling Facilities

1. Refuse storage and material recovery chambers (RS&MRC) Provision
Demonstrate RS&MRC of adequate size to cope with the waste generated. Prescribed space requirements are listed below:

Overall floor space of RS&MRC[#]
1m^2 per 925m^2 UFS
Remarks: • UFS = Usable Floor Area • The provision of Refuse Storage & Material Recovery Chamber (RS&MRC) is required under "Schedule" in B(RS&MRC&RC)R. • RS&MRR shall not be included in the RS&MRC space requirement calculation. Additional areas of waste and recycling facilities provided in addition to the statutorily required RS&MRR can be counted.

2. Mechanical ventilation and air purifying facilities for every RS&MRC is statutorily-required under Reg.12A of B(RS&MRC&RC)R.

(c) Minimum Types of Recyclables to be Collected

1. Metal;
2. Plastics;
3. Paper/ Cardboard; and
4. Glass.

For DC Developments located in part of building

(a) Recycle & Waste Management Strategy Plan

Provide proposal to:

1. Identify and estimate the quantities of expected waste streams (organic, recyclable and non-recyclable) of the development;

2. Demonstrate storage for recycling of, as a minimum, materials listed in (c); and

3. Demonstrate management plan, accessibility and hygiene. It includes the outlines of how the municipal solid waste disposal rate can be reduced by the waste management hierarchy - prevention, reuse, recycling, recovery and disposal; what is the collection and separation methodology of waste and recyclables; and how the building users dispose refuses and recyclables and janitorial staffs collect and deliver to refuse storage and material recovery chambers (RS&MRC) & Refuse Chutes.

(b) Recycle & Waste Management Strategy Plan

1. The Applicant shall provide at least one (1) storage facility with the capacity for paper, plastic and metal materials. The facility shall be placed in prominent location (i.e. cannot be located in a car park or other non-occupied areas), but not necessary within the project space. The storage facility size, and collection frequency are not regulated.

2. A waste collection firm employed by either Applicant or property management company shall collect all materials. Where the host building provides such a facility at prominent location, the Applicant is not required to duplicate it, if the host building management provides the required information for Assessment.

(c) Minimum Types of Recyclables to be Collected

1. Metal
2. Plastics
3. Paper/ Cardboard, and
4. Glass

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_P1_00	BEAM Plus New DCs submission template for MW P1	✓	✓
MW_P1_01	Recycle & Waste Management Strategy Plan	✓	✓
For Whole Building DC Developments, please provide the followings:			
MW_P1_02	Calculation showing the estimated quantities of expected waste streams	✓	✓
MW_P1_03	Drawings showing the locations of the waste handling facilities	✓	✓
MW_P1_04	Calculation showing the adequacy of the space requirement for the waste handling facilities	✓	✓
MW_P1_05	As-fitted drawings	-	✓
MW_P1_06	Alternative proposal on the provision of waste recycling facilities (if applicable)	✓	✓
For DC Developments located in part of building, please provide the followings:			
MW_P1_07	Information of responsible person	✓	✓
MW_P1_08	Drawings showing the locations of the waste handling facilities in host building	✓	✓
MW_P1_09	As-fitted drawings	-	✓
MW_P1_10	Record photographs	-	✓
MW_P1_11	Collection organisation/ recycler information, including: 1) Company name, address and contact information; 2) Collection frequency; and 3) Collection agreement signed by the Recycling firm and Applicant. Where the Applicant adopts the host building facility, the host building Collection Agreement (or an equivalent letter by the Property Manages organisation)	-	✓

Remarks

(a) Additional Information

Buildings Department. Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineer. PNAP APP-35 on requirements for Refuse Storage and Material Recovery Chambers, Material Recovery Chambers.

Environmental Protection Department. Waste Data & Statistics. [ONLINE] Available at:

http://www.wastereduction.gov.hk/en/assistancewizard/waste_red_sat.htm [Accessed August 2019]

(b) Related Credits

MW 12 Enhanced Waste Handling Facilities
This credit encourages enhanced provisions for recyclables collection, recycling facilities and waste treatment equipment.

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4 Materials and Waste **4.1 Use of Materials**

MW 1 Building Re-use

Extent of Application Whole Building DC Developments

Objective Encourage the reuse of major elements of existing building structures, to reduce demolition waste, conserve resources and reduce environmental impacts during construction.

Credits Attainable 3 BONUS

Credit Requirement 1 BONUS credit for the reuse of 20% or more (by mass or volume) of existing structures (sub-structure and superstructure).

2 BONUS credits for 40%.

3 BONUS credits for 90%.

Assessment

1. Provide all of the following supporting documents:
   - 1.1 Outline the extent of *reused* major building elements from the existing building;
   - 1.2 Include calculations with details of pre and post construction, drawings, and supporting documentation; and
   - 1.3 Demonstrate that the quantity (by mass or volume) of the retained and *reused* portions of the major building elements from the existing building *sub-structure* and *superstructure*, as a percentage of the quantity (by mass or volume) of the major building elements in the new building *sub-structure* and *superstructure*. Credits will be awarded where the prescribed percentage is achieved.
2. Existing major building elements to be reused include:
   - 2.1 Sub-structure (including foundation)
   - 2.2 Superstructure
   - 2.3 Enclosure materials (excluding windows, doors and similar assemblies)

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_01_00	BEAM Plus New DCs submission template for MW 1	✓	✓
MW_01_01	Pre and post construction details, structural drawings that demonstrate the re-use of the *sub-structure* and *superstructure*	✓	✓
MW_01_02	Calculation showing the percentage of *sub-structure* and *superstructure* being *reused*	✓	✓
MW_01_03	Report summarising the extent of *reuse*d major building elements from existing building, with structural drawings that support the extent.	✓	-

Remarks **(a) Additional Information**

None

(b) Related Credits

None

4 Materials and Waste **4.1 Use of Materials**

MW 2 Best Practice on Material Usage

Extent of Application All DCs

Objective Encourage the efficient use of material through adoption of green DC best practices

Credits Attainable 2 credits

Credit Requirement 2 credits for demonstrating the adoption of at least four (4) best practices relating to the efficient use of materials as mentioned in the Green Data Centre Practice Guide published by BEAM Society Limited (BSL).

Assessment

1. Demonstrate the adoption of best practice on efficient use of material as mentioned in the Green DC Practice Guide published by the BSL.

2. The adopted best practice should be from the following aspects as listed in the Green DC Practice Guide published by BSL:

   2.1 Green Construction

   2.2 Green Disposal

3. Prepare a technical report detailing the following:

   3.1 List of each adopted best practice;

   3.2 Detailed description of each adopted best practice and explanation on how it could benefit the DC development; and

   3.3 Evidences showing the adoption of the best practice including specifications specifying the application of the best practice, on-site photograph records, drawings, calculation, etc.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_02_00	BEAM Plus New DCs submission template for MW 2	✓	✓
MW_02_01	Technical report summarising the adopted best practice	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

4 Materials and Waste **4.2 Selection of Materials**

MW 3 Sustainable Forest Products

Extent of Application All DCs, except DC with an insignificant amount of timber products being adopted (e.g. all timber products used in the building consists of five sets of doors only).

Objective Encourage the use of timber from well-managed forests.

Credits Attainable 1 + 1 additional BONUS

Credit Requirement 1 credit for demonstrating at least 50% of all timber and composite timber products used for DCs are from sustainable sources/ recycled timber.

1 additional BONUS credit for 90%.

Assessment

1. Provide supporting documents quantifying the amount of forest products used are from sustainable source/ recycled (*reused* from other sites) timber, as a percentage of all the timber and composite timber products used. Timber products or accessories of an insignificant amount and not forming part of timber doors, flooring, skirting, wall panels, ceiling systems and built-in furniture can be ignored in the calculation for simplification. The unit may be mass/ volume/ dollar value but shall be consistent throughout the assessment of this credit.

2. The timber should conform to the requirement of sustainable forestry practice guidelines and accredited by recognised organisations, such as the non-profit Forest Stewardship Council (FSC) [1] or the American Forest and Paper Association (AFPA) [2]or Programme for the Endorsement of Forest Certification (PEFC) [3] or “known licensed sources” [4].or “known licensed sources” [5]. The Client shall demonstrate compliance with the specification for timber products with the recommended certifications (e.g. FSC, AFPA or PEFE).

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_03_00	BEAM Plus New DCs submission template for MW 3	✓	✓
MW_03_01	MW-03-1_Form_r1	✓	✓

1 Forest Stewardship Council. [ONLINE] Available at: http://www.fsc.org/ [Accessed August 2019]

2 American Forest and Paper Association. [ONLINE] Available at: http://www.afandpa.org/ [Accessed August 2019]

3 Programme for the Endorsement of Forest Certification. [ONLINE] Available at: https://www.pefc.org/ [Accessed August 2019]

4 Architectural Services Department, General Specifications for Building 2017, Section 13, Carpentry and Joinery. [ONLINE] Available at: https://www.archsd.gov.hk/media/291197/gs2017.pdf [Accessed August 2019]

5 Architectural Services Department, General Specifications for Building 2012, Section 13, Carpentry and Joinery, 13.01.03.

MW_03_02	Final summary table showing the product details, suppliers, source of sustainable forest, quantities, percentage of timber products originated from sustainable source.	-	✓
	The summary table shall be prepared and declared by the main contractor.	✓	-
MW_03_03	Specifications specifying the use of sustainable timber	✓	-
MW_03_04	Timber product compliance certificate	-	✓

Remarks

(a) Additional Information

World Wildlife Fund, Guide to Responsible Purchasing of Forest Products provides guidelines, templates and implementation measures to help organisations develop purchasing policies and practices that help conserve forest resources.

Buildings Department PNAP ADV-5 gives guidance for alternatives to the use of hardwoods in order to reduce the amount of tropical hardwood timber used in building projects.

(b) Related Credits

IDCM P2 Timber used for Temporary Works

The prerequisite requires no virgin forest products to be used for temporary works during construction.

4 Materials and Waste **4.2 Selection of Materials**

MW 4 Recycled Materials

Extent of Application All DCs

Objective Promote the use of recycled materials in order to reduce the consumption of virgin resources.

Credits Attainable 1 + 2 additional BONUS

Credit Requirement 1 credit for using recycled materials for one of the building components listed below, maximum up to 1 credit:

1) Outside Surface Works and Structures;
2) Building Façade and Structural Components; and
3) Interior Non-structural Components.

1 additional BONUS credit for compliances with all requirements listed sub-items.

2 additional BONUS credits for achieving 50% or more of all materials used for sub-items are materials with recycled content.

Assessment 1 credit for using recycled materials for one of the building components listed below, maximum up to 1 credit:

1. Outside Surface Works and Structures:

1.1 Demonstrate at least 10% of all materials used for site exterior surface works, structures and features with recycled content.

1.2 Provide all of the following supporting documents:

i. List the materials/ items/ products used that contain recycled material (minerals, plastics, etc.); and

ii. Demonstration for the target percentage of materials/ items/ products with recycled content as compared to all used for exterior surfacing works and structures

1.3 Exterior surfacing works and structures include paths, surfaces for recreational areas, structures such as seating, playground features, etc.

1.4 The unit may be mass/ volume/ dollar value but shall be consistent throughout the assessment of this credit.

2. Building Façade and Structural Components

2.1. 1 credit where at least 10% of all materials used for facade and structural components are materials with recycled content; **or**

the use of Pulverised Fuel Ash (PFA) as a partial cement replacement in concrete that the PFA content is not less than 25%; **or**

the use of Ground Granulated Blast-furnace Slag (GGBS) as a partial cement replacement in concrete that the GGBS content is not less than 40%.

2.2. Provide all of the following supporting documents:

i. List the materials/ items/ products used that contain recycled materials; and

ii. Demonstration for the target percentage of materials/ items/ products with *recycled content* as compared with all used for facade and structural components

2.3. The unit may be mass/ volume/ dollar value but shall be consistent throughout the assessment of this credit.

2.4. Crushed concrete aggregate complying with the quality and grading requirements of British Standard BS EN 12620 [1] or similar for use in concrete for foundations. The fills in foundations and for over-site use of recycled materials should comply with the requirements of BS 6543 [2] or similar specification.

2.5. Steel and glass which normally consist of recycled content will not be considered as materials with recycled content for this credit.

3. Interior Non-structural Components

3.1. 1 credit where at least 10% of all materials used for interior non-structural components are materials with recycled content.

3.2. Provide all of the following supporting documents:

i. List the materials/ items/ products used that contain recycled materials; and

ii. Demonstration for the target percentage of materials/ items/ products with *recycled content* as compared with all materials used for interior non-structural components.

3.3. The unit may be mass/ volume/ dollar value but shall be consistent throughout the assessment of this credit.

1 British Standards Institution. Aggregates for concrete. British Standard BS EN 12620:2002+A1:2008.

2 British Standards Institution. Guide to use of industrial by-products and waste materials in building and civil engineering. British Standard BS 6543: 1985.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_04_00	BEAM Plus New DCs Submission template for MW 4	✓	✓
MW_04_01	MW-06-4_Form_r1	✓	✓
MW_04_02	MW-06-4_Form_r1	✓	✓
MW_04_03	MW-06-4_Form_r1	✓	✓
MW_04_04	Summary table with product details, suppliers, recycled materials used, quantities, percentage of elements (outside surface works and structure, building façade and structural components, interior non-structural components) made from recycled materials.	-	✓
	The estimation table shall be prepared and declared by the main contractor/ owner.	✓	-
MW_04_05	Specifications specifying the use of recycled materials	✓	-
MW_04_06	Catalogues or information to demonstrate that the outside surface works and structures are made from recycled materials	-	✓
MW_04_07	As-fitted drawings	-	✓

Remarks

(a) Additional Information

A list of Recycled Materials for Construction Industry is available from the Environmental Protection Department.

Buildings Department PNAP APP-129 on Use of Recycled Aggregates in Concrete sets out the technical guidelines for using recycled aggregates in prescribed mixed concrete of specified grade strength of 20P and designed mixed concrete of specified grade strengths of 25D to 35D.

CIC & HKCI's study on PFA. [ONLINE] Available at: http://www.hongkongci.org/wp-content/uploads/2016/06/Better-Utiilzation-of-Ultimate-Strength-Gain-of-Concrete-with-Pozzolanic-Materials-for-Sustainable-Development-of-Construction-Works-in-HK-Ir-Prof.-Albert-K.-H.-Kwan.pdf [Accessed August 2019]

CEDD study on *GGBS*. [ONLINE] Available at: http://www.devb.gov.hk/filemanager/en/content_763/Part%203%20-%20H%20D%20Wong%20&%20J%20Y%20W%20Mak.pdf [Accessed August 2019]

British Standards Institution. Aggregates for concrete. British Standard BS EN 12620:2002+A1:2008

British Standards Institution. Guide to use of industrial by-products and waste materials in building and civil engineering. British Standard BS 6543: 1985.

(b) Related Credits

None

4 Materials and Waste **4.2 Selection of Materials**

MW 5 Ozone Depleting Substances

Extent of Application All Building Equipment & insulation servicing the Assessed DC.

Objective Reduce the release of harmful ozone-depleting substances into the atmosphere.

Credits Attainable 2

Credit Requirement

(a) Refrigerants

1 credit for the use of refrigerants with a value less than or equal to the threshold of the combined contribution to ozone depletion and global warming potential using the specified equation.

(b) Ozone Depleting Materials

1 credit for the use of products in the building fabric and services that avoid using ozone depleting substances in their manufacture, composition or use.

Assessment

(a) Refrigerants

1. The air-conditioning and refrigeration equipment shall fulfil the following equation which determines a maximum threshold for the combined contributions to ozone depletion and global warming potential:

$$LCGWP + LCODP \times 10^5 \leq 13$$

LCGWP = [GWPr x (Lr x Life + Mr) x Rc] / Life

LCODP = [ODPr x (Lr x Life + Mr) x Rc] / Life

LCGWP = Lifecycle *Global Warming Potential* (kg CO2 /kw -Yr)

LCODP = Lifecycle Ozone Depletion Potential (kg CFC 11/kw-Yr)

GWPr = *Global Warming Potential* of Refrigerant (0 to 12,000 kg CO2/kg r)

ODPr = Ozone Depletion Potential of Refrigerant (0 to 0.2 kg CFC11/kg r)

Lr = Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)

Mr = End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)

Rc = Refrigerant Charge

Life = Equipment Life (10 years; default based on equipment type as listed in table below, unless otherwise demonstrated)

Equipment	**Default Equipment Life**
Window air-conditioner, heat pump	10 years
Unitary, split, packaged air-conditioner, package heat pump	15 years
Reciprocating and scroll compressor, reciprocating chiller	20 years
Absorption chiller	23 years

Water-cooled packaged air-conditioner	24 years
Centrifugal chiller	25 years

2. For systems with different types of equipment, a weighted average of all the air-conditioning and refrigeration equipment shall be calculated using the following equation:

$$\lceil \Sigma (LCGWP + LCODP \times 10^5) \times Qunit \rceil / Qtotal \leq 13$$

Qunit = Gross ARI rated cooling capacity of an individual air-conditioning or refrigeration unit (kW)

Qtotal = Total gross ARI rate cooling capacity of all air-conditioning or refrigeration (kW)

3. Small air-conditioning units, defined as those containing less than 0.23 kg of refrigerant, and other equipment, such as standard refrigerators, small water coolers and any other cooling equipment that contains less than 0.23 kg of refrigerant, can be excluded from this assessment.

4. Provide calculation endorsed by locally qualified professional who has at least 3 years of post-qualification experience in mechanical/ BS discipline giving details of the air-conditioning and refrigeration equipment installed; and demonstrating that the *global warming potential* and ozone depletion potential of the refrigerants used in equipment meets the specified requirement. Reference shall be made to refrigerant suppliers and/or equipment manufacturer's data, etc.

(b) Ozone Depleting Materials

1. Provide a full description and specifications of all major thermal insulation and fire-retardant materials specified in roof constructions, walls, chilled water pipes, refrigerant pipes, ductwork, advising the presence or otherwise of ozone depleting agents.

2. Where there is any doubt as to the ozone depletion potential of a material or product, details shall be ascertained from the supplier. Credit will be awarded where demonstration of reasonable effort has been made to avoid the use of products that have significant ozone depletion potential.

Submittals

(a) Refrigerants

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_05_00	BEAM Plus New DCs Submission template for MW 5	✓	✓
MW_05a_01	Specifications specifying the use of refrigerants	✓	-
MW_05a_02	Summary table with equipment details, refrigerant employed, *ozone depleting potential* and *global warming potential*	✓	✓
MW_05a_03	Endorsed calculations showing the *global warming potential* and ozone depletion potential of the refrigerants	✓	✓
MW_05a_04	Equipment schedule of HVAC&R equipment showing the refrigerants employed	-	✓

MW_05a_05	Catalogues of HVAC&R equipment showing the refrigerants employed	-	✓
MW_05a_06	Catalogues of refrigerants or statement from manufacturer demonstrating that the products are free from CFC and HCFC	-	✓

(b) Ozone Depleting Materials

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_05_00	BEAM Plus New DCs Submission template for MW 7	✓	✓
MW_05b_01	Specifications specifying the use of insulation materials	✓	-
MW_05b_02	Endorsed summary table with insulation material details, manufacturer, blowing agent and fire retardant	✓	✓
MW_05b_03	Catalogues of insulation materials or statement from manufacturer demonstrating that the products are free from CFC and HCFC	-	✓

Remarks

(a) Additional Information

The Montreal Protocol has scheduled the phasing out of controlled substances, including chemicals containing chlorine and bromine used as refrigerants, solvents, foam blowing agents, aerosol propellants, fire suppressants, and for other purposes.

Ozone Layer Protection Ordinance (Cap. 403) gives effect to Hong Kong's international obligations to control the manufacture, import and export of ozone depleting substances.

Ozone Layer Protection (Controlled Refrigerants) Regulation requires the conservation of controlled refrigerants used in large scale installations and motor vehicles.

Ozone Layer Protection (Product Containing Scheduled Substances) (Import Banning) (Amendment) Regulation passed in 2009 extends the banning of the import of controlled products (including refrigeration and air-conditioning equipment, aerosol products such as metered dosed inhalers, insulation panel and pre-polymer) containing chlorofluorocarbons (CFCs) and halons to those containing other scheduled substances including hydrochloroflurocarbons (HCFCs) by phases.

All products containing HCFCs, except dichlorotrifluoroethane (HCFC-123) have been banned since 1 January 2015. It is targeted to ban all products containing HCFCs starting from 1 January 2020.

The Amendment Regulation also bans the import of CFC-containing metered dosed inhalers and fire extinguishers containing HCFCs and bromochloromethane (BCM) from 1 January 2010.
Given that CFCs and HCFCs have been banned, except HCFC-123, HFCs offer near-zero ODP but some have comparatively high GWPs.

Refrigerant	ODP[1]	GWP[1]
Hydrofluorocarbons		
HFC-23	~0	12240
HFC-32	~0	650
HFC-134a	~0	1320
HFC-152a	~0	140
HFC-402A	~0	1680
HFC-404A	~0	3900
HFC-407C	~0	1700
HFC-410A	~0	1890
HFC-413A	~0	1774
HFC-507A	~0	3900
Hydrochlorofluorocarbons		
HCFC-123	0.02	76
[1] – Sources: i. IPCC Second Assessment Report; ii. "World Resources Institute (2005), World Business Council for Sustainable Development"; iii. U.S. Environmental Protection Agency.		

The U.S. Environmental Protection Agency provides information on suitable substitutes for ozone depleting substances, including refrigerants for various types of air-conditioning and refrigeration equipment, fire suppression, blowing agents, solvents, etc.

CIBSE GN01 outlines the hazards of using these refrigerants and provides design guidance for refrigeration systems, thermal insulation and fire protection systems.

ASHRAE Guideline 3-1996. Reducing Emission of Halogenated Refrigerants in Refrigeration and AS recommends practices and procedures that will reduce inadvertent release of halogenated refrigerants. The practices and procedures in this guideline cover emission reduction of halogenated hydrocarbon and halogenated ether refrigerants:

i. from stationary refrigeration, air-conditioning, and heat pump equipment and systems; and
ii. during manufacture, installation, testing, operation, maintenance, and disposal of equipment and systems.

(b) Related Credits

None

4 Materials and Waste **4.2 Selection of Materials**

MW 6 Regional Materials

Extent of Application

All DCs

Objective

Encourage the use of materials originated locally so as to reduce the environmental impacts arising from transportation.

Credits Attainable

1+ 2 additional BONUS

Credit Requirement

1 credit for the use of *regional materials* meeting prescribed requirement, which contribute at least 10% of all building materials used in the project.

1 additional BONUS credit for 20%.

2 additional BONUS credits for 50%.

Assessment

1. Provide all of the following supporting documents:
   - 1.1 List of the materials satisfying the requirements;
   - 1.2 Quantification for the value of materials originated locally in percentage of the total value of the materials used;
   - 1.3 Supporting documents from the suppliers listing the name of the manufacturer; and
   - 1.4 Demonstration for the point of raw materials and manufacture within the prescribed radius of the HKSAR.
2. The unit may be mass/ volume/ dollar value but shall be consistent throughout the assessment of this credit.
3. Raw materials (constituents) used for making the claimed building materials shall fulfil the assessment requirements.
4. In-situ concrete, which is unlikely imported outside the region, will not be considered for this credit. The quantity of in-situ concrete shall be excluded from the calculation of the total building materials for this credit.
5. Mechanical and electrical systems components are excluded in the calculation. Plumbing products however may be included at the discretion of the project team.
6. *Reused* and salvaged material such as furniture may also be included. The location from which they were salvaged may be used as the point of manufacture.
7. The point of raw materials and manufacture shall be located within an 800km radius of the HKSAR by road transportation; within a 1,600km radius by rail transportation; or within a 4,000km radius by sea transportation.
   The 800km radius should radiate from the default coordinates of HKSAR. For simplicity, road travel distances within HKSAR are excluded in the calculation.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_06_00	BEAM Plus New DCs Submission template for MW 6	✓	✓
MW_06_01	Estimated summary table [MW-06_Form_r1] declared by the contractor/ owner. **[or]**	✓	-
	Endorsed summary table [MW-06-1_Form_r1] by contractor.	-	✓
MW_06_02	Specifications specifying the use of regionally manufactured materials	✓	-
MW_06_03	Maps showing the point of raw materials and the manufacture, and the distance from the HKSAR	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

4 Materials and Waste **4.2 Green Product/ Materials**

MW 7 Use of Green Products

Extent of Application All DCs

Objective Encourage the use of green products that have low environmental impacts.

