BEAM Plus NB (v2.0) rating tool as compared to its national and international counterparts

By HKGBC Secretariat   31 December 2020

Hong Kong is famous for its high-rise complex buildings. The design and operation of these buildings play a significant role in the city's environmental footprint as well as the lives and wellbeing of its citizens. The city started to have its own green building rating tool in 1996, just 6 years after the U.K. Building Research Establishment (BRE) launched the world-first rating scheme called 'BREEAM'. At that time, the Hong Kong rating tool was known as 'Building Environmental Assessment Method' (BEAM). After 23 years of evolution, the latest version of BEAM, known as 'BEAM Plus New Buildings (NB) Version 2.0' was launched in September 2019. This article attempts to give a brief comparison of BEAM Plus NB v2.0 against its national and international counterparts, namely China Three Star standard, LEED v4.1 and BREEAM UK NC 2018 with a view to enhancing readers' understanding on these green building rating tools.

BEAM Plus NB v2.0

BEAM Plus NB v2.0 is an updated version of the BEAM standard. This new version has incorporated new techniques related to integrative design and assurance of human wellbeing. In line with this objective, two new chapters are included in the manual: (a) integrated design and construction management; (b) health and wellbeing, which replaces the indoor environmental quality chapter in the old version. New credits in the manual include integrated design process, building information modelling (BIM), document management system, life cycle costing, active living and biophilic design. Design for climate change adaptation as well as outdoor thermal comfort are also incorporated.

LEED BD+C v4.1

LEED Building Design and Construction is the green building rating standard originating from the U.S. The salient features of LEED v4.1 are:

- Rigorous focus on material selection, human health and social equity issues.

- Ensuring a building is resilient from natural and unnatural disturbances through a comprehensive set of design and construction strategies.

BREEAM UK NC 2018

BREEAM U.K. New Construction is the green building rating standard originating from the U.K. Its salient features are:

- The 'Materials' category encourages whole building life cycle assessment and recognises construction products with independently verified environmental declarations.

- The addition of a new optional third stage of assessment, labelled as post-occupancy stage. This stage confirms the process of monitoring, reviewing and reporting on the performance of the building once occupied, typically a minimum of 12 months after occupancy.

China Three Star 2019

Three Star is a common name for China's national assessment standard for green building 'GB/T 50378'. The latest version was published in March 2019. Its salient features are:

- The core theme of the standard is set to be human-centric in order to raise the quality of buildings in line with user expectation.

- Energy, water and material are grouped under a 'resource' chapter, while new chapters are added: safety and durability, health and comfort, occupant convenience as well as environmental liveability.

- Like BREEAM, there are optional post-occupancy credits that projects may pursue if they prefer to delay the completion time of assessment to one year after occupation.

Grading structure comparison

Figure 1 gives a comparison of the grading structure of the four rating tools. The positions of the grades in the table have been adjusted to match the threshold scores so that readers can appreciate their relative differences. All rating tools, with the exception of BREEAM, adopt a 4-grade structure. BREEAM has an extra grade at the lower end, trying to give recognition to projects that obtain a score of 30. On the allocation of grades to the score spectrum, it is noted that BREEAM and Three Star have a higher upper end (at 85 marks); LEED sets the upper end at a middle level (80 marks) whereas BEAM Plus sets it 75. However, it should be noted that direct comparison of marks is not meaningful as different rating tools use different criteria and mechanisms to arrive at the final grades.

BEAM Plus		LEED		BREEAM		China Three Star	
				Outstanding	85	***	85
		Platinum	80				
Platinum	75			Excellent	70	**	70
Gold	65						
		Gold	60			*	60
Silver	55			Very Good	55		
		Silver	50				
				Good	45		
Bronze	40	Certified	40			Basic grade	40
				Pass	30		

Figure 1 Grading structure comparison

Comparison of aspects

Figure 2 gives a comparison of the aspects contained in the green building standards. The most noticeable differences are the 'Safety' and 'Property Management' rows. These two aspects come from China Three Star but they are NOT present in the other standards. If one looks into the rating tool contents, it would be found that Safety is a unique element of Three Star while the contents of Property Management are in fact embedded within various chapters within BREEAM. The inclusion of Property Management elements in a 'new building' rating scheme has the advantage that the rating scheme operator would be able to quickly know how well a newly completed building operates, without waiting for the completion of an 'existing building' assessment. Sometimes it is uncertain whether the future operator of a building would join the 'existing building' assessment scheme as such a decision would only be made 3 to 5 years later after the building is occupied. Nevertheless, these Property