Credits Attainable 2 + 3 additional BONUS + 1 BONUS

Credit Requirement

(a) Certified Green Products

1 credit for having at least 5% certified green products in one (1) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components).

2 credit for having at least 5% certified green products in two (2) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components).

1 additional BONUS credit for having at least 5% of certified green products under Construction Industry Council (CIC) Green Product Certification, Carbon Labelling Scheme/ HKGBC Green Product Accreditation and Standard (HK G-Pass) in one (1) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components).

For exemplary performance, additional BONUS credit for having at least 25% of certified green products under CIC Green Product Certification, CIC Carbon Labelling Scheme/ HK G-PASS in one (1) of the listed categories (outside surface works, building façade and structures, interior non-structural components, and building services components).

(b) Rapidly Renewable Materials

1 BONUS credit for 5% of all building materials/ products of interior non-structural components in the project is rapidly renewable materials.

2 BONUS credit for 25%..

Assessment

(a) Certified Green Products

1. <u>Outside Surface Works</u>

1.1 Use of certified green products contributing to at least 5% of all materials as listed below.

Outside surface works	i. Pavement Block ii. Stone (Natural/ Artificial) iii. Paint & Coating iv. Alternative elements proposed by the applicant.

1.2 Provide all of the following supporting documents:

1.2.1 Demonstrate the percentage calculation (by mass, volume, quantity, area or dollar value) of all the items including certified green products

1.2.2 Include a summary table listing the product type, manufacturer, certification body, calculation and reference source; and

1.2.3 Certificate(s) of the green products;

1.3 For certified green products as specified in CIC Green Product Certification are deemed to be included in the calculation.

1.4 For any green products, which have been certified under other internationally recognised schemes, the applicant shall refer to the Worldwide Recognised Green Building Product Certifications and Standards under HKGBC's Eco-Product Directory (http://epdir.hkgbc.org.hk/textdisplay.php?serial=32) or provide the product's technical information with justification for BSL's consideration.

2. <u>Building Façade and Structures</u>

1.1 Use of certified green products contributing to at least 5% of all materials as listed below.

Building Facade and Structures	i. Cement ii. Concrete iii. Reinforcing bar iv. Structural steel v. Extruded aluminum product vi. Glazing vii. Alternative elements proposed by the applicant.

1.2 Provide all of the following supporting documents:

4.2.1 Demonstrate the percentage calculation (by mass, volume, quantity, area or dollar value) of all the items including certified green products;

4.2.2 Include a summary table listing the product type, manufacturer, certification body, calculation and reference source;

4.2.3 Certificate(s) of the green products; and

4.2.4 Record photographs

2.3 For certified green products as specified in CIC Green Product Certification are deemed to be included in the calculation.

2.4 For any green products, which have been certified under other internationally recognised schemes, the applicant shall refer to the Worldwide Recognised Green Building Product Certifications and Standards under HKGBC's Eco-Product Directory (http://epdir.hkgbc.org.hk/textdisplay.php?serial=32) or provide the product's technical information with justification for BSL's consideration.

3. Interior Non-structural Components

1.3 Use of certified green products contributing to at least 5% of any 5 items as listed below.

Interior Non-structural Components	i. Panel board ii. Ceramic tile iii. Plant-based fibre composite iv. Furniture v. Stone (Natural/ Artificial) vi. Wall covering vii. Paint & coating viii. Adhesive & sealant ix. Block for internal partition x. Synthetic carpet xi. Thermal insulation xii. Alternative elements proposed by the applicant.

1.4 Provide all of the following supporting documents:

1.4.1 Demonstrate the percentage calculation (by mass, volume, quantity, area or dollar value) of all the items including certified green products

1.4.2 Include a summary table listing the product type, manufacturer, certification body, calculation and reference source;

1.4.3 Certificate(s) of the green products; and

1.4.4 Record photographs

1.5 For certified green products as specified in CIC Green Product Certification are deemed to be included in the calculation.

1.6 For any green products, which have been certified under other internationally recognised schemes, the applicant shall refer to the Worldwide Recognised Green Building Product Certifications and Standards under HKGBC's Eco-Product Directory (http://epdir.hkgbc.org.hk/textdisplay.php?serial=32) or provide the product's technical information with justification for BSL's consideration.

4. Building Services Components

4.1 Use of certified green products contributing to at least 5% of all materials under either (a), (b) or (c) categories as listed below.

Building Services Components	(a) Lighting & electrical installation	i. LED lighting ii. CFL iii. Electronic ballast iv. Cable & wire v. Alternative elements proposed by the applicant.
	(b) Air-conditioning systems	i. Chiller ii. VRF split type system

		iii. AHU iv. FCU v. Cooling tower vi. Alternative elements proposed by the applicant.
	(c) Plumbing & drainage	i. Water pump ii. Sanitary wares-ceramic product iii. Alternative elements proposed by the applicant.

4.2 Provide all of the following supporting document:

4.2.1 Demonstrate the percentage calculation (by mass, volume, quantity, area or dollar value) of all the items including certified green products;

4.2.2 Include a summary table listing the product type, manufacturer, certification body, calculation and reference source;

4.2.3 Certificate(s) of the green products; and

4.2.4 Record photographs.

4.3 For certified green products as specified in CIC Sustainable Product Certification are deemed to be included in the calculation.

4.4 For any green products, which have been certified under other internationally recognised schemes, the applicant shall refer to the of Worldwide Recognised Green Building Product Certifications and Standards under HKGBC's Eco-Product Directory (http://epdir.hkgbc.org.hk/textdisplay.php?serial=32) or provide the product's technical information with justification for BSL's consideration.

(b) Rapidly Renewable Materials

1 Use of at least 5% of all building materials/ products of interior non-structural components under the following categories are rapidly renewable materials, such as bamboo, cork, natural linoleum, soy bean composite, strawboard, sunflower seed and wheatboard.

Interior Non-structural Components	i. Flooring ii. Panel/ partitions iii. Cabinetry/ built-in furniture iv. Insulation v. Alternative elements proposed by the applicant.

2 Provide all of the following supporting documents:

2.1 Demonstrate the percentage calculation (by mass, volume, quantity, area or dollar's value) of all the items including rapidly renewable materials;

2.2 Include a summary table listing the product type, rapidly renewable material content, manufacturer, calculation and reference source;

2.3 Supporting documents of rapidly renewable materials; and

2.4 Record photographs

3 No material specified shall present a fire hazard when installed.

Submittals

(a) Certified Green Products

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_07_00	BEAM Plus New DCs Submission template for MW 7	✓	✓
MW_07a_01	Estimated table with product type, manufacturer, certification body, quantities declared by the main contractor/ owner.	✓	-
	The summary table shall be prepared and endorsed by the main contractor.	-	✓
MW_07a_02	Specifications specifying the use of green products	✓	-
MW_07a_04	Drawings showing the provision	-	✓
MW_07a_05	Certificate(s) of the green products	-	✓

(b) Rapidly Renewable Materials

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_07_00	BEAM Plus New DCs Submission template for MA 7	✓	✓
MW_07b_01	Estimated table with product type, rapidly renewable material content, manufacturer, quantities declared by the main contractor/ owner.	✓	-
	The summary table shall be prepared and declared by the main contractor.	-	✓
MW_07b_02	Specifications specifying the *rapidly renewable materials*	✓	-
MW_07b_03	Drawings showing the provision	-	✓
MW_07b_05	Supporting documents of *rapidly renewable materials*	-	✓

Remarks

(a) Additional Information

HKGBC's Eco-Product Directory [ONLINE] Available at: http://epdir.hkgbc.org.hk/textdisplay.php?serial=32 [Accessed August 2019]

CIC Green Product Certification [ONLINE] Available at: http://cicgpc.hkgbc.org.hk/ [Accessed August 2019]

HKGBC Green Product Accreditation and Standards - HK G-PASS [ONLINE] Available at: http://www.cic.hk/eng/main/zcb/carbon_labelling_scheme/ [Accessed August 2019]

(b) Related Credits

None

4 Materials and Waste **4.3 Selection of Materials**

MW 8 Life Cycle Assessment

Extent of Application Whole Building DC Developments

Objective Encourage the design of structural elements and choice of materials that results in lower *embodied energy*

Credits Attainable 1

Credit Requirement 1 credit for demonstrating the *embodied energy* in the major elements of the building structure of the DC has been studied and optimised through a Life Cycle Assessment (LCA).

Assessment

1. Demonstrate the reduced environmental effects by conducting a Life Cycle Assessment (LCA) on a baseline case, justified by the applicant, and the proposed case. The LCA should be conducted during the design stage

2. The LCA should cover only the elements and materials used in the building foundations, walls, primary and secondary structures and building facade, and does not include the building services system.

3. The service life of the baseline and proposed cases should be the same and at least of 50 years. The same software tools and data sets should be used to evaluate both the baseline building and the proposed building, and report all the listed impact categories. Data sets must be compliant with ISO 14044. In lieu to these requirements, the LCA tool developed by EMSD can also be used.

4. Select at least three of the following impact categories for reduction:
   - 4.1 *Global warming potential* (greenhouse gases), in CO_2e;
   - 4.2 Depletion of the stratospheric ozone layer, in kg CFC-11;
   - 4.3 Acidification of land and water sources, in moles H^+ or kg SO_2;
   - 4.4 Eutrophication, in kg nitrogen or kg phosphate;
   - 4.5 Formation of tropospheric ozone, in kg NO_x or kg ethene; and
   - 4.6 Depletion of non-renewable energy resources, in MJ.

5. Prepare an LCA report, including the following contents:
   - 5.1 Quantity of the building materials
   - 5.2 Assumptions made
   - 5.3 Methodologies
   - 5.4 Screenshots of input parameters
   - 5.5 Results
   - 5.6 Conclusions

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_8_00	BEAM Plus New DCs Submission template for MW 8	✓	✓
MW_8_01	LCA report	✓	✓

Remarks

(a) Additional Information

None.

(b) Related Credits

None.

4 Materials and Waste **4.3 Waste Reduction**

MW 9 Enhanced Waste Handling Facilities

Extent of Application All DCs

Objective Encourage integrated waste management for operational reduction at source, effective sorting and collection within the site and recycling/ reuse of waste.

Credits Attainable 2

Credit Requirement 1 to 2 credits for providing at least 3 **or** 5 of the following listed on-site recycling facilities and implementing the recyclable materials collection arrangement:

i. IT related waste such as, electronic equipment;
ii. Plastic recyclable;
iii. Metal recyclable;
iv. Glass recyclable;
v. Paper recyclable; and
vi. Beverage carton recyclable.

Assessment

1. In-house recycling facilities should be provided for the storage of the above listed recyclables. Same type of provision in multiple locations can only be counted once.

2. For each waste stream, provide at least one storage bin/ storage area for recycling. The recycling facilities shall be located at prominent locations(S) (i.e. cannot be located in car park or other non-occupied areas). The size and collection frequency are not regulated.

3. The collection organisation/ recycler shall be employed by either DC Owner or DC Management Company.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
MW_9_00	BEAM Plus New DCs Submission template for MW 9	✓	✓
MW_9_01	Summary table to illustrate the quantities and locations of facilities	✓	✓
MW_9_02	Drawings showing the locations of the waste handling facilities	✓	✓
MW_9_03	As-fitted drawings	-	✓
MW_9_04	Record photographs	-	✓
MW_9_05	Collection organisation/ recycler information, including: 1) Company name, address and contact information; 2) List of recycled material; 3) Collection frequency; and Collection agreement signed by the Recycling firm and Applicant. Where the Applicant adopts the host building facility, the host building Collection Agreement (or an equivalent letter by the Property Manages organisation).	✓	✓

Remarks

(a) Additional Information

None.

(b) Related Credits

MA P1 Minimum Waste Handling Facilities
The Prerequisite requires the minimum provisions of waste recycle facilities for the collection, sorting, storage, recycling (recovered material) and disposal (waste).

5 Energy Use

5.P Prerequisite
5.1 Energy Use Reduction and Control
5.2 Renewable and Alternative Energy Systems
5.3 Energy Efficient Equipment
5.4 Green DC Best Practice

Introduction

The Information and Communication Technology (ICT) sector including DCs generates up to 2% of the global CO_2 emissions and data centres are estimated to have the fastest growing carbon footprint from across the whole ICT sector, mainly due to new business such as cloud computing and the rapid growth of the use of Internet services.

Electricity generation accounts for around 60% of the total CO_2 emissions from energy use in Hong Kong. Buildings account for 90% of our electricity consumption. Ensuring DCs are designed for good energy performance is a key factor to the conservation of energy.

Power stations operate under licenses issued by the Director of Environmental Protection Department, requiring operators to employ the best practicable means to control the emissions to acceptable levels. However, there is a growth in demand which leads to an increasing power generation, transmission and distribution capacity, because of the use of air- conditioning where the buildings are responsible for much of the peak load in summer. Demand side management can reduce the rate of expansion of supply-side capacity.

5.P Prerequisite

EU P1 Minimum Energy Performance

Background

BEAM provides incentives to achieve energy performance better than the minimum requirements of building energy codes. Therefore, compliance with the up-to-date Building Energy Codes (BEC) is the mandatory requirement governing the energy performance of building services installations. This is taken as the energy performance prerequisite for BEAM certification.

Power Usage Effectiveness (PUE) is a metric for measuring infrastructure energy efficiency for DCs. It measures the relationship between the total facility energy consumed and the IT equipment energy consumed. To achieve better energy performance, the DC must have a maximum design PUE at full load condition of no more than 2.0 for BEAM certification. The IT equipment load shall be based on Power Distribution Unit (PDU) Output, i.e. Level 2 PUE.

5.1 Energy Use Reduction and Control

EU 1 Low Carbon Passive Design
EU 2 Reduction of CO_2 Emissions
EU 3 Metering and Monitoring

Background

The estimation of DC energy performance takes into account the design improvements to the building envelope and the efficiency of building services systems including air-conditioning, lighting systems, electrical installations. BEAM Plus gives credit to additional measures that address further improvement in the building energy efficiency.

As DCs often operate at part load conditions instead of full design load, the energy efficiency at part load contribute significantly to the overall energy consumption. BEAM Plus DCs thus assess the overall energy efficiency of a DC at its 75% of IT load condition, encouraging the design of DC equipment and cooling systems should aim to achieve part load efficiencies that approach full load conditions

Passive building design allows DCs to respond to the local climate and reduce the reliance on active means to satisfy human comfort, and therefore reduces energy consumption and the associated carbon dioxide emissions. Through effective planning and architectural design, it is possible to improve

building energy efficiency, particularly for the normally occupied areas. As such, this section also assesses various strategies including building *orientation*, layout plan and *external shading* devices etc.

5.2 System Energy Efficiency

EU 4 Cooling System Efficiency
EU 5 Air Distribution System Efficiency

Background

Overall DC energy efficiency shall be corroborated by the component systems efficiency in order to identify areas of improvement in the data centre operation. BEAM Plus encourage the use of high efficiency cooling and air distribution systems, in terms of equipment efficiency, plant and system configurations to minimise the energy consumption.

5.2 Renewable and Alternative Energy Systems

EU 6 Renewable and Alternative Energy Systems

Background

If energy consumption continues to increase at existing levels, projected carbon dioxide emissions generated by the year 2030 are expected to grow by more than 50% from the level in 2005. Effective use of renewable energy will reduce Hong Kong's reliance on fossil fuels and also our greenhouse gas emissions arising from the use of fossil fuels.

Although the large-scale application of renewable energy in buildings does not exist in Hong Kong, its wider use should be promoted in the interest of sustainable development. BEAM Plus credits award those meaningful installations that provide environmental benefits. The criteria for assessment have been set with reference to the percentage of the energy use in the assessed building that will be replaced by renewable sources. Furthermore, no distinction will be made on the selected means such as solar hot water systems, building integrated photovoltaic panels or wind turbines, etc for substituting electricity or fuel by renewable energy. Hence, different or a combination of systems and equipment may be incorporated into a building.

5.3 Energy Efficient Equipment

EU 7 Sustainable IT Equipment

Background

BEAM Plus recognise and encourage the procurement of energy-efficient IT equipment to ensure optimum performance and opportunities for energy savings. BEAM Plus gives credit to DCs that promoting the use of energy-efficient IT equipment.

5.4 Green DC Best Practice

EU 8 Best Practice on Energy Use

Background

BEAM Society Limited (BSL) publishes sets of green data centre practices aim to achieve better energy-efficiency and minimise environmental impacts in DC design and operation. BEAM Plus credits award those successfully implemented best practices that are related to energy use including, cooling system, air flow management, power system, monitoring and managing energy efficiency, IT equipment deployment, etc.

5 Energy Use **5.P Prerequisite**

EU P1 Minimum Energy Performance

Extent of Application All DCs

Objective To establish the minimum level of energy performance for the building services systems

Credits Attenable Prerequisite

Credit Requirement Demonstrate (a) performance improvement against the Building Energy Code (BEC) 2018 edition and (b) Maximum Power Usage Effectiveness (PUE)

(a) Performance against the BEC 2018 edition

Demonstrate **compliance** with the BEC 2018 edition on:

1) Air-conditioning equipment efficiency (full load COP); and

2) Lighting power density for listed space type in the code.

(b) Maximum Power Usage Effectiveness (PUE)

The data centre must have a design PUE at full IT load condition of no more than 2.0.

Assessment **(a) Performance Improvement against the BEC 2018 edition**

1. Air-conditioning System

1.1. The rated COP of the air conditioning equipment should comply with the minimum efficiency requirement stipulated in the code (For both full load and 75% load for VSD equipment).

1.2. The performance of the selected air conditioning unit types should refer to the corresponding equipment COP tables stipulated in the BEC 2018 edition.

1.3. Room air-conditioners (included single package window type and wall mounted split type) under the scope of the latest edition of Mandatory Energy Efficiency Labelling Scheme (MEELS), Energy Efficiency (Labelling of Products) Ordinance (Cap. 598) should achieve equipment efficiency equivalent to the Energy Efficiency Grade 2 or above, using cooling seasonal performance factor (CSPF), Fcsp.

1.4. Project using district cooling system and project without any air-conditioning installation (or not newly install with any air-conditioning system) are not assessed under this criteria.

2. Indoor Lighting Systems

2.1. The LPD must comply with the maximum allowable values of the listed space type listed in the BEC 2018 edition.

2.2. For space that without a listed space type suitable for calculation from the BEC code, LPD must be the same as the design value.

2.3. LPD requirements for this prerequisite follows the BEC 2018 edition of BEC. Exclude the lighting installations that are stated in the latest edition of BEC Technical Guideline.

(b) Maximum Power Usage Effectiveness (PUE)

1. Whole building energy simulation should be carried out in a prescribed methodology as listed below in order to demonstrate the proposed DC performance meet the prerequisite requirement.

2. Refer to **Appendix 9.2** for Energy Modelling Guideline.

3. Determine PUE at full IT load condition under Hong Kong climatic conditions.

4. Prepare a building energy simulation report to demonstrate the compliance of the Prerequisite requirement.

5. The report should be endorsed by a locally qualified professional who has at least 8-year of relevant experience in building energy modelling

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_P1_00	BEAM Plus New DCs submission template for EU P1	✓	✓
EU_P1_01	EU-P1-1_Form	✓	✓
EU_P1_02	Air-conditioning system equipment schedule, air-side and water-side schematic drawings highlighting all the air-conditioning equipment	✓	✓
EU_P1_03	Air-conditioning equipment and lighting specifications	✓	
EU_P1_04	Catalogue of Air-conditioning equipment highlighting the COP at full load Lighting schedule with luminaire	-	✓
EU_P1_05	Layout Drawing highlighting the space type	✓	✓
EU_P1_06	Space area schedule	✓	✓

EU_P1_07	Endorsed Building Energy Simulation Report	✓	✓
EU_P1_08	CV of the professional as per requirements in the assessment	✓	✓
EU_P1_09	Input and Output Simulation Summary	✓	✓
EU_P1_10	Supporting documents for input, based on project development status, including: i. OTTV calculation sheet based on the requirements of Buildings Department [1] for proposed case ii. Indoor design criteria from project team highlighting indoor thermal condition, occupancy density, fresh air flow rate requirement, internal load, equipment load and ventilation rate iii. System and equipment specification a) All selected air-conditioning equipment highlighting COP, cooling/ heating capacity and flow rate as well as energy recovery appliance b) All selected lift and escalator highlighting capacity, motor power and energy saving control system c) All selected water heater (if applicable) highlighting installed power iv. Pre-input calculation for modelling, including: a) Simplified Fan Power input Lighting Power Density	✓	✓

Remarks

(a) Additional Information

Electrical and Mechanical Services Department, Code of Practice on Energy Labelling of Products [ONLINE] available at:

https://www.emsd.gov.hk/energylabel/en/doc/2018%20CoP%20(English).pdf [Assessed August 2019]

(b) Related Credits

EU 2 Reduction of CO_2 Emissions

1 Buildings Department - Energy Efficiency of Buildings, Building (Energy Efficiency) Regulation; Code of Practice for Overall Thermal Transfer Value in Buildings 1995

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 1 Low Carbon Passive Design

Extent of Application All DCs

Objective Passive building design allows buildings to respond to the local climate; reducing the reliance on active means to meet human comfort. This in turn reduces energy consumption and its associated carbon dioxide emissions.

Credits Attainable 5

Credit Requirement Passive designs that can reduce building HVAC load, facilitate natural ventilation and maximise daylight will be rewarded in this credit under **either** prescriptive path **or** performance path.

Option 1: Prescriptive Path

1 credit for incorporating 1 of the passive design strategies listed below, maximum up to 2 credits:

i. Optimum Spatial Planning
ii. External Overhang (fix/ movable)
iii. Vegetated Building Envelope
iv. Cross Ventilation Provision
v. Daylighting Provision

Option 2: Performance Path

3 Credits for incorporating any 3 of the passive design strategies listed below:

HVAC Load Reduction

1. Built Form and *orientation*

1 credit for reducing building envelope load from a hypothetic case with at least 22.5° difference in *orientation* with justification by simulation.

2. Optimum Spatial Planning

1 credit for demonstrating consideration of optimum spatial planning to enhance energy conservation with justification by simulation.

3. External Shading Devices

1 credit for the provision of fixed or movable *external shading* devices, in the form of vertical or horizontal sun shading feature with justification by simulation.

4. Vegetated Building Envelope

1 credit for the provision of vegetated building envelope with justification by calculation.

Natural Ventilation

1. Space Layout for Natural Ventilation

1 credit for demonstrating that project space (for normally occupied space) is designed to facilitate the utilisation of natural ventilation with justification by simulation.

Daylight

2. Space Layout for Daylight Penetration

1 credit for demonstrating that the space is well-lit by daylight and reduce occupants' dependency on artificial lighting with justification by simulation method.

Assessment

Option 1: Prescriptive Path

Prepare a **passive building design report** with calculation, building elevations and drawings to demonstrate the compliance of adopting two (2) selected strategies.

1. Optimum Spatial Planning

Demonstrate the space planning complying with the following requirements:

1.1 For Non-open planned design:

Demonstrate at least 20% of external wall of the building to be occupied by non-conditioned space for buildings where the developer/owner has direct influence over the interior fit-out work for 50% or more of the occupied space

1.2 For Open planned design

Demonstrate at least 5% of external wall of the building to be occupied by non-conditioned space for buildings where developer/owner has direct influence over the interior fit-out work for less than 50% of the occupied space,

To document this strategy, the passive building design report should include the following information:

i. Building floor layout with indication on complied area;

ii. Measurement of the perimeter length of the typical floor layout;

iii. Measurement of the non-conditioned space external wall length;

iv. Calculation of non-conditioned space external wall area; and

v. Summary table showing the percentage calculation.

2. Fixed or Movable Overhangs

Demonstrate fixed or moveable overhangs are provided for project:

2.1 Incorporated overhangs that is >0.3 of window height on south orientated facade

To document this strategy, the passive building design report should include the following information:

i. Facade design drawings with highlighted overhangs

ii. Drawings demonstrating that the length of overhangs from facade zone is >0.3 of window height.

3. Vegetated Building Envelope

Demonstrate greenery are provided for project envelop:

3.1 Incorporate greenery for 50% roof of condition spaces; or Incorporate vertical greenery for 5% of external wall area for building condition spaces.

3.2 Demonstrate that the area of vegetation is at least 50% of the roof area. Roof of non-conditioned area (e.g. mechanical plant rooms) do not count towards the total roof area; OR

Demonstrate that the area of vegetation is at least 5% of the facade area. Facade of non-conditioned area (e.g. mechanical plant rooms) do not count towards the total facade area.

3.3 Only permanent planter is considered as vegetation area.

To document this strategy, the passive building design report should include the following information:

i. Drawings demonstrating the area of vegetation on the roof area (or external wall area);

ii. Drawings demonstrating the roof area of conditioned space (or the external wall area of conditioned space);

iii. Calculation demonstrating the percentage of compliance;

iv. Demonstration of reduction in U-value when compare with the project roof material (or external wall material); and

v. Maintenance contract or undertaking statement from project owner that landscape maintenance personnel/company will be employed for the maintenance of building envelope vegetation.

4. Cross Ventilation provision

Demonstrate each normally occupied space in project is cross ventilated:

4.1 Provide cross ventilation for each normally occupied space of the building with reference to the cross-ventilation requirement stipulated in the latest edition of the Guidelines on ASHRAE 62.1:2010 section 6.4.

To document this strategy, the passive building design report should include the following information:

i. Drawings of typical floors (or typical spaces design sections) showing the openable windows location and the cross-ventilation path;

ii. Drawings illustrating natural ventilation assessment for re-entrant; and

iii. Calculation for demonstrating the compliance of minimum openable window area to floor area.

5. Daylighting Provision

Demonstrate each normally occupied space is daylit:

5.1 Provide window for each normally occupied space with each window height > 50% of the corresponding normally occupied space depth.

To document this strategy, the passive building design report should include the following information:

i. Drawings of typical floors sections (or typical spaces design sections);

ii. Drawings highlighting the height of windows;

iii. Drawings highlighting the depth of normally occupied space; and

iv. Calculation demonstrating the percentage of compliance.

Option 2: Performance Path

Prepare a passive building design report to demonstrate selected passive design strategies achievement with numerical supporting.

1. Built Form and Orientation

1.1 Conduct a building total energy analysis to demonstrate that the design building has incorporated a better build form and *orientation*. Evaluation is carried out by rotating the design building. The selected baseline condition (hypothetic case) should be at least 22.5^{o} different from the designed building in *orientation*. A passive building design report should be provided to document the analysis and result.

To document this strategy, a passive building design report should include the following information:

i. A summary of simulation result;

ii. Baseline case building energy consumption;

iii. Design case building energy consumption;

iv. Demonstration the orientation angle difference between hypothetic and design case; and

v. Hourly data (i.e. 8,760 hours) of building energy consumption for both the baseline case and the design case should be appended.

The simulation program used for energy modelling should meet the following criteria. Compliance review for below criteria is required except those already accepted for performance based on Building Energy Code (BEC) by EMSD.

i. Capable to perform hourly simulation (8,760 hours per year);

ii. Capable to provide hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation;

iii. Capable to model 10 or more thermal zones;

iv. Capable to model and simulate the thermal behaviour of a building and the interaction of its building fabric, air-conditioning, lighting and other relevant energy consuming equipment and systems;

v. Capable to perform design load calculations to determine the required air-conditioning equipment capacities and air and water flow rates for both the design case and baseline case building;

vi. Capable to model part-load performance curves for mechanical equipment;

vii. Capable to model capacity and efficiency correction curves for mechanical heating and cooling equipment; and

viii. Capable to model air-side economizers with integrated control

2. Optimum Spatial Planning

2.1 Demonstrate at least a 20% reduction in façade irradiation gain for not normally occupied space and non-conditioned space.

To document this strategy, the passive building design report should include the following information:

i. Annual solar irradiation on each building elevation;

ii. Table summarizing external wall area of non-conditioned space on each orientation of building elevation; and

iii. Calculation demonstrating the design case compliance in irradiation gain reduction

$$\frac{\sum Facade\ irradiation\ of\ non-conditioned\ facade\ area}{Overall\ Facade\ irradiation} \geq 20\%$$

3. Fixed or Movable Horizontal / Vertical External Shading Devices

3.1 Demonstrate the provision of external shading devices in reducing direct solar irradiation entering the building interior. Any architectural features that shade the building surfaces from direct sunlight are considered as shading devices.

3.2 Conduct an external solar irradiation simulation to demonstrate that the annual solar irradiation on the facade is 2% lower than the baseline (hypothetic) case without a shading device.

To document this strategy, the passive building design report should include the following information:

i. Simulation result of solar irradiation on each building elevation for both design case and hypothetic case; and

ii. Drawings illustrating the solar shading design.

4. Vegetated Building Envelope

4.1 Demonstrate that U-value of the roof area is reduced by 50% by vegetation. Roof of non-conditioned area (e.g. mechanical plant rooms) does not count into the total roof area; OR

4.2 Demonstrate that the area of vegetation on facade contribute 5% reduction on the U-value of facade. Facade of non-conditioned area (e.g. mechanical plant rooms) does not count into the total facade area.

4.3 Only permanent plantation is considered as vegetation area.

To document this strategy, the passive building design report should include the following information:

i. Drawings that demonstrate the area of vegetation on the roof area (or external wall area);

ii. Drawings that demonstrate the roof area of conditioned space (or the external wall area of conditioned space);

iii. Calculation for demonstrating the percentage of compliance;

iv. Calculation for demonstrating a reduction in U-value when compare to the project roof material (or external wall material); and

v. Maintenance contract or undertaking statement from project owner that landscape maintenance personnel/ company will be employed for the maintenance of building envelope vegetation.

5. Space Layout for Natural Ventilation

5.1 Demonstrate that at least 50% of openings and operable areas in each normally *occupied space* has an average incoming/outgoing velocity of 0.2 m/s

5.2 Demonstration that at least 20% of normally occupied space, in terms of floor area, has achieved a wind velocity of 0.2 m/s at 1.2m level above the finished floor.

5.3 A CFD simulation should be conducted in accordance with the AVA methodology and assessment area of the simulation model outlined in Technical Circular No.1/06 [1] to obtain the external wind pressures at the centre of the opening area. Another model that simulates the indoor flow pattern 1.2m level above the finished floor shall also be conducted using the external wind pressures computed by previous CFD model.

5.4 For buildings with 3 stories above grade or more, at least 3 typical stories (covering high, mid and low levels of buildings) with similar interior layout should be selected and studied for multi-storey building. For buildings with less than 3 stories, the simulation should cover all floors.

1 Housing, Planning And Lands Bureau Technical Circular No. 1/06 [ONLINE] Available at: https://www.devb.gov.hk/filemanager/en/content_679/hplb-etwb-tc-01-06.pdf [Accessed August 2019]

5.5 For normally occupied space in a building with site environmental problems identified by authorities (e.g. poor air quality, poor acoustics condition) justification report with evidences should be provided to substantiate the non-practicality of providing operable windows for the identified normally occupied space. Thus, demonstrating this credit part is not applicable for that identified space. Only project with 100% occupied space identified as non-practical is allowed to apply not applicable (N/A) in this credit part.

To document this strategy, the passive building design report should include the following information:

i. The derived incoming/ outgoing velocity at the opening under 1 out of the 3 most prevailing wind directions in summer; and

ii. Calculation of the Area-Weighted Average Wind Velocity (AAWV) for the complied space.

6. Space Layout for Daylight

6.1 Demonstrate that 25% of normally *occupied space* achieves spatial Daylight Autonomy300/25% (sDA300/25%). In other words, at least 25% of the area can receive at least 300 lux of sunlight for at least 25% of operating hours each year.

6.2 Compliance with the assessment criteria by demonstrating through daylight simulation satisfying the below requirements:

i. Normally occupied spaces shall be assessed (including normally occupied spaces without window);

ii. Internal doors within a unit are assumed to be fully opened;

iii. Calculation grids shall be no more than 0.6m2;

iv. Assessment plane shall be placed at 0.8m above F.F.L. horizontally;

v. Assessment area shall cover typical floors of the lowest, topmost, middle level of each building within the site boundary. All normally occupied spaces shall be assessed if the project building has no typical floor;

vi. Annual sky file referencing a local climate file, such as an EnergyPlus weather format data file (*.epw), shall be used for sky model;

vii. The assessment shall cover hours between 8a.m. to 6p.m. local clock time, for a full calendar year, from January 1 to December 31;

viii. Overall external reflectance of an average of 0.2 for building (include the project development, unless provide other supporting materials) and 0.2 for ground;

ix. Internal wall, floor, ceiling reflectance can make reference to Table A1.12 in CIBSE - LG10/14 Lighting Guide 10: Daylighting

- a Guide for Designers - LG10 [2]. If the finishes in the space is not completed, use the following default surface reflectance: 0.8 for ceiling, 0.2 for floors, and 0.5 for walls. The entire floor plate, except for the core is assumed to be normally occupied space;

x. Surrounding buildings and terrain shall be included in the model based on the GIS information from Lands Department;

xi. The surrounding building and large structures should be included in the simulation model. The surrounding area should be at least 2H (H being the building height (m) of the tallest building on the project site) or 200m away from the project site boundary, whichever is larger. The building geometry can be simplified as blocks; and

xii. The terrain area shall be in a size of at least, 10H (H being the building height (m) of the tallest building on the project site) or 1000m × 1000m, whichever is larger, with the project placed in the centre. Where smaller terrain area is desired, the Applicant should propose a terrain area with justification and the terrain area should be surrounded by a wall with a height same as the average height of the surrounding buildings.

To document this strategy, the passive building design report should include the following information:

i. The industrial guidance/publications for arriving the adopted design criteria for the project;

ii. Software validation report;

iii. Simulation results of the spaces which have fulfilled the daylight illuminance requirements;

iv. Calculation for demonstrating the percentage of compliance; and

v. Input and output report generated by software.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_1_00	BEAM Plus New DCs submission template for EU 1	✓	✓
EU_1_01	Passive building design report	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

2 CIBSE - LG10/14 Lighting Guide 10: Daylighting - a Guide for Designers - LG10

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 2 Reduction of CO_2 Emissions

Extent of Application All DCs

Objective Reduce the consumption of non-renewable energy and the associated carbon dioxide (CO_2) emissions to the atmosphere.

Credits Attainable 15 + 2 BONUS

Credit Requirement **Predicted Power Usage Effectiveness (PUE)**

Demonstrate and quantify the proposed DC energy performance operating under Hong Kong climatic conditions at 75% of the design IT load and express them in terms of Power Usage Effectiveness (PUE).

Since DCs often operate at part load condition, the design of DCs and cooling system should aim to achieve good efficiency at part load, i.e. at 75% design IT load.

1 to 15 credits for exact design PUE value of 1.77 to 1.52 at 75% design IT load.

Additional of 2 BONUS credits for design PUE value lower than 1.5 and 1.4, respectively.

Credit(s)	PUE at 75% Design IT Load
1	1.77
2	1.74
3	1.71
4	1.68
5	1.65
6	1.62
7	1.60
8	1.59
9	1.58
10	1.57
11	1.56
12	1.55
13	1.54
14	1.53
15	1.52
15 + 1B	1.50
15 + 2B	1.40

Assessment Power Usage Effectiveness (PUE)

1. Whole building energy simulation should be carried out in a prescribed methodology as listed below in order to quantify the potential savings due to energy saving measures and improvements to achieve the most efficient design.

2. Determine PUE at 75% of the IT load under Hong Kong climatic conditions.

3. The IT equipment energy shall be measured at Power Distribution Unit (PDU) Output, i.e. PUE Level 2.

4. The energy performance improvements could be come from the following aspects:

    i. DC infrastructure design;

    ii. Selection of high efficient equipment;

    iii. Equipment capacities and part load characteristics;

    iv. System configuration; and

    v. Operational and control sequencing.

    Saving related to the energy use by the IT equipment will not be assessed in this credit.

DC Energy Model Set-up

Develop the propose DC building performance according to modelling set up guideline in Appendix 9.2.

Building Energy Simulation Report

The content should include the followings:

1. Executive summary

    1.1 Energy saving measures and management opportunities (EMOs) summary
    1.2 PUE at 75% design IT load.

2. Introduction

    2.1 Methodology of energy performance assessment

    2.2 Project information

3. Description of EMOs

4. Modelling Parameters

    4.1 Operating schedule

    4.2 Input parameters summary table with reference

5. Results and discussion

    5.1 Detail calculation of the design PUE at 75% IT load.

    5.2 Provide proposed case energy breakdown diagrams

6. Conclusions

    6.1 Conclude the major reasons for achieving design PUE.

The report should be endorsed by a locally qualified professional who has at least 8-year of relevant experience in building energy modelling.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
Option 1 – Performance Path			
EU_2_00	BEAM Plus New DCs submission template for EU 2	✓	✓
EU_2_01	EU-2-1 Form	✓	✓
EU_2_02	Endorsed Building Energy Simulation Report	✓	✓
EU_2_03	CV of the professional as per requirements in the assessment	✓	✓
EU_2_04	Building Energy Report	✓	✓
EU_2_05	Input and Output Simulation Summary	✓	✓
EU_2_06	Supporting documents for input, based on project development status, including: i. OTTV calculation sheet based on the requirements of Buildings Department [1] for proposed case ii. Indoor design criteria from project team highlighting indoor thermal condition, occupancy density, fresh air flow rate requirement, internal load, equipment load and ventilation rate iii. System and equipment specification a) All selected air-conditioning equipment highlighting COP, cooling/ heating capacity and flow rate as well as energy recovery appliance b) All selected lift and escalator highlighting capacity, motor power and energy saving control system c) All selected water heater (if applicable) highlighting installed power iv. Pre-input calculation for modelling, including: a) Simplified Fan Power input b) Lighting Power Density	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

1 Buildings Department - Guideline on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014; PNAP APP-156 - Design and Construction Requirements for Energy Efficiency of Residential Buildings; PNAP APP-67 – Energy Efficiency of Buildings, Building (Energy Efficiency) Regulation; Code of Practice for Overall Thermal Transfer Value in Buildings 1995

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 3 Metering and Monitoring

Extent of Application All DCs

Objective Enable DC operators to measure, monitor and develop measures to improve the performance of the building's engineering systems

Credits Attainable 2 + 1 BONUS

Credit Requirement

a) Fundamental Metering and Monitoring

1 credit for providing **energy** monitoring system for equipment and systems in spaces.

b) Metering and monitoring for PUE

1 credit for energy metering to provide total facility power and energy usage and total IT equipment power and energy at the output of Power Distribution Units (PDUs) for determining instantaneous and average PUE data at Level 2.

1 BONUS credit for providing metering that allows monitoring of individual IT equipments output at data hall racks for determining Level 3 PUE.

Assessment

1 Fundamental Metering and Monitoring

Metering Coverage

Energy monitoring provision covers the energy consumption (both electricity and gas) of the equipment, unit in (kWh).

The corresponding metering coverage should refer to the following requirements:

With reference to EMSD Code of Practice for Building Energy Audit 2018 [1]:

1.1 Provide energy monitoring system for all following installations in landlord's controlled area, where present in the project. Terminal unit is not in the assessment scope.

i. Each equipment in HVAC water-side system (chiller plant, heating plant & heat rejection plant);

ii. Each equipment in HVAC air-side system (Air handling unit); and

iii. Each equipment in Fresh Air system (Primary air unit);

iv. Each gas equipment in cooling or heating plant (e.g. Absorption chiller plant, centralized boiler plant)

1 Code of Practice for Building Energy Audit – Electrical and Mechanical Services Department HKSAR, 2018

v. Each equipment in plumbing and drainage system energy consumption

1.2 Provide energy monitoring system for all the following end-use in landlord's controlled area (Allow a minimum one single meter for each end-use):

i. Variable refrigerant volume air-conditioner energy consumption;

ii. Car park ventilation system energy consumption

iii. Lift system energy consumption;

iv. Escalator system energy consumption;

v. Lighting and receptacle power energy consumption;

Requirements of monitoring coverage are summarized as below:

Table EU4-1:

System (if applicable)		**Energy monitoring**
HVAC System	Each Equipment in HVAC (Water Side) - Chillers - Heat pumps - Pumps - Heat Rejection	• Electricity (kW and kWh)
	Each Equipment in HVAC (Water Side) - Absorption Chiller - Boiler	• Fuel (kW and kWh)
	Each Equipment in HVAC (Air Side) - Primary Air/ Air handling Unit Fans - Ventilation Fans	• Electricity (kW and kWh)
	VRV and Unitary System	• Electricity (kW and kWh)
	Exhaust System - Carpark Exhaust Ventilation - Toilet Exhaust Ventilation (>2.5kW each)	• Electricity (kW and kWh)

Lighting System	Lighting and receptacle system	• Electricity (kW and kWh)
Plumbing and Drainage System	Each equipment in Plumbing and Drainage	• Electricity (kW and kWh)
Lift and Escalators System	Each Lift and Escalators	• Electricity (kW and kWh)

Monitoring provision Requirement (Datapoint, Sensors or Meters)

i. Electricity metering should comply with BS EN [2] accuracy class 1 or equivalent.

ii. Sensors for performance sub-metering should meet the minimum accuracy requirements in ASHRAE Standard 114 [3] or similar equivalent.

Interval and Recording

i. Monitoring record should be at intervals of one hour or less and capable to record the item as required.

ii. All data recorded by the sub-metering system and monitoring system should be transferred to a Building Management System (BMS) or other data collection system. The BMS or other data collection system should have sufficient capacity to store for at least 36 months.

2 Metering and monitoring for PUE

PUE Level 2

2.1 All forms of energy related to PUE calculation shall be measured and tracked over time.

2.2 Energy meters should be provided to measure and track the energy usage at the following system in order to provide real-time display and data collection of PUE, and to compute the annual average PUE at Intermediate Level, i.e. Level 2:

i. Total facility energy;

ii. Total IT equipment energy at each Uninterruptible Power Supply (UPS); and

iii. Total IT equipment energy at each Power Distribution Unit (PDU) output.

2.3 The Monitoring provision, Interval and Recording Requirement should follow the criteria set out in EU 3a.

2 British Standard BS EN 60521:1995. Class 0.5, 1 and 2 alternating-current watthour meters.

3 ASHRAE. Standard 114-1986: Energy Management Control Systems Instrumentation, American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., USA. 1987.

PUE Level 3

2.4 Energy meters should be provided at each individual piece of IT equipment within the DCs, either by metered rack PDUs (i.e. plug strips) that monitor at the strip or receptable level or by the IT device itself.

2.5 The Monitoring provision, Interval and Recording Requirement should follow the criteria set out in EU 3a.

Submittals

(a) Fundamental Metering and Monitoring

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_3a_00	BEAM Plus New DCs submission template for EU 3a	✓	✓
EU_3a_01	Electrical schematics highlighting all locations of metering	✓	✓
EU_3a_02	Control diagrams of central chiller plant monitoring system	✓	✓
EU_3a_03	Specifications of all metering and measurement equipment	✓	✓
	Catalogues of all metering and measurement equipment	-	✓
EU_3a_04	Specifications of BMS or data collection facilities	✓	✓
	Catalogues of BMS or data collection facilities	-	✓
EU_3a_05	Schematic drawings and point schedule of BMS or data collection facilities	✓	✓
EU_3a_06	Test and commissioning records	-	✓
EU_3a_07	Operation manual	-	✓

(b) Metering and monitoring for PUE

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_3b_01	BEAM Plus New DCs submission template for EU 3b	✓	✓
EU_3b_02	Electrical schematics highlighting all locations of metering	✓	✓
EU_3b_03	Specifications of all metering and measurement equipment	✓	✓
	Catalogues of all metering and measurement equipment	-	✓
EU_3b_04	Specifications of BMS or data collection facilities	✓	✓
	Catalogues of BMS or data collection facilities	-	✓
EU_3b_05	Schematic drawings and point schedule of BMS or data collection facilities	✓	✓
EU_3b_06	Test and commissioning records	-	✓
EU_3b_07	Operation manual	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

IDCM 11 Digital Facility Management Interface

5 Energy Use **5.2 System Energy Efficiency**

EU 4 Cooling System Efficiency

Extent of Application All DCs

Objective Encourage the use of high efficiency cooling system in equipment and system configuration to minimise the energy consumption

Credits Attainable 2

Credit Requirement

Air-cooled Cooling System

1 to 2 credits for demonstrating the total cooling system efficiency serving data hall is of 0.85 kW/ton and 0.78 kW/ton, respectively.

Water-cooled Cooling System

1 to 2 credits for demonstrating the total cooling system efficiency serving data hall is of 0.8 kW/ton and 0.75 kW/ton, respectively.

Assessment

Air-cooled Cooling System

1. To demonstrate compliance of the credit, technical report with detail calculation of the total cooling system efficiency is required.

2. The prescribed system efficiency shall be achieved at 75% of the design IT load.

3. The system efficiency calculation should include the following components:

   Air Cooled Chilled-Water Plant:
   i. Air-cooled Chiller
   ii. Chilled Water Pump

   Unitary Air-Conditioners:
   i. Variable Refrigerant Flow (VRF) System
   ii. Single-Split Unit
   iii. Multi-Split Unit

4. The report should be endorsed by a locally qualified professional who has at least 5-year of relevant experience in Building Service Design.

Water-cooled Cooling System

1. To demonstrate compliance of the credit, technical report with detail calculation of the total cooling system efficiency is required.

2. The prescribed system efficiency shall be achieved at 75% of the design IT load.

3. The system efficiency calculation should include the following components:

   Water Cooled Chilled-Water Plant:
   i. Water-cooled chiller
   ii. Chilled water pump
   iii. Condenser water pump

iv. Cooling tower or Heat rejection unit

4. The report should be endorsed by a locally qualified professional who has at least 5-year of relevant experience in Building Service Design.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_4_00	BEAM Plus New DCs submission template for EU 4	✓	✓
EU_4_01	Endorsed technical report	✓	✓
EU_4_02	Design report showing the design IT load	✓	✓
EU_4_03	Cooling system equipment schedule showing all technical information of the system components	✓	✓
	Catalogue of all the system components	-	✓
EU_4_04	Water-side schematic and layout drawings highlighting all the system components.	✓	✓
EU_4_05	Test and Commissioning records	✓	✓
EU_4_06	CV of the professional as per requirements in the assessment	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

5 Energy Use **5.2 System Energy Efficiency**

EU 5 Air Management System

Extent of Application All DCs

Objective Encourage the use of high efficiency air distribution system to minimise the energy consumption

Credits Attainable 2

Credit Requirement 1 to 2 credits for demonstrating the total air flow efficiency of the air distribution system serving all data hall, from supply to return, is of 0.9 kW/m³/s and 0.8 kW/m³/s, respectively.

Assessment

1. To demonstrate compliance of the credit, technical report with detail calculation of the air flow efficiency in all data halls is required.

2. The calculation air flow efficiency should include both the supply and return air flows serving each data hall, and expressed in the following:

$$Airflow\ efficiency = \frac{\text{Total fan power (supply and return), kW}}{\text{Total fan airflow, (supply and return), } \mathrm{m^3/s}}$$

3. The prescribed air flow efficiency shall be achieved at 75% of the design IT load.

4. The report should be endorsed by a locally qualified professional who has at least 5-year of relevant experience in Building Service Design.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_5_00	BEAM Plus New DCs submission template for EU 5	✓	✓
EU_5_01	Endorsed technical report	✓	✓
EU_5_02	Data hall layout plan	✓	✓
EU_5_03	Data hall air-distribution system equipment schedule showing the information of fan power and flow rate	✓	✓
	Catalogue of all the supply and return fans	-	✓
EU_5_04	Data hall Air-side schematic and layout drawings highlighting all the supply and return fans.	✓	✓
EU_5_05	Test and Commissioning records	✓	✓

EU_5_06	CV of the professional as per requirements in the assessment	✓	✓

Remarks

(c) Additional Information

None

(d) Related Credits

None

5 Energy Use **5.2 Renewable and Alternative Energy Generation**

EU 6 Renewable and Alternative Energy Systems

Extent of Application All DCs

Objective Encourage the wider application of renewable energy sources in buildings.

Credits Attainable 4

Credit Requirement

(a) Solar Energy Feasibility Study

1 credit for evaluating the building roof's potential for harnessing solar energy.

(b) Renewable Energy Application

Path 1:

1 credit for using on-/ off-site renewable energy systems to offset annual building energy consumption for Non-data centre subsystem, i.e. Building Service systems servicing non-data hall areas, plant rooms, personal office areas and personal office loads, etc. to offset 0.4% energy consumption.

2 credits for offsetting 0.6% energy consumption.

3 credits for offsetting 0.8% energy consumption.

Credit	Percentage of annual building energy consumption
1	0.4%
2	0.6%
3	0.8%

Path 2:

1 to 3 credits where the minimum percentage of 40% to 80% of the building footprint is being covered/ used by PV panels respectively and/or other renewable power facility generation with equivalent renewable power output.

Credit	Percentage of building footprint with renewable power facility generation
1	40%
2	60%

3	80%

Assessment

(a) Solar Energy Feasibility Study

Conduct a feasibility study to evaluate the potential of standalone and building-integrated installation in harnessing solar energy including photovoltaic and solar water heating. The feasibility study report should include the following contents:

1 Consideration of PV, BIPV or Solar thermal potential installation

1.1 Number of potential surfaces

1.2 Potential surfaces area

1.3 Height variation between roofs

1.4 Potential shading from the surroundings including trees and adjacent buildings

1.5 Potential shading from on-site building services equipment

1.6 Other (proposed)

2 Technical generation potential of solar energy

2.1 Expected solar peak capacity

2.2 Expected annual yield

2.3 Project building energy use intensity (Default value could be used if EU 2 Performance path is not attempted) and the estimated percentage of reduction

3 Economics of solar energy

3.1 Upfront installation costs

3.2 Anticipated maintenance cost

3.3 Anticipated annual electricity bills

3.4 Anticipated cost saving

3.5 Payback period

4 Conclusions

4.1 Conclude whether the harnessing of solar energy is feasible for the project

5 *Roll-out plan* (if concluded to be feasible)

5.1 Propose access and safety measures if solar energy is to be harnessed

5.2 Propose recommendations to refine the roof design to maximise the usable roof space for M&E equipment

The feasibility should be endorsed by a locally qualified professional who has at least 3 years of relevant experience in renewable energy.

Note that the feasibility study imposes no obligation for implementation but encourages consideration of solar energy harnessing.

(b) Renewable Energy Application

Path 1:

1. Calculate the percentage of *annual building energy* consumption for Non-data centre subsystem obtained from all the on-site renewable energy sources with reference to the design value calculated in EU 2 Reduction of CO_2 emissions.

$$\frac{\text{Annual energy generated by Onsite renewable energy systems (kWh)}}{\text{Annual energy use (kWh)}}$$

2. Non-data centre subsystems refer to the followings:
   i. Building Service systems servicing non-data hall areas;
   ii. Plant rooms;
   iii. Personal office areas;
   iv. Personal office load; and
   v. Other sub-systems that are not serving data hall areas

3. The calculation of annual energy provided by the on-site renewable energy systems should take into account of the followings:
   i. Diurnal and seasonal variations in the external environmental conditions; and
   ii. Energy used and lost by the renewable energy systems should be discounted from the systems output.

4. The annual energy use figure should be derived from the design case as stated in EU 2. The tenant's electrical loads, which are not controlled or influenced by the applicant, should be excluded from the annual energy use.

5. For systems that generate energy from on-site renewable sources, the energy generated should count into the "annual energy generated by on-site renewable energy systems" in the above equation. This excludes any energy used as process load.

6. For systems that provide services directly from on-site renewable sources, which will otherwise use fuel or electricity to produce those services, the equivalent amount of electricity to produce those services should count into the "annual energy generated by on-site renewable energy systems" in the above equation.

7. Off-site renewable energy system refers to the purchasing of local Renewable Energy Certificates (REC) [1][2].
8. DCs should demonstrate continuous purchasing of local REC for at least 5 years.

Path 2:

1. Technical report providing details of the installations, and calculations showing the percentage of the building footprint is being covered/used by PV panels and/or other renewable power facility generation equivalent renewable power output.

Submittals

(a) Solar Energy Feasibility Study

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_6a_00	BEAM Plus New DCs submission template for EU 6	✓	✓
EU_6a_01	Endorsed Feasibility study report	✓	-
EU_6a_02	CV of the professional as per requirements in the assessment	✓	-

(b) Renewable Energy Application

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_6b_00	BEAM Plus New DCs submission template for EU 6	✓	✓
EU_6b_01	Specifications of on-site renewable energy system	✓	-
	Catalogue of on-site renewable energy system	-	✓
EU_6b_02	Elevation and layout plan highlighting the location of each on-site renewable energy system	✓	✓

1 CLP Renewable Energy Certificates, available at: https://www.clp.com.hk/en/community-and-environment/renewable-schemes/renewable-energy-certificates

2 HK Electric Renewable Energy Certificates, available at: https://www.hkelectric.com/en/customer-services/smart-power-services/renewable-energy-certificates

EU_6b_03	Schematic diagram of each renewable energy system	✓	✓
EU_6b_04	Declaration letter confirming the commitment to purchasing of local Renewable Energy Certificates	✓	-
	5 years of valid local Renewable Energy Certificates	-	✓
EU_6b_05	Endorsed calculation of annual yield of each on-site renewable energy system and assumptions	✓	✓
EU_6b_06	Endorsed Calculation of percentage of annual building energy consumption obtained from on-site renewable energy sources	✓	✓
EU_6b_07	Test and commissioning report of on-site renewable energy system	-	✓
EU_6b_08	CV of the professional as per requirements in the assessment	✓	✓

Remarks

(a) Additional Information

EMSD – HK RE Net

http://re.emsd.gov.hk/english/gen/overview/over_intro.html

EMSD – Energy Land

http://www.energyland.emsd.gov.hk/en/energy/energy_use/application.html

EMSD – New & Renewable Energy

http://www.emsd.gov.hk/en/energy_efficiency/new_renewable_energy/GovHK – Renewable Energy

http://www.gov.hk/en/residents/environment/energy/renewableenergy.htm

Scheme of Control

Hongkong Electric Co. Ltd. and HK Electric Investments Ltd.(PDF version) (1 January 2019 to 31 December 2033)
http://www.enb.gov.hk/sites/default/files/en/node66/new_HKE_SCA_eng.pdf

CLP Power Hong Kong Ltd. and Castle Peak Power Company Ltd.(PDF version) (1 October 2018 to 31 December 2033)
http://www.enb.gov.hk/sites/default/files/en/node66/new_CLP_SCA_eng.pdf

(b) Related Credits

EU 1 Low Carbon Passive Design

EU 2 Reduction of CO_2 Emissions

BEAM Plus appreciates comprehensive energy saving measures. Thorough consideration of passive design, active design and renewable energy will help buildings achieve significant reduction in energy consumption.

5 Energy Use **5.3 Energy Efficient Equipment**

EU 7 Efficient IT Equipment

Extent of Application
EU 7a: All DCs
EU 7b: DCs with operational control over the IT Equipment.

Objective
To recognise and encourage the procurement of energy-efficient equipment to ensure optimum performance and energy savings.

Credits Attainable
2

Credit Requirement

(a) Use of Efficient UPS

1 credit for demonstrating that the Uninterruptible Power Supplies (UPS) is procured in accordance with certified energy efficient products scheme.

(b) Use of Sustainable IT Equipment

1 credit for demonstrating that the IT Equipment for the running and operating of the DCs of is procured in accordance with certified energy efficient products scheme.

Assessment

(a) Use of efficient UPS

1. Demonstrate all the installed Uninterruptible Power Supplies (UPS) have achieved USEPA ENERGY STAR Rated [1] or certified under an equivalent labelling scheme.
2. Provide a schedule of UPS including the location, quantity, model and the rated power.

(b) Use of Sustainable IT Equipment

1. This credit assesses only the IT Equipment provided by the developer.
2. Demonstrate at least 80% of the installed IT Equipment listed below have achieved USEPA ENERGY STAR Rated [2] or certified under an equivalent labelling scheme.
   - 1.1 Servers;
   - 1.2 Data Centre Storage;
   - 1.3 Small Network Equipment; and
   - 1.4 Large Network Equipment.
3. Provide a schedule of all IT Equipment including the location, quantity, model and the rated power.

1 USEPA ENERGY STAR website [ONLINE] Available at: https://www.energystar.gov/products/data_center_equipment/uninterruptible_power_supplies

2 USEPA ENERGY STAR website [ONLINE] Available at: h https://www.energystar.gov/products/data_center_equipment

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_07_00	BEAM Plus New DCs submission template for EU 7	✓	✓
EU_07_01	Schedule of all UPS	✓	✓
	Schedule of all IT Equipment	✓	✓
EU_07_02	Specifications that demonstrated the control of purchasing energy efficient label for the project	✓	-
EU_07_03	Catalogues of all IT Equipment highlighting the compliance of USEPA Energy Star	-	✓
EU_07_04	Electrical schematic drawing (s) highlighting all IT efficient appliances	✓	✓
EU_07_05	Justification report for the equivalent label used in the assessment	✓	✓
EU_07_06	Photographic evidence confirming installation of compliant IT equipment	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

5 Energy Use **5.3 Green Data Centre Practice**

EU 8 Best Practices on Energy Use

Extent of Application All DCs

Objective Encourage the adoption of green DC best practices to achieve better energy-efficiency DCs.

Credits Attainable 5

Credit Requirement

1. 3 credits for incorporating at least 2 best practices from each of the following aspects as listed in the Green DC Practice Guide published by BEAM Society Limited.

i. Cooling System;
ii. Air Flow Management;
iii. Operating at Higher Temperature and Humidity;
iv. Cooling Management; and
v. Power System.

2. 2 credits for incorporating at least 6 best practices should be adopted from the following aspects as listed in the Green DC Practice Guide published by BEAM Society Limited:

i. Design of Resilience;
ii. Monitoring and Managing Energy Efficiency;
iii. IT Equipment Deployment;
iv. IT Application System and IT Service Deployment; and
v. Telecommunications and Network Cabling.

Assessment

1. Demonstrate the adoption of best practice on energy use as mentioned in the Green DC Practice Guide published by the BEAM Society Limited.

2. At least **2** best practices should be adopted from each of the following aspects as listed in the Green DC Practice Guide published by BEAM Society Limited:

i. Cooling System;
ii. Air Flow Management;
iii. Operating at Higher Temperature and Humidity;
iv. Cooling Management; and
v. Power System;

3 credits will be awarded for successfully demonstrating at least 2 best practices from each of the abovementioned aspects.

3. At least **6** best practices should be adopted from the following aspects as listed in the Green DC Practice Guide published by BEAM Society Limited:

i. Design of Resilience;
ii. Monitoring and Managing Energy Efficiency;
iii. IT Equipment Deployment;
iv. IT Application System and IT Service Deployment; and
v. Telecommunications and Network Cabling.

2 credits will be awarded for successfully demonstrating at least 6 best practices from the abovementioned aspects.

4. Prepare a technical report detailing the following:

4.1 List of each adopted best practice;
4.2 Detailed description of each adopted best practice and explanation on how it could benefit the DC development; and
4.3 Evidences showing the adoption of the best practice including specifications specifying the application of the best practice, on-site photograph records, drawings, calculation, etc.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
EU_08_00	BEAM Plus New DCs submission template for EU 8	✓	✓
EU_08_01	Technical report summarising the adopted best practice	✓	✓

Remarks

(c) Additional Information

None

(d) Related Credits

None

6 Water Use

6.1 Water Conservation
6.2 Effluent
6.3 Water Harvesting / Recycling
6.4 Water Management

Introduction

Water is known to be in scarce supply in many parts of the world. Globally, water shortage is already a major issue. Hong Kong has been enjoying a reliable and economic supply of most of its fresh water needs from the Mainland.

However, with increased industrialisation of Guangdong Province there is likely to be greater competition for water supply in the pearl river region, meaning that water conservation may become a significant issue for Hong Kong in the future. Hong Kong should look into ways to improve the utilisation and conservation of water resources.

6.1 Water Conservation

WU 1 Annual Water Use
WU 2 Water Efficient Irrigation
WU 3 Water Leakage Detection
WU 4 Cooling Tower Water

Background

In Hong Kong, WSD ensures that the quality of drinking water provided to customers complies fully with the Hong Kong Drinking Water Standards, currently being the corresponding guideline values or provisional guideline values in the fourth edition of the World Health Organization's Guidelines for Drinking-water Quality published in 2011 (WHO Guidelines). Drinking water quality, however, can be affected by the condition of a building's inside service. To safeguard tap water quality, property owners and building managers are advised to carry out proper maintenance of inside service and regular cleaning of water storage tanks. While water quality satisfying WSD's requirement is the mandatory requirement, water conservation is another focus area under water category.

Despite the continued decline in industrial water consumption there is an annual trend of rising consumption due to increasing domestic consumption. Based on projected population growth, the domestic and service uses, being the key components of our fresh water consumption, are expected to increase. Industrial use, for the same period, is expected to drop because of further decline in water intensive industries. Fresh Water Cooling Tower Scheme (FWCT Scheme) will contribute to consumption by the non-domestic sector.

Water from the Dongjiang River in Guangdong continues to be Hong Kong's main source of supply and accounting for about 70-80 percent of Hong Kong's needs. Hong Kong has limited options to reduce dependency on the Mainland, where water resources are becoming increasingly limited. There is opportunity to reduce potable water use through better design, management and user awareness.

6.2 Effluent

WU 5 Effluent Discharge to Foul Sewers

Background

While 80% of users in Hong Kong are supplied with seawater for flushing purposes, there are environmental impacts associated with the treatment

and delivery of seawater, and the load imposed on municipal sewage treatment plants. Measures taken to reduce volumes of effluent flows have significant environmental benefits.

6.3 Water Harvesting and Recycling

WU 6 Water Harvesting and Recycling

Background

There are opportunities to recycle used water and rain water in order to reduce the use of potable water. Additional benefits of potable water conservation can reduce energy use on transport and treatment of raw water.

6.4 Water Management

WU 7 Water Metering

Background

Provision of water meters for better control and monitoring of water consumption which can help to reduce water consumption through regularly keep tracking the water usage, exploring water reduction opportunities, promote and implement water conservation measures and practices.

6 Water Use 6.1 Water Conservation

WU 1 Annual Water Use

Extent of Application All DCs

Objective To reduce the consumption of potable water through the application of water saving devices that have proven performance and reliability.

Credits Attainable 3

Credit Requirement **Potable Water Saving**

1 credit for demonstrating that the use of water efficient devices leads to an estimated annual saving of 20%.

2 credits for 25%.

3 credits for 30%.

Credit(s)	Estimated annual water saving / %
1	20%
2	25%
3	30%

Assessment

1. Prepare a Potable Water Use Report which should include the following contents:
2.
   2.1. Schedule including the types of fixture with the location and number of each type of fixture;
   2.2. Calculation of potable water use following the guidance below; and
   2.3. Percentage of annual potable water saving.

The calculation of potable water use should be based on the following methodology:

Users

Specify the number of users, male to female ratio according to the sanitary fitment schedule in the project General Building Plan. If no sanitary fitment schedule is available, use the assumed occupancy (9m^2/person) and male to female ratio (1:1).

For projects with accessible toilets, bathrooms and the like, it can be assumed that the rate of users with disability is 8.1% and the non-accessible toilets, bathrooms and the like are used by the remaining 91.9% of the dedicated users [1]

The same number of users should be applied to both the baseline case and the project design case.

1 Hong Kong Monthly Digest of Statistics (January 2015) Feature Article – Persons with Disabilities and Chronic Diseases in Hong Kong. [ONLINE] Available at: http://www.statistics.gov.hk/pub/B71501FB2015XXXXB0100.pdf. [Accessed August 2019]

Operational Days

Specify the number of operational days per annum. Alternatively, assume full year operation (365 days).

The same operational days should be applied to both the baseline case and the project design case.

Number of Use, Product Flow Rate and Duration of Use

Establish a baseline case for water consumption by the assumptions outlined in the following table. The calculation should only consider the listed fixtures.

Fixture Type	Flow Rate (L/min)	Operation Time (sec)	Number of Use per Occupant per day
Shower	12	300	0.1
Non-mixing Type Water Taps (bathrooms and toilets)	4	10	5
Mixing Type Water Taps (bathrooms and toilets)	7	10	5

Establish the project design case and identify the fixture flowrate at 5bar:

If automatic controls such as proximity sensors are used in the project to reduce the operation time, product catalogues are required to substantiate the performance.

The same number of use should be applied to both the baseline case and the project design case.

Annual Potable Water Percentage Saving

Add up the total annual potable water use for both baseline and design. The annual potable water percentage saving can be calculated as follow:

$$1 - \frac{\text{Annual potable water use (design)}}{\text{Annual potable water use (baseline)}} \times 100\%$$

Any fixtures (other than commercial kitchen fixtures) that is not considered in the calculation should demonstrate that the water taps are rated grade 1 by the WSD voluntary Water Efficiency Labelling Scheme.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_01_00	BEAM Plus New DCs submission template for WU 1	✓	✓
WU_01_01	WU-1-1_Form	✓	✓
WU_01_02	General Building Plan (GBP) highlighting the sanitary fitting schedule and the male to female ratio	✓	✓
WU_01_03	Plumbing schematic drawing (s) and plumbing layout drawings, highlighting the tanks, pump(s), PRV(s), flow controllers, mPD level, operating pressure per floor, primary piping routes	✓	✓
WU_01_04	Calculation summary of potable water	✓	✓
WU_01_05	Specifications of each type of fixture counted in the calculation, including the flow rate curve and working pressures to substantiate the flow rate values used in design case	✓	
WU_01_06	Catalogues of each type of fixture counted in the calculation, including the flow rate curve and working pressure to substantiate the flow rate values used in design case	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

6 Water Use **6.1 Water Conservation**

WU 2 Water Efficient Irrigation

Extent of Application DCs with permanent greenery and permanent irrigation system under the control of Applicant.

Objective Reduce the reliance on potable water for irrigation.

Credits Attainable 2 + 1 additional BONUS

Credit Requirement 1 to 2 credits for reducing potable water consumption for irrigation in comparison with the baseline.

Credit(s)	Percentage of reduction of potable water consumption for irrigation
1	25%
2	50%
2 + 1 additional BONUS	100%

Assessment Specify the area of each landscape type making up the total area of greenery in the project. For each landscape type, calculate the annual irrigation demand using the following formula.

$$\mathrm{ID} = \sum_{\text{January}}^{\text{December}} \frac{\mathrm{ET} \times \mathrm{K_L} \times \mathrm{A} \times \mathrm{CE}}{\mathrm{IE}}$$

ID : Annual irrigation demand satisfied by using potable water (L)

ET : Monthly reference evapotranspiration (mm)

K_L : Landscape coefficient of the landscape type

A : Area of the landscape type (m^2)

CE : Efficiency of controller serving the landscape type

IE : Efficiency of irrigation method serving the landscape type

In theory the reference evapotranspiration is correlated to crop coefficient. For calculation, the reference evapotranspiration can be assumed to be equivalent to potential evapotranspiration. The potential evapotranspiration can be found on the Hong Kong Observatory website [1].

Landscape coefficient indicates the volume of water lost via evapotranspiration and is dependent on landscape species, planting density and microclimate factor. For the ease of assessment, the calculation of landscape coefficient is simplified and listed in manual for calculation reference.

1 HKO - Monthly Sea Surface Temperature Recorded at North Point and Waglan Island and Monthly Total Evaporation and Potential Evapotranspiration Recorded at King's Park between 1961-1990

Justification is needed for any proposed value.

Refer to the below table for landscape coefficient. Vertical greenery type should refer to the same table per plant type:

Refer to the below table for irrigation method.

Landscape type	Landscape coefficient (K_L)
Tree	0.5
Shrubs	0.5
Groundcovers	0.5
Mixed (Trees + Shrubs + Groundcovers)	0.6
Turfgrass	0.7
Adaptive Species (No irrigation require)	0

Irrigation method	Irrigation efficiency (IE)
Manual	0.5
Drip – Standard	0.7
Drip – Pressure compensated	0.9
Fixed Spray	0.65
Micro Spray	0.7
Rotor	0.7

Calculate the total Irrigation demand that uses potable water in both baseline and project design cases by the above formula. Sum up the calculated ID(s) for all landscape types. The irrigation demand should cover all permanent greenery in the project. For private garden not under the control of the building management, irrigation demand for the design case should be assumed the same as the baseline case.

1. Baseline

The composition of landscape type making up the permanent greenery in the project should be the same as design case.

i. Assume all landscape types are irrigated manually (i.e. IE = 0.5) and no controller is used (i.e. CE = 1).

ii. Assume no *reused* or recycled water is used.

2. Design

i. Specify the irrigation method and controller (if used) for each landscape type and calculate the ID correspondingly.

ii. If controllers, including weather-based and moisture sensor-based, are used, the CE should be supported by manufacturer's documentation.

iii. If harvested rainwater or recycled grey water is used to replace potable water for irrigation, the corresponding annual amount of replaced water can be deducted from the irrigation demand. The calculation method of the amount of harvested rainwater and recycled grey water should be consistent with WU 8.

Demonstrate sufficient collection tank (or retention pond) capacity:

Harvested rainwater: 10 days or more [2] of the month with the peak rainfall (assume 30 days in a month).

Recycled grey water: 8-10 hours

The percentage reduction in annual irrigation demand that uses potable water can be calculated as follow:

$$1 - \frac{\text{ID (design)}}{\text{ID (baseline)}} \times 100\%$$

Alternatively, if self-sustained plants are used to form all permanent greenery, which do not require irrigation beyond their establishment period (maximum two years), provide justification to explain why no irrigation will be required based on local rainfall and plants' water demands. The justification should be endorsed by a professional landscape architect or ecologist. Two credits can be attained.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_02_00	BEAM Plus New DCs submission template for WU 2	✓	✓
WU_02_01	WU-2-1_Form	✓	✓
WU_02_02	Calculation of demand of potable water for irrigation in both baseline and project	✓	✓

2 Water Supplies Department, Technical Specifications on Grey water reuse and Rainwater Harvesting [ONLINE] Available at: https://www.wsd.gov.hk/filemanager/en/content_1459/technical_spec_grey_water_reuse_rainwater_harvest.pdf Accessed 05 Aug 2019].

	design cases and percentage reduction as detailed in the credit assessment		
WU_02_03	Greenery plan including the total greenery area (distinguish between communal greenery and private garden if applicable) and an area break-down according to irrigation method or controller used	✓	✓
WU_02_04	Calculation demonstrating sufficient tank (or retention pond) storage capacity	✓	✓
WU_02_05	Plumbing schematic drawing (s) and plumbing layout drawings, highlighting the rainwater harvesting system and the grey water recycling system (if applicable)	✓	✓
WU_02_06	Specifications of controllers (if applicable)	✓	-
WU_02_07	Catalogues of controllers (if applicable)	-	✓
WU_02_08	Justification report for self-sustain plants that require no irrigation beyond their establishment period (Alternative approach)	✓	✓

Remarks

(a) Additional information

None

(b) Related credits

Calculation method of amount of harvested rainwater and recycled grey water should be consistent with WU 6.

6 Water Use **6.1 Water Conservation**

WU 3 Water Leakage Detection

Extent of Application All DCs (if water tanks are installed in open areas, water leakage detection systems are required to install in data halls only)

Objective To identify water leakage once detected for the arrangement of maintenance work.

Credits Attainable 1

Credit Requirement 1 credit for installing water leakage detection systems in all municipal potable water tank rooms and data halls.

Assessment Demonstrate that water leakage detection systems are installed in all municipal potable water tank rooms, including rooms comprising potable water tank, irrigation tank and cleansing water tank, and flush water tank if using fresh water for flushing and all data halls.

Water tank rooms, which consists of only non-potable water tank and/ or fire services tank, are not assessed.

Water tank rooms which have multiple water tanks should have at least one leakage detection system.

The detection systems should have the capability to automatically alert the operator or the security guard and identify the room with leakage when leakage occurs.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_03_00	BEAM Plus New DCs submission template for WU 3	✓	✓
WU_03_01	WU-3-1_Form	✓	✓
WU_03_02	Plumbing schematic drawing(s) and plumbing layout drawings, highlighting the provisions of water leakage detection systems in all water tank rooms and data halls	✓	✓
WU_03_03	Commissioning data of water leakage detection systems in all water tank rooms and data halls	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

6 Water Use **6.1 Water Conservation**

WU 4 Cooling Tower Water

Extent of Application All DCs equipped with cooling tower using potable water as makeup water.

Objective To reduce potable water consumption for cooling tower makeup.

Credits Attainable 2

Credit Requirement 1 credit for achieving 7 or more cycles of concentration with acceptable water quality.

2 credits for use of cooling tower water treatment system which can achieve minimum of 10 cycles of concentration of acceptable water quality.

Assessment

The ratio between the concentration of dissolved solids in the cooling tower and the make-up water should be 7 or more/ minimum of 10 cycles for 1 or 2 credits, respectively. Demonstrate that the corresponding make-up water pumps can provide sufficient flow rate and pressure to sustain the specified cycle of concentration.

All cooling tower using potable water within the assessment boundary should comply with this requirement.

Submit cooling tower water treatment proposal developed in accordance to the latest EMSD Code of Practice for Fresh Water Cooling Tower [1] to demonstrate minimum cycles of concentration of 7 or more/ minimum of 10 cycles is designed and adopted.

After project completion, submit EMSD Form EE CT3 [2] regarding the cooling water sampling results and the associated water sampling test report to substantiate satisfactory cooling water quality.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_04_00	BEAM Plus New DCs submission template for WU 6	✓	✓
WU_04_01	WU-4-1_Form	✓	✓
WU_04_02	Water treatment proposal highlighting the design cycles of concentration	-	✓

1 Electrical and Mechanical Services Department – Code of Practice for Fresh Water Cooling Towers CoP (FWCT). [ONLINE] Available at: http://www.emsd.gov.hk/en/energy_efficiency/fwct_scheme/publications/index.html. [Accessed August 2019]

2 Electrical and Mechanical Services Department – Fresh Water Cooling Towers Scheme Summary of Operational Information for Cooling Tower Installation. [ONLINE] Available at: http://www.emsd.gov.hk/filemanager/en/content_1058/EMSD_EE_CT3_eng.pdf. [Accessed August 2019]

WU_04_03	Specifications of cooling tower, water treatment equipment and make-up water pumps	✓	
WU_04_04	Catalogues of cooling tower, water treatment equipment and make-up water pumps	-	✓
WU_04_05	EMSD Form EE CT3 and associated water sampling test report	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

6 Water Use **6.2 Effluent**

WU 5 Effluent Discharge to Foul Sewers

Extent of Application All DCs

Objective To reduce the volumes of sewage discharged from buildings thereby reducing burdens on municipal sewage services and treatment facilities.

Credits Attainable 1

Credit Requirement 1 credit for demonstrating a reduction in annual sewage volumes by 20% or more.

Assessment The **flushing water use report** should include all the following contents:

1. Schedule including the types of fixture, location, number of occupants, daily usage and flushing volumes;
2. Flushing water use calculation following the below guidance; and
3. Annual effluent discharge reduction percentage.

Flushing water use calculation should be based on the followings:

1. Occupancy

Specify the number of users, male to female ratio according to the sanitary fitment schedule in the project General Building Plan. If no sanitary fitment schedule is available, use the assumed occupancy (9m^2/person) and male to female ratio (1:1).

For projects with accessible toilets, bathrooms and the like, it can be assumed that the rate of users with disability is 8.1% and the non-accessible toilets, bathrooms and the like are used by the remaining 91.9% of the dedicated users [1].

The same number of users should apply to both the baseline case and the project design case.

2. Operational days

Specify the number of operational days per annum. Alternatively, assume a full year operation (i.e. 365 days).

The same operational days should apply to both the baseline case and the project design case.

1 Hong Kong Monthly Digest of Statistics (January 2015) Feature Article – Persons with Disabilities and Chronic Diseases in Hong Kong. [ONLINE] Available at: http://www.statistics.gov.hk/pub/B71501FB2015XXXXB0100.pdf. [Accessed August 2019]

3. Number of use

The same number of use should apply to both the baseline case and the project design case.

Fixture type	Number of use per day
Male WC Single Flush	1
Male WC Dual Flush	1 full flush volume
Female WC Single Flush	5
Urinal	4
Female WC Dual Flush	1 full and 4 low volume

4. Flushing Volume

Based on the above, establish a baseline case for flushing water consumption by the following assumptions. While dual flush WC is used, a single flush WC baseline can be adopted.

Fixture type	Flushing volume (L / flush)
Single Flush WC	6.5
Urinal	2.5

Establish the flushing water consumption for the project design case based on the flushing volumes shown in the catalogues and specifications. Note that no pressure calculation is required if worse case condition is considered in reduction calculation.

5. Annual Effluent Discharge Reduction Percentage

The annual flushing water percentage saving can be calculated as follows:

$$1 - \frac{\text{Annual flushing water use (design)}}{\text{Annual flushing water use (baseline)}} \times 100\%$$

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		PA	FA
WU_05_00	BEAM Plus New DCs submission template for WU 5	✓	✓
WU_05_01	WU-5-1_Form	✓	✓

WU_05_02	General Building Plan (GBP) sanitary fitting schedule and male to female ratio	✓	✓
WU_05_03	Plumbing schematic drawing (s) and plumbing layout drawings, highlighting tanks, pump(s), PRV(s), flow controllers, mPD level, primary piping routes	✓	✓
WU_05_04	BD standard drainage schematic drawing(s) and drainage layout drawings, highlighting the sanitary fitment	✓	✓
WU_05_05	Flushing water use report	✓	✓
WU_05_06	Specifications of each type of fixture illustrating the flush volume per flush	✓	-
WU_05_07	Catalogues of each type of fixture illustrating the flush volume per flush	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

6 Water Use **6.3 Water Harvesting and Recycling**

WU 6 Water Harvesting and Recycling

Extent of Application All DCs

Objective To encourage harvesting of rainwater and recycling of grey water in order to reduce consumption of potable water.

Credits Attainable 2 + 1 BONUS

Credit Requirement

i. Harvested Rainwater

1 credit for harvesting of rainwater that achieve a reduction of 5% or more in the consumption of potable water.

ii. Recycled Grey Water

1 credit for recycling grey water that achieves a reduction of 5% or more in the consumption of potable water.

iii. Exemplary Water Recycling

1 BONUS where harvested rainwater, recycled grey water or a combination of both leads to a reduction of 10% or more in the consumption of potable water.

Assessment

i. Harvested Rainwater

1. <u>Calculation of the monthly harvested rainwater yield</u>

Accepted rainwater sources are from roofs, permeable paving, non-permeable paving and surface runoff from grass and landscaped areas [1]. For each source, calculate the monthly harvested rainwater yield throughout the year using the below formula.

$$Y_r = A_c \times R_m \times C_r$$

Yr is the monthly average rainwater yield (litre/month)
Ac is the collection area (m2)
Rm is the monthly mean of rainfall in Hong Kong between 1981-2010 (mm) [2]
Cr is the run-off coefficient

If an in-line filter is installed to the rainwater collection system, a filter efficiency, Nf, should be incorporated into the above equation, which can be assumed to be 0.9.

1 Water Supplies Department – Technical Specifications On Grey Water Reuse And Rainwater Harvesting (1st Edition) May 2015 .[ONLINE] Available at: https://www.wsd.gov.hk/filemanager/en/content_1459/technical_spec_grey_water_reuse_rainwater_harvest.pdf [Accessed Aug 2019].

2 Hong Kong Observatory – Monthly Meteorological Normals for Hong Kong. 2017. [ONLINE] Available at: http://www.hko.gov.hk/cis/normal/1981_2010/normals_e.htm [Accessed August 2019].

Surfaces run off coefficients are provided in manual. Provide supplier's product catalogue to substantiate if other values are used.

Surfaces/ substrates	***Runoff coefficients***
Water bodies	1
Flat roof/ road/ hardscape with impervious construction	0.85
Flat roof covered with pebbles	0.65
Green roof (soil depth of at least 300mm)	0.35
Earth-covered (soil depth not more than 500mm) basement	0.35
Pervious paving and construction (maximum slope of porous pavement surface to a gradient of 1:20; the minimum *permeability coefficient* under 15℃ for permeable paving / construction should be 1.0 x 10-2 cm/s)	0.25
At-grade softscape	0.15
Earth-covered (soil depth more than 500mm) basement	0.15

Note:

i. The above information has made reference to the design guides for stormwater management/runoff control GB50014 and DB11/685 of PRC.

ii. Alternative runoff coefficients may be proposed and justified by applicant which is subject to approval.

2. <u>Calculation of the monthly demand for harvested rainwater</u>

Calculate the monthly demand for harvested rainwater throughout the year which includes only the activities which otherwise would need to consume potable water but is then replaced by harvested rainwater in the project.

Accepted activities include flushing, irrigation volume of water consume by manual irrigation is excluded from the calculation), water features, car washing, external cleaning, fire-fighting and industrial processes.

3. <u>Comparison of yield and demand</u>

Compare the total yield and the total demand, month by month, to calculate the amount of potable water replaced by harvested rainwater.

For months when the yield exceeds the demand (i.e. surplus), the amount of replaced potable water is equivalent to the demand. For months when the

demand exceeds the yield (i.e. shortage), the amount of replaced potable water is equivalent to the yield.

4. Calculation of the annual amount of potable water replaced by harvested rainwater

Add up the replaced water throughout the year to show the annual amount. This is the nominator for the calculation of percentage reduction.

5. Calculation of the percentage reduction in potable water use replaced by harvested rainwater

The denominator should at least include the annual potable water use for irrigation and flushing (figures should be consistent with WU 1 design case and WU 2 design case, excluding manual irrigation; reused and recycled water are not considered in the calculation.), and, only if harvested rainwater is used for the activity, the annual potable water use for water features, car washing, external cleaning, fire-fighting and industrial processes.

6. Sufficient tank storage capacity

Demonstrate the collection tank(s) (or retention pond) has sufficient capacity.

Harvested rainwater: 10 days or more [3] of the month with the peak rainfall (assume 30 days in a month).

7. Water quality standards

Demonstrate the harvested rainwater, after treatment, meet the recommended water quality standards prescribed in in the WSD Technical Specifications [4].

ii. Recycled Grey Water

1. Calculation of the monthly recycled greywater yield

Accepted grey water sources are wash basins, baths, showers, dishwashers, laundry machines, kitchen sinks, cooling tower bleed-off water and air conditioning condense [5].

3 Water Supplies Department, Technical Specifications on Grey water reuse and Rainwater Harvesting [ONLINE] Available at: http://www.wsd.gov.hk/filemanager/en/content_1081/technical_spec_grey_water_reuse_rainwater_harvest.pdf [Accessed 05 July 2017].

4 Water Supplies Department – Technical Specifications On Grey Water Reuse And Rainwater Harvesting (1st Edition) May 2015. [ONLINE] Available at: http://www.wsd.gov.hk/filemanager/en/content_1081/technical_spec_grey_water_reuse_rainwater_harvest.pdf. [Accessed 05 July 2017].

5 Water Supplies Department – Technical Specifications On Grey Water Reuse And Rainwater Harvesting (1st Edition) May 2015. [ONLINE] Available at: https://www.wsd.gov.hk/filemanager/en/content_1459/technical_spec_grey_water_reuse_rainwater_harvest.pdf [Accessed Aug 2019].

Follow the calculation method specified in Section 3.4 in WSD Technical Specifications On Grey Water *Reuse* And Rainwater Harvesting [7]. Provide further calculation for air conditioning condense.

2. Calculation of the monthly demand for recycled greywater yield

Calculate the monthly demand for recycled grey water throughout the year which includes only the activities which originally would have used potable water but is then replaced by recycled greywater in the project.

Accepted activities include flushing, irrigation (excluding manual irrigation), water features, car washing, external cleaning, fire-fighting and industrial processes.

3. Comparison of yield and demand

Compare the yield and the demand, month by month, to calculate the amount of potable water replaced by recycled greywater.

For months when the yield exceeds the demand (i.e. surplus), the amount of replaced potable water is equivalent to the demand. For months when the demand exceeds the yield (i.e. shortage), the amount of replaced potable water is equivalent to the yield.

4. Calculation of the annual amount of potable water replaced by recycled greywater

Add up the replaced water throughout the year to show the annual amount. This is the nominator for the calculation of percentage reduction.

5. Calculation of the percentage reduction in potable water use replaced by recycled greywater

The denominator should at least include the annual potable water use for irrigation and flushing. The figures should be consistent to: WU 2 design case, excluding manual irrigation, and should be consistent to WU 1 design case, without deducting any *reused* / recycled water. Only if recycled greywater is used for the activity, the annual potable water use for water features, car washing, external cleaning, fire-fighting and industrial processes.

6. Sufficient tank storage capacity

Demonstrate the collection tank(s) has sufficient capacity.

Recycled grey water: 8-10 hours

7. Water quality standards

Demonstrate the recycled grey water, after treatment, meet the recommended water quality standards prescribed in Table 1-1 in the WSD Technical Specifications [6].

iii. Exemplary Water Recycling

In additional to the requirements stipulated in parts (a) and (b), demonstrate that harvested rainwater, recycled grey water or a combination of both leads to a reduction of 10% or more in the consumption of potable water.

Submittals

(a) Harvested Rainwater

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_6a_00	BEAM Plus New DCs submission template for WU 6a	✓	✓
WU_6a_01	WU-6-1_Form	✓	✓
WU_6a_02	WU-6-2_Form	✓	✓
WU_6a_03	Calculation of reduction in demand of potable water from rainwater harvesting system	✓	✓
WU_6a_04	Landscape plan including the total landscape area (distinguish between communal greenery and private garden if applicable) and area break-down according to irrigation method or controller used	✓	✓
WU_6a_05	Catchment area plan including area break-down, type of surface and surface coefficient adopted	✓	✓
WU_6a_06	Plumbing schematic drawing (s) and plumbing layout drawings	✓	✓
WU_6a_07	Rainwater harvesting system schematic drawing(s)	✓	✓
WU_6a_08	Commissioning data of rainwater systems	-	✓

6 Water Supplies Department, Technical Specifications on Grey water reuse and Rainwater Harvesting [ONLINE] Available at: https://www.wsd.gov.hk/filemanager/en/content_1459/technical_spec_grey_water_reuse_rainwater_harvest.pdf Accessed Aug 2019].

WU_6a_09	Water quality measurement protocol	✓	✓
WU_6a_010	Water quality measurement report	-	✓

(b) Recycled Grey Water

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_6b_00	BEAM Plus New DCs submission template for WU 6b	✓	✓
WU_6b_01	WU-6-3_Form	✓	✓
WU_6b_02	WU-6-4_Form	✓	✓
WU_6b_03	Calculation of reduction in demand of potable water from grey water system	✓	✓
WU_6b_04	Plumbing schematic drawing (s) and plumbing layout drawings, highlighting the grey water recycling system	✓	✓
WU_6b_05	Commissioning data of grey water systems	-	✓
WU_6b_06	Water quality measurement protocol	✓	✓
WU_6b_07	Water quality measurement report	-	✓

(c) Exemplary Water Recycling

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_6c_00	BEAM Plus New DCs submission template for WU 6c	✓	✓
WU_6c_01	WU-6-1_Form	✓	✓
WU_6c_02	WU-6-2_Form	✓	✓
WU_6c_03	WU-6-3_Form	✓	✓
WU_6c_04	WU-6-4_Form	✓	✓
WU_6c_05	Calculation of reduction in demand of potable water from rainwater harvesting system	✓	✓

WU_6c_06	Landscape plan including the total landscape area (distinguish between communal greenery and private garden if applicable) and area break-down according to irrigation method or controller used	✓	✓
WU_6c_07	Catchment area plan including area break-down, type of surface and surface coefficient adopted	✓	✓
WU_6c_08	Calculation of reduction in demand of potable water from grey water system	✓	✓
WU_6c_09	Plumbing schematic drawing (s) and plumbing layout drawings, highlighting the rainwater harvesting system and the grey water recycling system (if applicable)	✓	✓
WU_6c_10	Commissioning data of rainwater and grey water systems	-	✓
WU_6c_11	Water quality measurement protocol	✓	✓
WU_6c_12	Water quality measurement report	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

Calculation method of amount of potable water should be consistent with WU 1

Calculation method of amount of irrigation demand should be consistent with WU 2.

4 6 Water Use 6.4 Water Management

WU 7 Smart Water Metering

Extent of Application All DCs

Objective To support water management and to provide opportunity to reduce the water use by tracking the water consumption records on different water systems.

Credits Attainable 1

Credit Requirement 1 credit for provision of permanent smart water for cooling towers water use and Indoor plumbing fixtures and fitting,

and at least two (2) of the other water systems, which able to display metered data, treading of water consumption and relevant parameters.

Assessment

1. Permanently installation of smart water meters for cooling towers water and Indoor plumbing fixtures and fitting, and at least two (2) of the following water systems:

   1.1. Irrigation (if applicable);
   1.2. Cleansing;
   1.3. Water features/ pools; and
   1.4. Other process water.

2. The smart meters should be able to display metered data, trending of water consumption and relevant parameters, and with data logging capability/ connected to Building Management System (BMS).

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
WU_7_00	BEAM Plus New DCs submission template for WU 7	✓	✓
WU_7_01	Technical Report detailing description of the water metering system.	✓	✓
WU_7_02	Plumbing schematic diagrams and layout drawings highlighting all location of water meter	✓	-
WU_7_03	Catalogues of all metering and measurement equipment	✓	-
	Specification of all metering and measurement equipment		
WU_7_04	Test and commissioning records	-	✓

WU_7_05	Operation manual	-	✓
WU_7_06	On-site photographs of the water meters	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

7 Health and Wellbeing

7.P Prerequisite

7.1 Inclusive Design

7.2 Indoor Environmental Quality

Introduction

This section of BEAM Plus considers the broader perspectives of sustainable buildings as well as the building occupants' health and wellbeing. The broader sustainable issues include provisions of hygiene and amenities maintenance provided in the DC, which have impact on the quality of working and living environments. Indoor environmental quality (IEQ) includes indoor air quality and ventilation provisions that safeguard health. Considerations of these issues, as well as thermal comfort, lighting, acoustics and noise, impact on well-being, comfort and productivity.

7.P Prerequisite

HWB P1 Minimum Ventilation Performance

Background

This requirement ensures that ventilation systems of the premises have been designed according to recognised procedures to provide a minimum ventilation of sufficient quality and quantity.

7.1 Inclusive Design

HWB 1 Inclusive Design

Background

Designs that allow users to enjoy spaces safely, easily and with dignity, and ensure efficient services to meet their needs, etc. They enhance the quality and efficiency of built environments and thereby ensure buildings to be more sustainable.

7.2 Indoor Environmental Quality

HWB 2 Enhanced Ventilation

HWB 3 Acoustic and Noise

HWB 4 Indoor Vibration

HWB 5 Indoor Air Quality

HWB 6 Thermal Comfort

HWB 7 Artificial Lighting

HWB 8 Biological Contamination

Given that on average people in Hong Kong spend around 85% of their time indoors, indoor environmental conditions have a significant impact on the quality of life. DCs should provide safe, healthy, convenient and efficient indoor spaces. Poor indoor environments in DCs can impact on productivity and may pose health risks to users. The design, management, operation and maintenance of DCs should seek to provide a good quality indoor environment, but with optimum use of energy and other resources.

7	**Health and Wellbeing**	**7.P**	**Prerequisite**

HWB P1 Minimum Ventilation Performance

Extent of Application

All DCs

Objective

Assess the quality of on-site outdoor air and demonstrate that a minimum quantity of outdoor air is supplied to all normally occupied spaces in the project in order to safeguard the health and comfort of DC users.

Credits Attainable

Prerequisite

Credit Requirement

(a) Measure outdoor air pollutants on-site prior to DC design to understand the *site* conditions.

(b) Demonstrate the project is in compliance with the minimum ventilation quantity with respective to its designed ventilation mode.

Assessment

(a) On-site Outdoor Air Quality

Engage an IAQ certified issuing body [1] to measure the quality of outdoor air. Measurements should be taken for the following outdoor air pollutants:

1. Carbon monoxide (CO);
2. Nitrogen dioxide (NO_2);
3. Ozone (O_3); and
4. Respirable suspended particulates (PM_{10}).

Report from accredited inspection bodies for indoor air quality inspection is acceptable.

One sample should be taken at the centre of the *site*. If emission sources, which are under operation by the time the measurement is taken, are present in the immediate surroundings of the project *site*, additional samples should be taking at locations facing the sources. The examples of emission sources can be found in the EPD's website [2].

Representative locations are acceptable if there is accessibility issue. The samples should be taken when no construction activities were on-going on the day of measurement. All parameters at one sampling location should be taken on the same day.

1 IAQ Certificate Issuing Body Accreditation [ONLINE] Available at https://www.iaq.gov.hk/en/iaq-certification-scheme/certificate-issuing-body-accreditation.aspx [Accessed Aug 2019].

2 Environmental Protection Department – Hong Kong Air Pollutant Emission Inventory, 2017. [ONLINE] Available at: http://www.epd.gov.hk/epd/english/environmentinhk/air/data/emission_inve.html [Accessed August 2019].

Prepare a narrative to benchmark the measurement results against the below acceptance limits. Note that the measurement results are not required to comply with the limits and should be served as design information only. The measurement results should be acknowledged receipt by the representative of the project owner.

Parameter	8-hour average acceptance limit [3]
Carbon monoxide (CO)	<7,000 µg/m^3 or <6.1 ppmv
Nitrogen dioxide (NO_2)	<150 µg/m^3 or <80 ppbv Plus [1-hour] <200 µg/m^3 or <106 ppbv
Ozone (O_3)	<120 µg/m^3 or <61 ppbv
Respirable suspended particulate (PM_{10})	<100 µg/m^3

Due to site constraints, it may not be practicable to take 8-hour continuous measurement. In these circumstances, surrogate measurement (i.e. an intermittent measurement strategy based on the average of half-an-hour measurements conducted at four time-slots) is also accepted.

(b) Minimum ventilation

Prepare a schedule of all spaces present in the building. Categorise the spaces into normally occupied, not normally occupied and unoccupied according to the space type matrix in Appendix 9 of this Manual.

Specify the system (mechanical or natural) used to ventilate the spaces.

Spaces with significant indoor air pollution sources such as toilets, car park, refuse room and plant room are excluded from the assessment. Staircases are also excluded.

Demonstrate compliance with the below criteria.

1. Mechanical Ventilation Spaces

Provide a report demonstrating compliance with the minimum ventilation rate stipulated in ASHRAE Standard 62.1-2016 [4] in all *normally occupied spaces*.

2. Natural Ventilation Spaces

Select one of the following paths. The Applicant is not limited to adopt only one path for all the spaces.

3 Environmental Protection Department – IAQ Certification Scheme. [ONLINE] Available at: http://www.iaq.gov.hk/en/iaq-certification-scheme.aspx [Accessed in August 2019

4 American Society of Heating Refrigeration and Air Conditioning Engineers – ANSI/ASHRAE Standard 62.1-2016 Ventilation for Acceptable Indoor Air Quality

Prescriptive path

Provide a report demonstrating compliance with section 6.4 Natural Ventilation Procedure stipulated in ASHRAE Standard 62.1-2016 in all *normally occupied spaces*.

Performance path – for project cannot achieve through prescriptive method

For *normally occupied spaces*, the ventilation rate meets 1.7 ACH under one annual prevailing wind direction with the highest wind frequency. The annual wind rose (wind probability table) in Building (Planning) Regulation is used.

Wind data, such as wind frequency, wind rose, wind profile should be adopted from the appropriate and reliable sources, such as simulated *site* wind data based on appropriate mathematical models, such as RAMS from PlanD [5] or experimental *site* wind data from *wind tunnel* test.

Ventilation performance should be demonstrated using *wind tunnel* tests, computational fluid dynamics or approaches that range from simple single zone models to elaborate multi-zone models [6].

The below requirements should be fulfilled in the CFD simulation:

i. Surrounding buildings and terrain shall be included in the model based on the GIS information from Lands Department, the Government of HKSAR [7];

ii. The surrounding area shall be at least, 2H (H being the building height (m) of the tallest building on the project *site*) or 200m away from the project *site* boundary, whichever is larger. The buildings within the surrounding area can be simplified to block;

iii. The terrain area shall be in a size of at least, 10H (H being the building height (m) of the tallest building on the project *site*) or 1000m × 1000m, whichever is larger, with the project placed in the centre; and

Prepare a Natural Ventilation Report including the following contents:

i. Summary of naturally ventilated spaces highlighting compliance

ii. All assumptions made

iii. Methodology

iv. Results

5 Site Wind Availability System. 2017. [ONLINE] Available at: http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html. [Accessed August 2019].

6 American Society for Testing Materials. ASTM E 2267-03. Specifying and Evaluating Performances of Single Family Attached and Detached Dwellings – Indoor Air Quality. 2003.

7 Lands Department - Survey and Mapping Office - GIS Projects Section. 2017. Survey and Mapping Office - GIS Projects Section. [ONLINE] Available at: http://www.landsd.gov.hk/mapping/en/lic/lic_gis.htm. [Accessed August 2019].

The Natural Ventilation Report should be endorsed by a locally qualified professional who has at least 3 years of relevant experience in natural ventilation design and CFD modelling.

Submittals

(a) On-site Outdoor Air Quality

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_P1a_00	BEAM Plus New DCs submission template for HWB P1a	✓	✓
HWB_P1a_01	HWB-P1-1_Form	✓	✓
HWB_P1a_02	Rectifying plan describing the design of air purification strategies if air quality is not achieved	✓	-
HWB_P1a_03	HKIAS endorsed report showing measurements of all required outdoor air pollutants	✓	-

(b) Minimum Ventilation

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_P01_00	BEAM Plus New DCs submission template for HWB P1b	✓	✓
HWB_P01_01	HWB-P1-2_Form	✓	✓
HWB_P01b_02	Schedule of all spaces present in the building	✓	✓
HWB_P01b_03	Report demonstrating compliance with the minimum ventilation rate stipulated in ASHRAE Standard 62.1-2016 in all mechanically ventilated *normally occupied spaces*	✓	✓
HWB_P01b_04	MVAC fan schedule, air side schematics	✓	✓
HWB_P01b_05	MVAC layout plan	-	✓
HWB_P01b_06	Floor plan highlighting primary openings location that provided in all naturally ventilated normally occupied rooms	✓	✓

	(applicable to natural ventilation prescriptive path only)		
HWB_P01b_07	Window Schedule and primary openings information that provided in all naturally ventilated normally occupied rooms (applicable to natural ventilation prescriptive path only)	✓	✓
HWB_P01b_08	Calculation of ratio of the total area of the primary openings provided in the room to the floor area of the room (applicable to natural ventilation prescriptive path only)	✓	✓
HWB_P01b_09	Natural ventilation report (applicable to natural ventilation performance path only)	✓	✓
HWB_P01b_10	CV of the professional as per requirements in the assessment (for performance path only)	✓	✓

Remarks

(a) Additional Information

Site Wind Availability System. 2017. [ONLINE] Available at: http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html. [Accessed August 2019].

(b) Related Credits

HWB 2 Enhanced Ventilation

The related credit awards project demonstrating enhanced ventilation performance in *normally occupied spaces* and not *normally occupied spaces*.

HWB 5 Indoor Air Quality

Carrying out on-site outdoor analysis provides useful information for the selection of selecting ventilation means and ventilation system design in order to achieve satisfactory indoor air quality. From the measurement result, a proper design to ensure a good air quality provision could help gaining credit points in HWB 5.

7 Health and Wellbeing **7.2 Inclusive Design**

HWB 1 Inclusive Design

Extent of Application All DCs

Objective Encourage well integrated weather protection and user-friendliness in the building design for outdoor or semi-outdoor communal / private space design at various levels of a DC.

Credits Attainable 1 + 1 BONUS

Credit Requirement

(a) Universal Accessibility

1 credit for providing at least five (5) applicable enhanced provisions as stipulated in the "Recommended Design Requirements" of BFA 2008.

(b) Weather Protection and Family Friendly Features

1 BONUS credit for providing prescribed weather protection and at least two (2) family friendly facilities features.

Assessment

(a) Universal Accessibility

Provide a report detailing at least five (5) applicable enhanced provisions as stipulated in the "Recommended Design Requirements" of BFA 2008" [1].

(b) Weather Protection & Family Friendly Facilities

Provide weather protection features against wind-driven rain for all covered semi-outdoor communal areas within the building, allowing a minimum width of 2 m protected zone from driving rain.

Minimum driving rain angles (MRA) from edges of rain protection features shall be calculated based on the following equation:

$$MRA = \tan^{-1}(u / 4.5\, I^{0.107})$$

Where,

u = Hourly mean wind speed affecting the rain (m/s)

I = Intensity of rainfall (mm/hr)

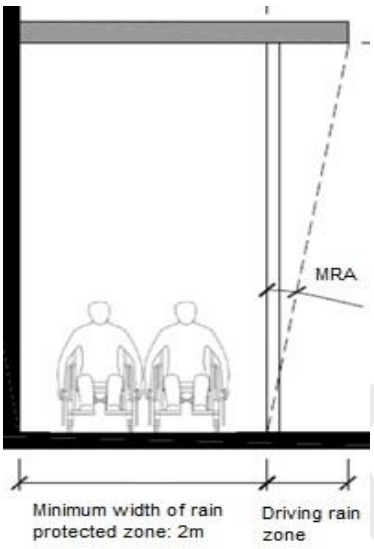
A default figure of 30 mm/hr is taken as the hourly rainfall intensity under heavy rain conditions (Hong Kong Observatory defines "heavy rain days" as days with hourly rainfall greater than 30 mm).

Wind speed can be determined from the wind profile diagram available at PlanD's Site Wind Data webpage [2]. For a semi-external communal space

1 Buildings Department – Design Manual - Barrier Free Access 2008 – Codes of Practice and Design Manuals http://www.bd.gov.hk/english/documents/code/e_bfa2008.htm. [Accessed August 2019].

2 Planning Department – Site Wind Availability Data. 2017. [ONLINE] Available at: http://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html. [Accessed August 2019].

facing a certain *orientation*, the wind profile for that *orientation* at its proposed location (height above ground) shall be used.



Family Friendly Facilities:

1. At least one shaded rest areas with seating for care-takers near play equipment for children. This accounts for 1 inclusive design feature.
2. At least one water closet for children or family in each male and female or stand-alone toilet with seat height in the range of 310 mm to 380 mm for communal use. This accounts for 1 inclusive design feature.
3. At least one baby-care facilities / breast feeding room in the communal areas of the building. This accounts for 1 inclusive design feature.

Additional or alternative inclusive design features may be included, which achievement in credit objectives should be demonstrated.

Submittals

(a) Universal Accessibility

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_01_00	BEAM Plus New DCs submission template for HWB 1	✓	✓
HWB_01a_01	Specifications specifying the design measures	✓	-
HWB_01a_02	Drawings showing design measures and/or amenity features	✓	✓
HWB_01a_03	Report showing justifications and details for each design measures and/or amenity features provided	✓	✓

HWB_01a_04	Catalogues/ information of design measures provided OR Photograph	-	✓

(b) Weather Protection & Family Friendly Facilities

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_01_00	BEAM Plus New DCs submission template for HWB 1	✓	✓
HWB_01b_01	Specification specifying the design measures	✓	-
HWB_01b_02	Drawings showing design measures and/or amenity features	✓	✓
HWB_01b_03	Report showing justifications and details for each design measures and/or amenity features provided	✓	✓
HWB_01b_04	Catalogues/ information of design measures provided OR Photograph	-	✓

Remarks

(a) Additional Information

Chand, Bhargava, Estimation of Angle of Deflection of Rain at Driving Rain Prone Stations in India, 2005.

Sagadashvili, Methods of Processing Meteorological Observational Data for Assessment of Driving Rain Parameters, Proceedings of the Symposium on Building Climatology, Moscow, 619 – 629, 1982.

Buildings Department, PNAP ADV-32, Provision of Babycare Rooms in *Commercial Buildings*. [ONLINE] Available at: https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/ADV/ADV032.pdf [Accessed Aug 2019]

(b) Related Credits

SS 1 Green Building Attributes

The related credit promotes convenient and barrier-free pedestrian environment in *site* planning of the outdoor spaces.

7 Health and Wellbeing **7.3 Indoor Environmental Quality**

HWB 2 Enhanced Ventilation

Extent of Application All DCs

Objective Maintain effective ventilation and prevent exposure to concentrated indoor pollutant sources to support occupants' health and wellbeing.

Credits Attainable 2 + 1 additional BONUS

Credit Requirement **Fresh Air Provision**

1. Fresh air provision in *normally occupied spaces*

1 credit for demonstrating that all normally occupied spaces in the DC are provided with increased ventilation.

2. Fresh air provision in not normally occupied spaces

1 credit for demonstrating that all not normally occupied spaces in the DC are provided with adequate ventilation.

3. On-site measurements

1 additional BONUS credit for conducting on-site measurements to verify the ventilation performance for all normally occupied spaces.

Assessment **Fresh Air Provision**

Prepare a schedule of all spaces present in the DC. Categorise the spaces into normally occupied, not normally occupied and unoccupied according to the space type matrix in Appendix 9 of this manual.

Specify the system (mechanical or natural) used to ventilate the spaces.

Spaces with significant indoor air pollution sources such as toilets, car park, refuse room and plant room are excluded from the assessment. Staircases are also excluded.

1. Fresh air provision in normally occupied spaces

Demonstrate compliance with the below criteria.

1.1. Mechanical ventilation spaces

Provide a report demonstrating compliance with the minimum ventilation rates stipulated in ASHRAE Standard 62.1-2016 [1] in all *normally occupied spaces* is exceeded by at least 30%.

1 American Society of Heating Refrigeration and Air Conditioning Engineers – ANSI/ASHRAE Standard 62.1-2016 Ventilation for Acceptable Indoor Air Quality

1.2. Natural ventilation spaces

Select one of the following paths. The Applicant is not limited to adopting only one path for all the spaces.

a) Prescriptive path

For *normally occupied spaces*, the openable area should be not less than 5.2% (exceed 4%, as stipulated in ASHRAE 62.1 – 2016 Section 6.4.2, by 30%) of the net occupiable floor area.

b) Performance path

For normally occupied spaces, the ventilation rate meets 2.2 ACH under one annual prevailing wind direction with the highest wind frequency. The annual wind rose (wind probability table) at 400 – 600m of the site should be used.

Wind data, such as wind frequency, wind rose, wind profile should be adopted from the appropriate and reliable sources, such as simulated site wind data based on appropriate mathematical models, such as RAMS from PlanD [3] experimental site wind data from wind tunnel test.

Ventilation performance should be demonstrated using wind tunnel tests, computational fluid dynamics or approaches that range from simple single zone models to elaborate multi-zone models [4].

The below requirements should be fulfilled in the CFD simulation:

i. Surrounding buildings and terrain shall be included in the model based on the GIS information from Lands Department, the Government of HKSAR;

ii. The surrounding area shall be at least, 2H (H being the building height (m) of the tallest building on the project *site*) or 200m away from the project *site* boundary, whichever is larger. The buildings within the surrounding area can be simplified to block;

iii. The terrain area shall be in a size of at least, 10H (H being the building height (m) of the tallest building on the project *site*) or 1000m × 1000m, whichever is larger, with the project placed in the centre; and

iv. Buoyancy and turbulence driven flows need not be considered.

Prepare a Natural Ventilation Report including the following content:

i. Summary of naturally ventilated spaces highlighting compliance

ii. All assumptions made

iii. Methodology

iv. Results

The Natural Ventilation Report should be endorsed by a locally qualified professional who has at least 3 years of relevant experience in natural ventilation design and CFD modelling.

2. Fresh air provision in not normally occupied spaces

2.1. Mechanical ventilation spaces

Demonstrate compliance with the minimum ventilation rates stipulated in ASHRAE Standard 62.1-2016 in all not *normally occupied spaces*.

2.2. Natural ventilation spaces

Demonstrate the ventilation rates in all not normally occupied spaces meets 1.7 ACH. Methodology should follow the performance route for part 1.

3. On-site measurements

BONUS credit will be granted only if the credits in part 1 has been achieved.

Prepare a measurement methodology which includes the proposed measurement locations and methodology.

3.1. Mechanical ventilation spaces

Demonstrate, by measurement, the required amount of outdoor air corresponding to the design outdoor air flow rate is provided. Accepted measurement methods include the followings:

i. ASHRAE 111 [2]; **OR**

ii. Tracer gas techniques in accordance with ASTM E 741[3]

At least one sampling point should be present in each *normally occupied space* usage.

If the measurement results demonstrate unmet requirement in part 1, the credit in both part 1 and part 3 will be not be awarded.

3.2. Natural ventilation spaces

Demonstrate, by measurement, the design ACH is achieved. Tracer gas decay test in accordance with ASTM E 741 or equivalent is an accepted measurement method.

At least one sampling point should be present in each *normally occupied space* type. For each *normally occupied space* usage, the sampling locations should cover all *orientation*s and low, mid and high floors.

If the measurement results demonstrate unmet requirement in part 1, the credit in both part 1 and part 3 will be not be awarded.

2 American Society of Heating Refrigeration and Air Conditioning Engineers – ANSI/ASHRAE Standard 111-2008 Measurement, Testing, Adjusting and Balancing of Building HVAC Systems

3 ASTM International – ASTM E471-11 Standard Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_2_00	BEAM Plus New DCs submission template for HWB 2	✓	✓
HWB_2_01	HWB-2-1_Form	✓	✓
HWB_2_02	HWB-2-2_Form	✓	✓
HWB_2_03	HWB-2-3_Form	✓	✓
HWB_2_04	Schedule of all spaces present in the building	✓	✓
HWB_2_05	Mechanical Ventilation Report (Applicable to parts 1 and 2)	✓	✓
HWB_2_06	Natural Ventilation Report (Applicable to parts 1 and 2)	✓	✓
HWB_2_07	CV of the professional as per requirements in the assessment (Applicable to parts 1 and 2)	✓	✓
HWB_2_08	MVAC fan schedule and air side schematics (Applicable to parts 1 and 2)	✓	✓
	MVAC equipment catalogue	-	✓
HWB_2_09	MVAC layout plan	-	✓
HWB_2_10	Testing and commissioning reports (Applicable to parts 1 and 2)	-	✓
HWB_2_11	Measurement methodology (Applicable to part 3)	✓	✓
HWB_2_12	Measurement results (Applicable to part 3)	-	✓

Remarks

(a) Additional Information

World Health Organization – Health and sustainable development – Natural Ventilation. [ONLINE] Available at:

http://www.who.int/sustainable-development/housing/strategies/natural-ventilation/en/. [Accessed August 2019]

Whole Building Design Guide, National Institute of Building Sciences. Natural Ventilation. [ONLINE] Available at:

https://www.wbdg.org/resources/natural-ventilation. [Accessed August 2019]

(b) Related Credits

EU 2 Reduction CO_2 Emissions

Although enhanced ventilation rate may increase building energy consumption, the Applicant is encouraged to adopt additional energy saving strategies, for instance demand control ventilation to overcome the compromise between indoor environmental quality and energy consumption.

HWB 5 Indoor Air Quality

Indoor air quality can be improved via dilution resulted by maintaining suitable ventilation rate.

7	**Health and Wellbeing**	**7.4**	**Indoor Environmental Quality**
		HWB 3	**Acoustics and Noise**

Extent of Application

All DCs

Objective

Ensure the DCs building are in comfortable acoustic environment.

Credits Attainable

3

Credit Requirement

(a) Data Hall Noise Control

1 credit for demonstrating the internal noise level at data hall areas do not exceed the prescribed limit.

(b) Noise Isolation

1 credit for demonstrating airborne noise isolation between spaces fulfils the prescribed criteria.

(c) Background Noise

1 credit for demonstrating background noise levels within the prescribed criteria (including traffic noise and external building services equipment that are within the project boundary).

Assessment

(a) Data Hall Noise Control

Demonstrate that the internal noise level at data hall area are maintained at an appropriate level and meets the below criteria.

Criteria

5 dB(A) better than First Action Level a daily personal noise exposure (LEP, d) [1] of 85 dB(A).

Compliance should be demonstrated by (1) detailed calculations or (2) measurements depending on the applicant's preference. The acoustic calculation or measurement report should be endorsed by a Corporate Member of Hong Kong Institute of Acoustics or equivalent.

Internal noise calculations or site measurements should include all data halls, taking account into the worst case condition of exposure to noise sources to the space, and undertaken during periods appropriate to the usage pattern for the data hall.

Measurements during commissioning shall use the method given in ISO 3382 [2] or equivalent. The measurements locations should be evenly distributed within the data hall. Data hall without design (e.g. finishes, system) should provide endorsed acoustic calculation to support the potential achievement in both PA and FA submission.

1 Labour Department. Guidance Notes on Factories and Industrial Undertakings (Noise at Work) Regulation. [ONLINE] Available at: https://www.labour.gov.hk/eng/public/os/C/FIUNR.pdf

2 International Standard Organization – ISO 3382:2009 - Acoustics -- Measurement of room acoustic parameters.

The assessment should take into account noise from all IT equipment and building services equipment installed in data hall, under normal operation mode.

(b) Noise Isolation

Demonstrate airborne noise isolation between spaces fulfil the prescribed criteria.

Criteria

Compliance should be demonstrated by computer simulation, detailed calculations, or measurements depending on the Applicant's preference. The performance of the weighted Sound Reduction Index (SRI) or Level Difference should fulfil the requirements as stated in the blow table. The computer simulation report, acoustic calculations or the measurement report should be endorsed by a Corporate Member of Hong Kong Institute of Acoustics or equivalent.

Type of Premises	Weighted SRI	Level Difference
Between offices/ conference rooms	R_w 44	$D_{nT,w}$ 38

Based on the nature of the building, alternative appropriate criteria with sufficient justification and evidence provided by the applicant will be allowed.

The criteria apply to partition walls which are actually provided and potentially provided by the landlord.

For buildings without the abovementioned spaces, with no spaces where speech intelligibility is important, or with rooms of a special acoustical nature, submit a schedule of spaces present in the building and relevant justifications for this credit to become not applicable.

(c) Background Noise

Demonstrate the background noise levels from both external sources and external building services equipment of project building are within the below criteria.

Criteria

Internal noise level (NR and NC value should be consistently used in the project):

Office type premises: NR/NC 40

Based on the nature of the building, alternative appropriate criteria with sufficient justification and evidence provided by the applicant will be allowed.

Compliance should be demonstrated by detailed calculations or measurements depending on the applicant's preference. The acoustic calculation or measurement report should be endorsed by a Corporate Member of Hong Kong Institute of Acoustics or equivalent.

Internal noise calculations or *site* measurements should include at least one sample of each type of *occupied space*, taking account into the worst case condition of exposure to noise sources external to the space, and undertaken during periods appropriate to the usage pattern for the space. Measuring equipment shall conform to the accuracy requirements given in IEC 61672-1 [3] Class 1 requirements, or equivalent.

The assessment should take into account noise from building services equipment under normal operation mode. For residential units, the assessment should only account traffic noise and chiller/water plant equipment (window type and outdoor unit of VRV is not considered)

For buildings without the abovementioned spaces, with no spaces where speech intelligibility is important, or with rooms of a special acoustical nature, submit a schedule of spaces present in the building and relevant justifications for this credit to become not applicable.

3 International Electrotechnical Commission. IEC 61672-1:2013 Electroacoustic – Sound level meters.

Submittals

(a) Data Hall Noise Control

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_3_00	BEAM Plus New DCs submission template for HWB 3	✓	✓
HWB_3a_01	Data hall noise calculation at representative locations with supporting documents including noise data of the installed IT equipment and Building Service Equipment in data hall (Applicable to calculation route only)	✓	✓
HWB_3a_02	Data hall noise measurement report at representative locations with supporting documents including noise data of the installed IT equipment and Building Service Equipment in data hall (Applicable to measurement route only)	-	✓
HWB_3a_03	Data hall noise measurement protocol (Applicable to measurement route only)	✓	✓
HWB_3a_04	Valid calibration certificate of sound level meters (Applicable to measurement route only)	✓	✓
HWB_3a_05	CV of the professional as per requirements in the assessment	✓	✓

(b) Noise Isolation

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_3_00	BEAM Plus New DCs submission template for HWB 3.	✓	✓
HWB_3b_01	Layout plan or elevation drawings showing the location of partition walls.	✓	✓
HWB_3b_02	Construction details of the partition walls (Applicable to calculation and simulation route only).	✓	✓
HWB_3b_03	Airborne noise isolation computer simulation results or calculations	✓	✓

	(Applicable to calculation and simulation route only)		
HWB_3b_04	Airborne noise isolation measurement protocol (Applicable to measurement route only)	✓	✓
HWB_3b_05	Airborne noise isolation measurement reports (Applicable to measurement route only)	-	✓
HWB_3b_6	CV of the professional as per requirements in the assessment	✓	✓

(c) Background Noise

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_3_00	BEAM Plus New DCs submission template for HWB 3	✓	✓
HWB_3c_01	Background noise calculations (Applicable to calculation route only)	✓	✓
HWB_3c_02	Background noise measurement protocol (Applicable to measurement route only)	✓	✓
HWB_3c_03	Acoustic measurement report (Applicable to measurement route only)	-	✓
HWB_3c_04	Valid calibration certificate of sound level meters (Applicable to measurement route only)	✓	✓
HWB_3c_05	CV of the professional as per requirements in the assessment	✓	✓

Remarks

(a) Additional Information

Acoustic windows or other attenuation may contribute to mitigate background noise problem.

Environmental Protection Department - Innovative Noise Mitigation Designs and Measures - Acoustic Window. [ONLINE] Available at: http://www.epd.gov.hk/epd/Innovative/greeny/eng/acoustic_window.html [Accessed August 2019].

(b) Related Credits

None

7 Health and Wellbeing **7.3 Indoor Environmental Quality**

HWB 4 Indoor Vibration

Extent of Application All DCs

Objective Avoidance of excessive vibration from building services equipment and other *external sources* within site boundary.

Credits Attainable 1

Credit Requirement 1 credit for demonstrating vibration levels not exceeding the prescribed criteria.

Assessment Vibration generated from the building services equipment shall be in compliance with the criteria given in ISO 2631-2:2003 [1], BS 6472-1:2008 [2], BS 6472-2:2008 [3], Department of Environment and Conservation of NSW - Assessing Vibration: a technical guideline [4] or equivalent standard.

Calculation/Measurements should be carried out at representative normally occupied spaces. The selection of sampling points should follow the guidance given in ISO 2631-2:2003, BS 6472-1:2008, BS 6472-2:2008, Department of Environment and Conservation of NSW - Assessing Vibration: a technical guideline or equivalent standard. Vibration from emergency generator is excluded from assessment.

The level of vibration in terms of root mean square acceleration shall be determined by calculation or on-site measurement. Root mean square acceleration requirement should be assessed with regards to the above standards or equivalent.

Vibration source identified in the report should be justified. External sources other than building service equipment that might impact a building space may include nearby railway, underground tunnel etc.

Calculation or measurement report should be endorsed by a Corporate Member of Hong Kong Institute of Acoustics or equivalent.

1 International Standard Organisation. ISO 2631-2:2003. Evaluation of human exposure to whole-body vibration – Part 2: Continuous and shock-induced vibration in buildings (1 to 80Hz).

2 British Standard. BS 6472-1:2008. Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting

3 British Standard. BS 6472-2:2008. Guide to evaluation of human exposure to vibration in buildings Part 2: Blast-induced vibration

4 Department of Environment and Conservation of NSW Assessing Vibration: a technical guideline or equivalent standard 2006. [ONLINE] Available at: http://www.epa.nsw.gov.au/resources/noise/vibrationguide0643.pdf. [Accessed August 2019].

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_4_00	BEAM Plus New DCs submission template for HWB 4	✓	✓
HWB_4_01	HWB-4-1_Form	✓	✓
HWB_4_02	Specification for isolation efficiency	✓	✓
HWB_4_03	Calculations on the isolation efficiency	✓	✓
HWB_4_04	Layout drawings showing the location of sensitive receivers and vibration source	✓	✓
HWB_4_05	Endorsed calculation	✓	-
	Endorsed measurement report	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

7 Health and Wellbeing **7.3 Indoor Environmental Quality**

HWB 5 Indoor Air Quality

Extent of Application All DCs

Objective Demonstrate that airborne contaminants do not give rise to unacceptable levels of air pollution in the DC.

Credits Attainable 3 + 1 BONUS

Credit Requirement **Indoor Air Quality in Occupied Spaces**

Demonstrate compliance in one of the following paths:

1. Path 1

2 credits for demonstrating compliance with the prescribed limits for Carbon monoxide (CO), Nitrogen dioxide (NO2), Ozone (O3), Carbon dioxide (CO_2), Respirable suspended particulates (PM10), Total volatile organic compounds (TVOCs), Formaldehyde (HCHO) and Radon (Rn) in the sampled occupied spaces.

1 credit for demonstrating compliance with the prescribed limits for Airborne bacteria and conduct the Mould assessment in the sampled occupied spaces.

2. Path 2

3 credits for submitting a valid IAQ Certification Scheme (Good Class) certificate issued by the Environmental Protection Department (EPD) covering the whole building.

1 additional BONUS credit for achieving Excellent Class.

Assessment **Indoor Air Quality in Occupied Spaces**

1. Path

Prepare a measurement protocol prepared by a IAQ Certificate Issuing Body (CIB) [1] following guidance stated in Step 1 – Step 4 in A Guide on Indoor Air Quality Certification Scheme for Offices and Public Spaces [2].

Measurements should be taken in occupied spaces (including *normally occupied spaces* and *not normally occupied spaces*) and the limits are specified below.

At least one sampling point should be located at each type of IAQ area as defined by the applicant.

1 Indoor Air Quality Information Centre – Certificate Issuing Body Accreditation. [ONLINE] Available at: http://www.iaq.gov.hk/en/iaq-certification-scheme/certificate-issuing-body-accreditation.aspx. [Accessed August 2019].

2 Indoor Air Quality Management Group – A Guide on Indoor Air Quality Certification Scheme for Offices and Public Spaces 2019. [ONLINE] Available at: http://www.iaq.gov.hk/media/8694/certguide-eng.pdf.. [Accessed Aug 2019]

Parameter	8-hour average acceptance limit [3]
Carbon dioxide (CO_2)	<1,800 mg/m^3 or <1,000 ppmv
Carbon monoxide (CO)	<7,000 µg/m^3 or <6.1 ppmv
Nitrogen dioxide (NO_2)	<150 µg/m^3 or <80 ppbv Plus [1 hour] <200 µg/m^3 or <106 ppbv
Ozone (O_3)	<120 µg/m^3 or <61 ppbv
Respirable suspended particulate (PM_{10})	<100 µg/m^3
Total volatile organic compounds (TVOC)	<600 µg/m^3 or <261 ppbv
Formaldehyde (HCHO)	<100 µg/m^3 or <81 ppbv Plus [30 mins] <100 µg/m^3 or <81 ppbv
Radon (Rn)	<167 Bq/m^3
Airborne bacteria	<1,000 cfu/m^3
Mould	Prescriptive Checklist

Given the floor plan of the building has not been changed, the sampling points agreed during Provisional Assessment will remain the same for Final Assessment. Otherwise, if the floor plan has been undergone major change, the sampling points will be re-assessed during Final Assessment.

2. <u>Path 2</u>

Submit a valid certificate issued by the Environmental Protection Department (EPD) covering the whole building. The whole building should be fully furnished.

3 Indoor Air Quality Management Group – A Guide on Indoor Air Quality Certification Scheme for Offices and Public Spaces 2019. [ONLINE] Available at: http://www.iaq.gov.hk/media/8694/certguide-eng.pdf.. [Accessed Aug 2019]

Submittals

Indoor Air Quality in Occupied Spaces

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_5_00	BEAM Plus New DCs submission template for HWB 5	✓	✓
HWB_5_01	HWB-5-1_Form	✓	✓
HWB_5_02	HWB-5-2_Form	✓	✓
HWB_5_03	Specification for CIB to endorsed IAQ measurement methodology	✓	-
	CIB endorsed IAQ measurement methodology	-	✓
HWB_5_04	CIB endorsed IAQ test reports	-	✓
HWB_5_05	Valid certificate issued by the Environmental Protection Department (EPD) covering the whole building (only for alternative path)	-	✓

Remarks

(a) Additional Information

US Environmental Protection Agency - A Brief Guide to Mold, Moisture and Your Home. [ONLINE] Available at: https://www.epa.gov/mold/brief-guide-mold-moisture-and-your-home. [Accessed August 2019].

(b) Related Credits

EU 2 Reduction of CO_2 Emissions

By delinking the control of temperature and humidity using standalone or integrated dehumidification system, energy reduction may be achieved by avoiding overcooling to reach the targeted humidity.

7	**Health and Wellbeing**	**7.3**	**Indoor Environmental Quality**
		HWB 6	**Thermal Comfort**

Extent of Application

All DCs

Objective

Ensure that DCs and systems are tested practicable and the specified thermal comfort conditions can be achieved under conditions of normal occupancy and expected heat gains.

Credits Attainable

2 Credits

Credit Requirement

(a) Temperature Performance in Data Halls

1 credit for sustaining the air temperature at the design value within ±2.0ºC when air side system in **data halls** is operating at steady state.

(b) Temperature Performance in Normally Occupied Areas

1 credit for sustaining the air temperature at the design value within ±1.5ºC when air side system in **normally occupied areas** is operating at steady state under normal occupied periods.

Assessment

i. Submit a Thermal Comfort Measurement Report demonstrating compliance with the assessment criteria.

The report should include:

ii. Sampling locations;

iii. Design report/ specification showing the air temperature design value of concerned spaces;

iv. Measurement methodology, equipment catalogue, photo, calibration certificate, and results; and

v. Calculations for thermal comfort.

The reports should be endorsed by a locally qualified professional who has at least 3 years of relevant experience.

Spaces without design (e.g. finishes, system) should provide endorsed calculation to support the potential achievement in both PA and FA submission.

vi. For PA submission, submit a Thermal Comfort Measurement Methodology demonstrating compliance with the assessment criteria.

The report should include:

vii. Proposed sampling locations;

viii. Design report/ specification showing the air temperature design value of concerned spaces; and

ix. Measurement method statement, proposed equipment catalogue, calibration certificate, etc.

x. Record the main physical parameters including indoor air temperature, indoor mean radiant temperature, indoor relative humidity and indoor wind speed. The indoor mean radiant temperature can be assumed to be indoor air temperature. The measurement should take note on the following:

xi. The measurement should not be taken on a rainy day;

xii. The measurements should be represented as 8-hour average in the daytime or surrogate measurement;

xiii. For the measurement at data hall areas, the measurements should be represented as 9-hour average in any period of a day;

xiv. The measurement of indoor temperature and indoor relative humidity; and

xv. The sensors used in the measurement survey shall have an accuracy that complies with ASHRAE 55-2013, ISO 7726 or equivalent.

xvi. The measurement results shall demonstrate compliance with the prescribed design criteria within the prescribed, for a minimum of 90% of the prescribed locations.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_6_00	BEAM Plus New DCs submission template for HWB 6	✓	✓
HWB_6_01	HWB-9-1_Form	-	✓
HWB_6_02	Thermal Comfort Measurement Methodology	✓	✓
HWB_6_03	Thermal Comfort Measurement Report	-	✓
HWB_6_04	CV of the professional as per requirements in the assessment	-	✓

Remarks

(a) Additional Information

Indoor Air Quality Management Group – A Guide on Indoor Air Quality Certification Scheme for Offices and Public Spaces

2003. [ONLINE] Available at: https://www.iaq.gov.hk/media/8694/certguide-eng.pdf. [Accessed Aug 2019]

(b) Related Credits

None

7 Health and Wellbeing **7.3 Indoor Environmental Quality**

HWB 7 Artificial Lighting

Extent of Application All DCs

Objective Promote indoor lighting design which is comfortable for occupants' indoor activities.

Credits Attainable 2

Credit Requirement

(a) Artificial lighting in Data halls

1 credit for achieving the prescribed lighting performance in Data halls.

(b) Artificial lighting in *normally occupied spaces, not normally occupied spaces* and *unoccupied spaces*

1 credit for achieving the prescribed lighting performance in normally occupied spaces, not normally occupied spaces and unoccupied spaces.

Assessment

(a) Artificial lighting in Data halls

This credit only assesses data hall areas with permanently installed lighting fixtures provided by the project owner. Data halls with fixtures, which are temporarily installed for Occupation Permit (OP) inspection purposes and out of the project owner's fit-out scope, are not assessed.

Demonstrate the achievement of the prescribed lighting performance in *normally occupied spaces* regarding the lighting performance criteria adopted based on The SLL Code for Lighting 2012 Section 2.2 [1]. If the task area is unknown by the time of design, assume the entire space, with 0.5m from walls, is the task area.

Sensors of occupancy-based control or/and bi-level lighting should be adopted.

Demonstrate compliance with the assessment criteria including maintained illuminance, Unified Glare Rating limit and minimum illuminance uniformity either by measurements using a standardised measurement protocol appropriate to the parameter being assessed, or by modelling.

The following typical surface reflectance can be adopted. If different values are adopted, supporting documents (cut sheets / catalogues / laboratory reports) showing the corresponding information are required for justification.

1 The Chartered Institution of Building Services Engineers (CIBSE) – The SLL Code for Lighting 2012

Table HWB 7-1

Surfaces	Reflectance of surfaces
Ceiling	0.6
Walls	0.3
Working planes	0.2
Floor	0.1

Submit an Artificial Lighting Performance Report, including the following content:

i. Technical details of the installed lighting systems;

ii. Design criteria for data hall; and

iii. Results of measurements or simulation.

(b) Artificial lighting in normally occupied spaces, not normally occupied spaces and unoccupied spaces

This credit only assesses indoor not normally occupied spaces and unoccupied spaces with permanently installed lighting fixtures provided by the project owner. Spaces with fixtures, which are temporarily installed for Occupation Permit (OP) inspection purposes and out of the project owner's fit-out scope, are not assessed.

Demonstrate the achievement of the prescribed lighting performance in normally occupied spaces, not normally occupied spaces and unoccupied spaces regarding the lighting performance criteria adopted based on The SLL Code for Lighting 2012 Section 2.2.

Sensors for occupancy-based control or/and bi-level lighting should be adopted.

Demonstrate compliance with the assessment criteria including maintained illuminance, Unified Glare Rating limit and minimum illuminance uniformity either by measurements using a standardised measurement protocol appropriate to the parameter being assessed, or by modelling.

The following typical surface reflectance can be adopted. If different values are adopted, supporting documents (cut sheets / catalogues / laboratory reports) showing the corresponding information are required for justification.

Table HWB 10-2

Surfaces	Reflectance of surfaces
Ceiling	0.6
Walls	0.3
Working planes	0.2

Floor	0.1

Submit an Artificial Lighting Performance Report, including the following content:

1) Technical details of the installed lighting systems;
2) Design criteria for each room type; and
3) Results of measurements or simulation

Submittals

(a) Artificial lighting in Data hall

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_7_00	BEAM Plus New DCs submission template for HWB 7a	✓	✓
HWB_7a_01	HWB-10-1_Form	✓	✓
HWB_7a_02	Specifications highlighting the design intent with adopted lighting performance criteria for data halls	✓	✓
HWB_7a_03	Catalogues or other supporting documents showing the reflectance value (if non-typical values have been adopted)	✓	✓
HWB_7a_04	Lighting control schedule	✓	✓
HWB_7a_05	Lighting fitting schedule	✓	✓
HWB_7a_06	Artificial Lighting Performance Report	✓	✓

(b) Artificial lighting in normally occupied spaces, not normally occupied spaces and unoccupied spaces

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_7_00	BEAM Plus New DCs submission template for HWB 7b	✓	✓
HWB_7b_01	HWB-10-2_Form	✓	✓
HWB_7b_02	Specifications highlighting the design intent with adopted lighting performance criteria for each type of rooms	✓	✓

HWB_7b_03	Catalogues or other supporting documents showing the reflectance value (if non-typical values have been adopted)	✓	✓
HWB_7b_04	Lighting control schedule	✓	✓
HWB_7b_05	Lighting fitting schedule	✓	✓
HWB_7b_06	Artificial Lighting Performance Report	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

7 Health and Wellbeing **7.3 Indoor Environmental Quality**

HWB 8 Biological Contamination

Extent of Application The systems are controlled by the Landlord

Objective To reduce the risk of biological contamination by adopting appropriate design precautions of the water supply systems, HVAC systems and other water features

Credits Attainable 1

Credit Requirement 1 credit for complying with the recommendations given in the Code of Practice for Prevention of Legionnaires' Disease 2016 Edition in respect of Water Supply Systems, HVAC Systems and other Water Features.

Assessment

Water Supply Systems

Demonstrate compliance, if relevant items are present, with the following sections of the Code of Practice for Prevention of Legionnaires' Disease 2016 Edition:

i. Hot Water Supply Systems – Section 4.4.1.1

ii. Cold Water Supply Systems – Section 4.5.1

HVAC Systems

Demonstrate compliance, if relevant items are present, with the following sections of the Code of Practice for Prevention of Legionnaires' Disease 2016 Edition [1]:

Cooling Tower – Section 4.2.1;

i. Air Handling Unit / Fan Coil Unit – Section 4.3.1 Items (a) – (d);

ii. Air Duct and Air Filters – Section 4.3.2 Items (a) – (c);

iii. Humidifiers – Section 4.3.3 Items (a) – (c); and

iv. Air Washers – Section 4.3.4 Items (a), (b) and (d).

Other Water Features

Demonstrate compliance, if relevant items are present, with the following sections of the Code of Practice for Prevention of Legionnaires' Disease 2016 Edition:

i. Architectural Foundations – Section 4.6.1; and

ii. Spa Pools (Whirlpools) – Section 4.7.2.

1 Prevention of Legionnaires' Disease Committee, Hong Kong – Code of Practice for Prevention of Legionnaires' Disease 2016 Edition [ONLINE] Available at: http://www.emsd.gov.hk/filemanager/en/content_645/COP-PLD_2016.pdf. [Accessed August 2019].

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
HWB_8_00	BEAM Plus New DCs submission template for HWB 8	✓	✓
HWB_8_01	Specifications of Water Supply Systems	✓	✓
HWB_8_02	Schematic diagram of Water Supply Systems	✓	✓
HWB_8_03	Specifications of HVAC Systems	✓	✓
HWB_8_04	Schematic diagram of HVAC Systems	✓	✓
HWB_8_05	Specifications of Other Water Features	✓	✓
HWB_8_06	Schematic diagram of Other Water Features with mark-up narratives	✓	✓
HWB_8_07	Testing and commissioning report for all installed mitigation measures and equipment for the prevention of legionnaires' disease	-	✓
HWB_8_08	Drawing of installation details	-	✓

Remarks

(a) Additional Information

None

(b) Related Credits

None

8 Innovations and Additions

8.1 Innovations and Additions

Introduction

BEAM Encourage innovative and/ or new techniques that are yet to find in the mainstream application in Hong Kong addressing sustainability objectives for new buildings.

Background

Any credits gained under this heading shall be regarded as ‘Bonus’ credits, counting towards the total credits obtained, but not towards the total credits obtainable. BEAM encourages application of new practices, technologies and techniques together with the associated benefits in addressing sustainability objectives for new buildings.

8 Innovations and Additions

8.1 Innovations and Additions

IA 1 Innovative Techniques

Extent of Application

All DCs, for innovations that have not been addressed in the respective categories of the New DCs certification.

Objective

Encourage innovative and/ or new techniques/ practices/ design that are yet to find in the mainstream application in Hong Kong addressing sustainability objectives for new DCs.

Credits Attainable

Maximum 10 BONUS credits for IA.

Assessment

Present evidence of the application of new practices, technologies and/ or techniques that are (1) not described in this manual; or (2) not market mainstream implementation; or (3) multiple aspect achievement; and the associated benefits in addressing sustainability objectives for new DCs:

i. Identify the sustainability objectives addressed by the proposed innovative applications.
ii. Detail the method and criteria evaluating the benefits and effectiveness of the applications (quantifiable performance indicators to be proposed if applicable).
iii. Justify the number of bonus credits for the proposed applications.
iv. Provide evidence of the implementation of the applications.
v. Evaluate preliminary achievements and any suggestion for improvement for the applications.

The Assessor will refer the proposal to the BSL Technical Review Committee who will consider each application on its merits.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**FA**
1.1	BEAM Plus New DCs submission template for IA	✓	✓
1.2	Report on the objectives, evaluating method and criteria, and proposed number of bonus credits for the innovative techniques	✓	✓
1.3	Report on the evidence of implementation and evaluation of preliminary achievements / proposed improvements for the innovative techniques	-	✓

Remarks

(a) Additional Information
None

(b) Related Credits
None

9 Appendices

9.1 Glossary

Air Ventilation Assessment

Air Ventilation Assessment, in accordance with ETWB Technical Circular No. 1/06, is a tool to assess the impacts of the proposal on the pedestrian wind environment.

Albedo

The proportion of incident radiation reflected by a system. A perfect reflector would have an *albedo* of 1, whereas a perfect absorber would have an *albedo* of 0.

Annual Building Energy

Annual building energy refers to the total annual building energy consumption estimated for baseline case or proposed case. Both setting could be referred to Appendix 9 of this manual.

Biophilic Design

Designing for people as a biological organism, respecting the mind-body systems as indicators of health and well-being in the context of what is locally appropriate and responsive.

Bioretention Facilities

Bioretention facilities filter rainwater that becomes polluted as it flows over hard surfaces like streets, parking lots, roofs, and driveways. The bioretention facility retains the water and filters various pollutants.

Brownfield

Brownfield refers to previously developed land, or land that contains or contained permanent structures and associated infrastructures.

Certificate Validity

Certificate Validity refers to the duration for which a BEAM Plus certificate and grading remain effective and officially recognized by the HKGBC.

Charrette,

Charrette, a design workshop to quickly generate a design solution while integrating the aptitudes and interests of project team and core design disciplines, shall be held no later than design development phase and preferably during schematic design.

Computer Fluid Dynamics

Computational fluid dynamics (CFD) is a branch of fluid mechanics that uses numerical analysis and data structures to analyse and solve problems that involve fluid flows.

Construction Waste

It means any substance, matter or thing which is generated as a result of construction work and abandoned whether or not it has been processed or stockpiled before being abandoned. It is a mixture of surplus materials arising from *site* clearance, excavation, construction, refurbishment, renovation, demolition and road works.

Core amenities

Basic services/ recreational facilities that are most vital and essential to the subject development

Cultural heritage

Declared monuments/ Grade 1 to Grade 3 historic buildings confirmed by the Antiquities Advisory Board (AAB) and other *sites*/ historic buildings proposed to be recorded/ graded by AAB.

Demolition waste

It means all wastes (including recyclable waste) generated from deconstruction of existing buildings at the demolition stage are counted as demolition waste.

Designed for Disassembly

Materials which can be disassembled by using non-specialist tools and for *reuse*, recycling or reprocessing

Embodied Energy

Embodied energy is the energy used during the entire life cycle of a product, including its manufacture, transportation, and disposal, as well as the inherent energy captured within the product itself

Environmental Management Plan (EMP)

An Environmental management plan is a plan to address the potential significant environmental aspects and impacts and to propose appropriate mitigation measures for construction works.

Environmental monitoring and auditing plan (EM&A)

EM&A aims to provide systemic procedures for monitoring, auditing and minimizing environmental impacts associated with Project activities.

External Shading

External shading is a device incorporated in the building facade to limit the internal heat gain resulting from solar radiation.

Facade Zone

The projection of the curtain wall system from the outer face of the structural elements does not exceed 200 mm for a domestic building and 250 mm for a non-domestic building

FSC Certification

A certification system for timber products which confirms that timber has been harvested in a sustainable manner.

Functional program

A *functional program* describes the requirements which a building must satisfy in order to support and enhance human activities. The program also defines the character, services, scope, functions and space requirements.

Girth

Diameter of a tree trunk measured at 1.3 m above ground; or refers as Diameter at Breast Height (DBH)

Global Warming Potential

GWP provides a measure of the potential for damage that a chemical has relative to one unit of carbon dioxide, the primary greenhouse gas

Global Warming Potential

Global Warming Potential, GWP, provides a measure of the potential for damage that a chemical has relative to one unit of carbon dioxide, the primary greenhouse gas.

Ground Granulated Blast Furnace Slag (GGBS)

GGBS is a by-product of the iron manufacturing industry that, after the molten iron is tapped off, the remaining molten slag (consisting of mainly siliceous and aluminous residue) is then water-quenched rapidly, dried and ground to the required size.

Height of Building

The height of a building refers to the delta mPD between street level and the highest top roof as recorded in statutory documents

High Void

A high void is a space over 9m measured vertically by its clear height between building structure. Any structures inside a void and the clear vertical height between structures is over 9m, the space between structures is regarded as a high void. For multi-building development, the calculation of percentages of high voids to total building heights shall be considered for individual buildings separately

Hydro-chlorofluorocarbons

HCFCs cause ozone depletion when released into the atmosphere.

Hydro-fluorocarbons

HFCs are commonly used to replace HCFC refrigerants to reduce the OPD, however HFCs refrigerants have a high GWP.

Interior general Lighting

Interior general Lighting**,** lighting that provides a substantially uniform level of illumination through an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

Intra-Urban Heat Index

The effects of intra-urban heating can be quantified by *Intra-urban heat index*, which is defined as the temperature difference between urban and reference meteorological air temperature. Higher *Intra-urban heat index* suggests a more severe intra-urban heating effect.

Local velocity ratio (LVR)

Corresponds to the average velocity ratio of the **overall test points in the open spaces** in the assessment area

Main pedestrian access pathways

The widest pathway(s) of width not less than 2m for pedestrian circulation from building main entrance(s) to *site* entrance(s) or amenities within the *Site*

Master Plan

The masterplan design that certified under BEAM Plus Neighbourhood certification, that has a validity of 5 years and is “scheme sensitive”.

Modular Component

Materials which are manufactured with standardized dimensions, and can be arranged or fitted together in various scenarios of design.

Multi-disciplinary design *charrette*

An intensive, multiparty workshop that brings people from different disciplines and backgrounds together to explore, generate, and collaboratively produce design options.

Non-renewable resource

A resource does not renew itself at a sufficient rate for sustainable extraction in meaningful human time-frames.

Normally occupied spaces

Normally occupied spaces are enclosed areas where people normally stay more than 1 hour. Spaces which are not used daily, but will be occupied for more than one hour when used, are considered *normally occupied spaces*. Refer to Appendix 9.3 for examples of regularly occupied spaces.

Not *normally occupied spaces*

Not normally occupied spaces are enclosed areas within the building where people normally stay less than 1 hour. Refer to Appendix 9.3 for examples of not *normally occupied spaces*.

Occupied Space (Habitable Space)

Enclosed space intended for human activities, excluding those spaces that are intended primarily for other purposes, such as storage rooms and equipment rooms, and that are only occupied occasionally and for short periods of time. Occupied spaces are further classified as regularly occupied or non-regularly occupied spaces based on the duration of the occupancy, individual or multi-occupant based on the quantity of occupants, and densely or non-densely occupied spaces based on the concentration of occupants in the space.

Open planned design

Open plan is the design for any floor plan which makes use of large, open spaces and minimizes the use of small, enclosed rooms such as private offices

Orientation

Orientation is the compass direction the facade faces

Other Building Type

Other Building Type include, but not limited to, government building, industrial building, data centre, pump house, hospital, library, museum and law court.

Ozone Depleting Potential

ODP of a chemical compound is the relative amount of degradation to the ozone layer it can cause.

Permeability coefficient

A measure of a material's capacity to transmit water. It is defined as a constant of proportionality relating the specific discharge of a porous medium under a unit hydraulic gradient. Hydraulic conductivity is another term for coefficient of permeability.

Primary zone

The 15m vertical zone of a *site* along the abutting street level. The greenery in this zone is for providing visual contacts or access from a street through common parts of the building for enhancing the walkability of urban space to the public, visitors or occupiers. The top level of soil or similar base for planting should be taken as the reference level for inclusion in the Primary Zone**.**

Public realm

Public spaces within and surrounding the *Site* for socialization and enjoyment by the community

Pulverised Fuel Ash (PFA)

PFA is a by-product from power plant as a partial replacement for cement in concrete.

Rapidly Renewable Materials

Planted and harvested in less than a 10-year cycle, and do not result in significant biodiversity loss, increased erosion, or air quality impacts.

Recycle Content

With reference to ISO 14021, recycle content is defined as the proportion, by mass, of the recycled material in a product.

Regional Materials

Materials which are extracted and manufactured within an 800km radius of HKSAR by road transportation; within a 1,600km radius by rail transportation; or within a 4,000km radius by sea transportation.

Reuse

Materials which can be used again with the same functions as their original use.

Roll-out plan

The Rollout Plan describes the overall plan for the attaining BEAM Plus EB certification. The plan is an increment-based approach that includes specific tasks, actions, milestones, and action parties.

Runoff coefficient

A dimensionless coefficient relating the amount of runoff to the amount of precipitation received. It is a larger value for areas with low infiltration and high runoff (pavement, steep gradient), and lower for permeable, well vegetated areas (forest, flat land).

“simple box” environmental/ energy modelling

A simple energy analysis that informs the team about the building’s likely distribution of energy consumption and is used to evaluate potential project energy strategies. A simple box analysis uses sketches and schematic building information. Block blush calculation is expected to demonstrate the building operation pattern. Also refers as “building-massing modelling”.

Site

Site refers to the land, water, vegetation and developable area that constitute the project application *site* within BEAM Plus assessment boundary.

***Site* velocity ratio (SVR)**

Corresponds to the average velocity ratio of the **perimeter test points on site boundary**.

Solar Reflectance Index (SRI)

The *Solar Reflectance Index (SRI)* is a measure of the solar reflectance and emissivity of materials that can be used as an indicator of how hot they are likely to become when solar radiation is incident on their surface. The lower the SRI, the hotter a material is likely to become in the sunshine.

South orientated facade

For building elevation plan that is within 15deg of true south. Building elevation plan that partly fall into the range of 15deg of true south, the entire elevation will be considered as *south orientated facade*.

Sub-structure

Substructure is the part of the structure which is below ground level or supporting *superstructure* loads, such as foundation and basement.

Superstructure

Superstructure is the part of the structure which is above ground level, and which serves the purpose of its intended use.

Sustainable Building Design (SBD) Guidelines

A guideline, promulgated by the Buildings Department, on building design which aim to enhance the quality and sustainability of the built environment in Hong Kong.

Sustainable Forestry Product

Timber or timber products are originally sourced from forestlands participating in an acceptable system or program which certifies sustainable forest management.

Tree Coverage

Area covered by crown of design trees

Unoccupied spaces

Unoccupied spaces are areas within the building where the primary function is not intended for human activities. These spaces are occupied by occupants for a short period of time and only occasionally. Refer to Appendix 9.3 for examples of *unoccupied spaces*.

Whole-systems thinking

A method of analysis and decision-making that looks at the interrelationships of the constituent parts of a system rather than narrowly focusing on the parts themselves.

Wind tunnel

Wind tunnels are large tubes with air moving inside. The tunnels are used to copy the potential air movement, pressure and turbrance around the object.

9 Appendices

9.2 EU 2 Energy Modelling Guideline

Energy Modelling Methodology

Whole Building Energy Simulation is required for determine the energy performance of the DCs. The proposed DC energy model must cover all building energy components listed in this appendix. The simulation models for calculating proposed case DC should be developed in accordance with the modelling methodology and the requirements in the following sections.

Power Usage Effectiveness (PUE) is a metric for quantifying DCs efficiency using the total annual facility energy and total annual IT equipment energy.

The IT equipment energy shall be measured at Power Distribution Unit (PDU) Output, i.e. PUE Level 2.

Energy modelling shall be used to assess PUE and system efficiency at multiple design IT load conditions, i.e. 75% (EU 2 Reduction of CO_2 Emissions) and 100% (Prerequisite requirement for EU P1).

The energy performance of a DC shall take into consideration of its unique design, such as N+1 or 2N design.

The system configurations must consider the redundant equipment and sequencing arrangements that enable the spare equipment capacity on “hot” standby, i.e. running together with base capacity.

Separate zones and schedules shall be modelled based on spaces with different temperature, such as raised floor, data hall and ceiling return.

The energy performance improvements could be come from the following aspects:

a) DC infrastructure design;
b) Selection of high efficient equipment;
c) Equipment capacities and part load characteristics;
d) System configuration; and
e) Operational and control sequencing.

Saving related to the energy use by the IT equipment will not be assessed in this credit.

Simulation Software

Simulation program used for energy modelling should meet the following criteria:

1) Tested with industry standard methods: ANSI/ASHRAE Standard 140-2007 or equivalent.

2) Capable to perform hourly analysis (i.e. 8,760 hours per year);

3) Provide hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation;

4) Capable to model 10 or more thermal zones;

5) Capable to simulate the thermal behaviour of a building and the interaction of its building fabric, air-conditioning, interior lighting and other relevant energy consuming equipment and systems;

6) Capable to perform design load calculations to determine the required air-conditioning equipment capacities and air and water flow rates for both the proposed building and baseline building;

7) Capable to model part-load performance curves for mechanical equipment;

8) Capable to model capacity and efficiency correction curves for mechanical heating and cooling equipment; and

9) Capable to model air-side economizers with integrated control.

Exceptional Calculation Method (ECM)

When no simulation program can adequately model a design, materials or device, an ECM can be used to demonstrate above-standard performance. Its adoption is subject to justification (submitted by the Applicant) of its underlying principles, quantitative & qualitative techniques, assumptions etc. in details.

Any claim of non-regulated load saving or strategies that lead to a difference between proposed and baseline model is required to submit a narrative and provide with ECM calculation.

ECM is allowed to create a representation of that element. If the methodology of approximation has not been previously published in any technical circular or FAQ, it is the responsibility of the applicant to submit a narrative explanation describing the calculation methodology and providing the results for energy savings if necessary.

Documentation include the minimum:

(i) Description of software limitation;

(ii) Description of design mechanism

(iii) Description of calculation mythology, theoretical and empirical information to support the accuracy of the method;

(iv) Demonstrate result and corresponding saving

Necessary software being used in calculation other than that used for building energy assessment shall provide corresponding verification

On-site Renewable Energy

On-site renewable energy generation is included in the proposed case calculation for the non-data hall system to further reduce the whole building CO_2 emission. By providing annual energy generation estimation details in the proposed case, the percentage reduction of CO_2 emission is accounted by the percentage of reduction from baseline CO_2 emission.

Equivalent Carbon Dioxide Emissions

Electricity: 0.7kg CO_2 per kWh electricity consumed [1]
Town gas: 3.141 kg CO_2 per unit of town gas consumed (1 unit of town gas = 48 mega-joules consumed

1 Environmental Protection Department. Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong, 2010 https://www.climateready.gov.hk/files/pdf/Guidelines_English_2010.pdf

Table-App 1 Modeling Requirements for Calculating Proposed DC Performance

Building Envelope
a. All components of the building envelope in the proposed case shall be modelled as shown on design documents (or as-built for existing building envelopes) b. All components of the building envelope in the proposed case shall be modelled as shown on design documents (or as-built for existing building envelopes). This included: Building geometry and window design *Albedo* of the envelope Thermal properties for the external walls, roof, floors and fenestrations (vertical fenestration and skylight) SC and VLT for fenestrations c. No manual fenestration shading devices such as blinds or shades shall be modelled. Automatically controlled fenestration shades or blinds might be modelled with creditable documentation provided. d. Permanent shading devices such as fins, overhangs and light shelves may be modelled.
***Interior General Lighting* System**
a. Lighting that provides a substantially uniform level of illumination through an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area. All installed lighting shall be modelled in each **thermal block**. Lighting Power shall be determined in space by space method with same categorization as the proposed design. Lighting system power shall include all lighting system components shown or provided for on the plans for background lighting. Lighting system that solely use for emergency purpose is not in scope. Lighting power shall include all power used by the luminaires, including lamps, ballasts, transformers and control devices. Any independently operating lighting systems in a space that are capable of being controlled to prevent simultaneous user operation, the installed interior lighting power shall be based solely on the lighting system with the highest wattage Lighting equipment that additional to general lighting requirement for a space and is controlled by an independent control device is not included. Lighting that is integral to equipment or instrumentation and is installed by its manufacturer is not included in this assessment methodology For space that the completed fixed lighting installations in the space does not exceed 70W, baseline shall be modelled as 70W in the space Lighting installations in BEC TG-2018 ver.0 [2] clauses 5.1.2 are excluded. Automatic lighting control shall be modelled in the baseline case in accordance to BEC2018 ver.0 [3] table 5.4 and clauses 5.6. **Exceptions**: emergency lighting that is automatically off during normal building operation; lighting that is specially designated as required by a health or life safety statute, ordinance, or regulation b. For spaces where a complete lighting system designed (or installed) shall be consistent with design documents (or actual equipment used) c. For spaces where a lighting system neither exists nor is specified in a space, lighting power shall be modelled identically with the baseline case, unless a legally bounding documents for future use is provided to justify the input. d. For automatic lighting controls in addition to those mandatory requirements in BEC 2018, ECM is required to justify the modification of lighting schedules uses for the proposed case. Credible technical documentation for the modification shall be provided.

[2] Technical Guidelines on Code of Practise for Energy Efficiency of Building Services Installation 2018 (Ver. 0) – Electrical and Mechanical Services Department HKSAR

[3] Code of Practise for Energy Efficiency of Building Services Installation (Ver.0) – Electrical and Mechanical Services Department HKSAR

Receptacle and Other Load (Process Load)
a. Energy for receptacle, and process loads (unregulated load) shall be modelled with respect to building type. Process load shall be input as per design information to reflect the expected energy consumption. Justification shall be provided by applicant through ECM. If no information could be provided, default power density shall be used for the below space type[4] Office: 25W/m^2 Data Centre: 900W/m^2
b. Receptacle and process loads shall be input as design information with supporting through ECM; if no information could be provided, default value shall be used.
c. Both baseline and proposed case shall be modelled identically, including power, schedule and control.
d. If both cases are not identical, submission of ECM is required to support the justification by qualified professional.
IT Equipment Load
a. The IT load comprises critical systems including servers, storage and networking power use, telecommunications and operation affecting monthly server CPU utilisation percentages.
b. The proposed design must use the IT loads and schedule developed for the project.
c. The IT load must be taken at the Power Distribution Unit (PDU) Output.
d. Two models with design IT load at 100% and 75% should be developed.
e. The operation s

[4] LEED 2009 Appendix 2, Table 1, LEED v4 Appendix 3, Table 1-4 and EMSD - Performance-based Building Energy Code 2007 “Space type categories: default assumptions”

Miscellaneous
Miscellaneous energy uses are defined as those that may be treated separately since they have little or no interaction with the conditioned thermal blocks or the HVAC systems that serve them. • Exterior Lighting System • Services Hot Water System • Lift & Escalator System • Irrigation, plumbing and drainable, fire services
Exterior Lighting System
a. When exterior lighting system has been specified (or installed) in the proposed case, the system shall be modelled consistent with design documents (or actual system information) b. Where no exterior lighting has been specified in proposed case, no exterior lighting shall be modelled.
Services Hot Water System
a. For a combination of equipment and auxiliary devices (e.g. controls, accessories, interconnecting means and terminal elements) by which energy is transformed so it heats up water for commercial purpose other than space heating and process requirements. b. Where a service hot-water system has been specified (or installed) in the proposed case, the system shall be modelled consistent with design documents (or actual system information). c. Where no service hot water system has been specified but the building will have service hot water loads, a service water system shall be modelled identical to the baseline case. d. For building that will have no service hot-water loads, no service hot-water heating shall be modelled.
Lift and Escalator System
a. Where lift and escalator system has been specified (or installed), the system shall be modelled consistent with design documents (or actual system information) b. For controls in addition to those mandatory requirements in BEC 2018, ECM is required to justify the modification of lift schedules uses for the proposed case. Credible technical documentation for the modification shall be provided.
Irrigation, Plumbing and Drainage, Fire Services
No system to be modelled
On-*site* Power Generation
Where an on-*site* power generation system has been specified (or installed) in the proposed case, the system shall be modelled consistent with design documents (or actual system information)
HVAC system
1. General Weather conditions used in sizing runs to determine baseline equipment capacities maybe based either on hourly historical weather files containing typical peak conditions or on design days developed using 99.6% heating design temperatures and 1% dry-bulb and 1% wet bulb cooling design temperature Outdoor condition to be used for both baseline and proposed case sizing shall reference to BEC 2018 Table 6.4. Indoor condition (s) to be used for both baseline and proposed case shall be identical. Justification shall be provided else value in BEC 2018 Table 6.4 shall be used. 2. All conditioned spaces in the proposed design should be simulated as being both heated and cooled even if no heating or cooling system is to be installed and temperature and humidity control set points and schedules should be the same for proposed and baseline building designs unless justification is provide through ECM calculation.

3. The HVAC system(s) in baseline building design shall be of the type and description specified in Table 2 "Baseline HVAC System Setting Summary".
4. Equipment Efficiencies

   All HVAC equipment in the baseline case shall be modelled at the minimum efficiency levels, both part load and full load, in accordance with BEC 2018 ver.0 Table 6.12a (Part 1) and Table 6.12b.

   All HVAC equipment in the proposed case shall be modelled consistent with design documents (or actual installed equipment information)

   In both baseline and proposed case, for package type system the descriptor shall be broken down into its components so that supply fan energy can be modelled separately
5. Equipment Capacities

   The equipment capacities for the baseline case shall be based on sizing run and shall be oversized by 15% for cooling.
6. Minimum outdoor air ventilation rate shall be modelled identical in both baseline and proposed case.
7. Demand control is required in baseline case conditioned area when a space with design fresh air flow rate ≥ 1400 L/s
8. Design airflow rates for the baseline case shall be based on a supply-air-to-room-air temperature difference of 11°C or the required ventilation air or makeup air, whichever is greater. If return or relief fans are specified in the proposed case, the baseline case shall also be modelled with fans serving the same functions and sized for the baseline supply fan air quality less the minimum outdoor air, or 90% of the supply fan air quantity, whichever is larger
9. Design chilled water temperature to be used in the baseline case shall reference to the corresponding value in BEC 2018 Table 6.12b (7°C / 12.5°C)
10. Chilled water pump shall be modelled as 65% combined impeller and motor efficiency for baseline case.
11. Performance impact due to pipe / duct loses and refrigerant pipe length are not considered in this assessment methodology.
12. Existing equipment shall be modelled identical in both baseline and proposed case. The corresponding energy consumption shall be separately metered.
13. Space where complete HVAC system has been designed (or installed), the model shall consistent with design documents (or actual system type used).
14. Space where no HVAC system has been designed (or installed) but AC platform is designed for future provision, the HVAC system should be identical to the system modelled in baseline (unitary (split type)

Exception: if natural ventilation design and provision is provided, justification is required through ECM calculation to demonstrate the number of non-AC hours that complied with design condition (with reference to ASHRAE 62.1-2013) for natural ventilation. The corresponding design shall be equipped with automatic change over provision.

District cooling system (if applicable)

a. Based on actual efficiency performance; or
b. If project team cannot obtain actual performance data for main plant, it is permissible to use the following default average performance values:

   DCS cooling plant – COP of 4.4 for total cooling plant average efficiency (including cooling towers and primary pumps)
c. Seasonal Thermal distribution losses – including minor leaks and condensate losses (but not pumping energy, which must be accounted for separately where it applies): chilled water district cooling: 5%

Ventilation System

Carpark ventilation shall be consistent with design documents (or actual system installed)

Table-App 4 Default operation Schedule for Calculation*5*

Office Occupancy

Hour of Day (Time)	Schedule for Occupancy			Schedule for Lighting / Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12 - 1am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
2 (1 - 2am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
3 (2 - 3am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
4 (3 - 4am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
5 (4 - 5am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
6 (5 - 6am)	0	0	0	10	5	5	Off	Off	Off	8	8	7	0	0	0
7 (6 - 7am)	10	10	5	10	10	5	On	On	Off	7	7	4	0	0	0
8 (7 - 8am)	20	10	5	30	10	5	On	On	Off	19	11	4	35	16	0
9 (8 - 9am)	95	30	5	65/90	30	5	On	On	Off	35	15	4	69	14	0
10 (9 - 10am)	95	30	5	65/90	30	5	On	On	Off	38	21	4	43	21	0
11 (10 - 11am)	95	30	5	65/90	30	5	On	On	Off	39	19	4	37	18	0
12 (11 - 12pm)	95	30	5	65/90	30	5	On	On	Off	47	23	6	43	25	0
13 (12 - 1pm)	50	10	5	55/80	15	5	On	On	Off	57	20	6	58	21	0
14 (13 - 2pm)	95	10	5	65/90	15	5	On	On	Off	54	19	9	48	13	0
15 (14 - 3pm)	95	10	5	65/90	15	5	On	On	Off	34	15	6	37	8	0
16 (15 - 4pm)	95	10	5	65/90	15	5	On	On	Off	33	12	4	37	4	0
17 (16 - 5pm)	95	10	5	65/90	15	5	On	On	Off	44	14	4	46	5	0
18 (17 - 6pm)	30	5	5	35/50	5	5	On	On	Off	26	7	4	62	6	0
19 (18 - 7pm)	10	5	0	30	5	5	On	Off	Off	21	7	4	20	0	0
20 (19 - 8pm)	10	0	0	30	5	5	On	Off	Off	15	7	4	12	0	0
21 (20 - 9pm)	10	0	0	20	5	5	On	Off	Off	17	7	4	4	0	0
22 (21 - 10pm)	10	0	0	20	5	5	On	Off	Off	8	9	7	4	0	0
23 (22 - 11pm)	5	0	0	10	5	5	Off	Off	Off	5	5	4	0	0	0
24 (23 - 12am)	5	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0
Total/Day	920	200	60	800/1040	280	120	1600	1200	0	537	256	113	555	151	0
Total/Week	48.60 hours			44.00/56.00 hours			124 hours			30.54 hours			29.26 hours		
Total/Year	2534 hours			2288/2920 hours			6465 hours			1592 hours			1526 hours		

wk = Weekday

1. Elevator schedules, except for resturants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space

[5] ASHRAE 90.1-2010

Parking Garage Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting / Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
		Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12 - 1am)				50/100	50/100	50/100									
2	(1 - 2am)				50/100	50/100	50/100									
3	(2 - 3am)				50/100	50/100	50/100									
4	(3 - 4am)				50/100	50/100	50/100									
5	(4 - 5am)				50/100	50/100	50/100									
6	(5 - 6am)				50/100	50/100	50/100									
7	(6 - 7am)				100	100	50/100									
8	(7 - 8am)				100	100	50/100									
9	(8 - 9am)				100	100	50/100									
10	(9 - 10am)				100	100	50/100									
11	(10 - 11am)				100	100	50/100	Based on likely use						Included with other occupancies		
12	(11 - 12pm)		NA		100	100	50/100					NA				
13	(12 - 1pm)				100	100	50/100									
14	(13 - 2pm)				100	100	50/100									
15	(14 - 3pm)				100	100	50/100									
16	(15 - 4pm)				100	100	50/100									
17	(16 - 5pm)				100	100	50/100									
18	(17 - 6pm)				100	50/100	50/100									
19	(18 - 7pm)				100	50/100	50/100									
20	(19 - 8pm)				100	50/100	50/100									
21	(20 - 9pm)				100	50/100	50/100									
22	(21 - 10pm)				100	50/100	50/100									
23	(22 - 11pm)				50/100	50/100	50/100									
24	(23 - 12am)				50/100	50/100	50/100									
Total/Day					2000/2400	1750/2400	1200/2400									
Total/Week					129.50/168 hours											
Total/Year					6734/8760 hours											

wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space. For parking garage lighting, the schedule has been revised to accompany the office schedule: the lighting in the parking garage is set to be on at 100% for all hours when the building occupancy is 10% or greater, but reduced to 50% for all hours when the building occupancy is less than 10%. For other uses, it is acceptable to modify the parking garage schedule to parallel that use.

Restaurant Occupancy

Hour of Day (Time)	Schedule for Occupancy			Schedule for Lighting / Receptacle			Schedule for HVAC System			Schedule for Service Hot Water			Schedule for Elevator		
	Percent of Maximum Load			Percent of Maximum Load						Percent of Maximum Load			Percent of Maximum Load		
	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1 (12 - 1am)	15	30	20	15	20	20	On	On	On	20	20	25	0	0	0
2 (1 - 2am)	15	25	20	15	15	15	On	On	On	15	15	20	0	0	0
3 (2 - 3am)	5	5	5	15	15	15	On	On	On	15	15	20	0	0	0
4 (3 - 4am)	0	0	0	15	15	15	Off	Off	Off	0	0	0	0	0	0
5 (4 - 5am)	0	0	0	15	15	15	Off	Off	Off	0	0	0	0	0	0
6 (5 - 6am)	0	0	0	20	15	15	Off	Off	Off	0	0	0	0	0	0
7 (6 - 7am)	0	0	0	35/40	30	30	Off	Off	Off	0	0	0	0	0	0
8 (7 - 8am)	5	0	0	35/40	30	30	On	Off	Off	60	0	0	0	0	0
9 (8 - 9am)	5	0	0	55/60	55/60	45/50	On	Off	Off	55	0	0	0	0	0
10 (9 - 10am)	5	5	0	55/60	55/60	45/50	On	On	Off	45	50	0	0	0	0
11 (10 - 11am)	20	20	10	85/90	75/80	65/70	On	On	On	40	45	50	0	0	0
12 (11 - 12pm)	50	45	20	85/90	75/80	65/70	On	On	On	45	50	50	0	0	0
13 (12 - 1pm)	80	50	25	85/90	75/80	65/70	On	On	On	40	50	40	0	0	0
14 (13 - 2pm)	70	50	25	85/90	75/80	65/70	On	On	On	35	45	40	0	0	0
15 (14 - 3pm)	40	35	15	85/90	75/80	65/70	On	On	On	30	40	30	0	0	0
16 (15 - 4pm)	20	30	20	85/90	75/80	65/70	On	On	On	30	40	30	0	0	0
17 (16 - 5pm)	25	30	25	85/90	75/80	55/60	On	On	On	30	35	30	0	0	0
18 (17 - 6pm)	50	30	35	85/90	85/90	55/60	On	On	On	40	40	40	0	0	0
19 (18 - 7pm)	80	70	55	85/90	85/90	55/60	On	On	On	55	55	50	0	0	0
20 (19 - 8pm)	80	90	65	85/90	85/90	55/60	On	On	On	60	55	50	0	0	0
21 (20 - 9pm)	80	70	70	85/90	85/90	55/60	On	On	On	50	50	40	0	0	0
22 (21 - 10pm)	50	65	35	85/90	85/90	55/60	On	On	On	55	55	50	0	0	0
23 (22 - 11pm)	35	55	20	45/50	45/50	45/50	On	On	On	45	40	40	0	0	0
24 (23 - 12am)	20	35	20	30	30	30	On	On	On	25	30	20	0	0	0
Total/Day	750	740	485	1370/1455	1290/1365	1040/1155	0	0	0	790	730	625	0	0	0
Total/Week	49.75 hours			91.80/97.55 hours			135 hours			53.05 hours			0 hours		
Total/Year	2594 hours			4774/5086 hours			7039 hours			2766 hours			0 hours		

wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

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9.3 Space type

BEAM Plus considers indoor environmental quality (IEQ) as a key to sustain occupants' health and wellbeing. To assist the applicant design more thorough and satisfactory IEQ strategies, BEAM Plus imposes high requirements for indoor environmental quality covering ventilation, air quality, acoustics and lighting.

As the impacts of IEQ are dependent on the level of interaction between the occupants and the indoor spaces where they spend their time in, it is crucial for the applicant to understand and identify the level of usage of each indoor space. To facilitate assessment, the applicant should prepare a schedule including all spaces present within the building and their respective location. The spaces should be categorised into the following three space type (refer to Glossary for definitions):

- *Normally occupied spaces*
- *Not normally occupied spaces*
- *Unoccupied spaces*

Listed below are some example of each space type. These examples are not exhaustive. If a space present in the applicant's DC is not included below, the applicant should identify similar examples or categorise the space type according to the definition. Justification is required should the applicant believe a space cannot be categorised according to the space type definitions.

Space Usage of *normally occupied spaces*

- Auditorium
- Concourse
- Conference room
- Dining
- Food and beverage dining area
- Front desk
- Kitchens (commercial)
- Lecture hall
- Meeting room
- Open office
- Private office
- Reception
- Gallery area
- Information desk

Space Usage of *not normally occupied spaces*

- Break room
- Copy rooms
- Corridor
- Entrance lobby
- Staircases
- Lift lobby
- Pantry
- Toilet

Space Usage of *Unoccupied spaces*

- Emergency exit corridor
- Mechanical and electrical rooms
- Car park
- Store room
- Warehouse

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9.4 Stormwater Detention Systems O&M Checklist

Operation and maintenance checklist for stormwater detention system:

#	DESCRIPTIONS	Y/N/ NA	Findings / Follow Up actions
1	**Monthly/after significant storm event**		
a	No stagnant water in tank		
b	No residual water at inlet/outlet structures		
c	No mosquito breeding		
d	No pest infestation within the system		
e	No clogging at inlet/outlet structures/trash racks		
f	No excessive sediment builds up in tanks		
g	Inspect, lubricate and conduct routine test to check reliability of pump(s)		
h	Check condition and conduct function test of all pump starters and their controls including level control systems		
i	Standby generator load test		
j	Structural integrity of tank and features are not compromised (check for crack/leaks)		
k	No obstruction of maintenance access/openings		
l	Access into the detention tank system is secure (out of bounds to public and unauthorised personnel)		
2	**Yearly/as required (before year-end monsoon season)**		
a	Desilting detention tank has been carried out, trash screens have been cleaned		
b	Inspect, service, replace, lubricate and test performance of pump(s)		

c	Inspect protective devices such as overload, earth fault, residual current relays		
d	Check condition and conduct function test of all pump starters and controls including level control systems. Replace faulty and worn out parts if required		

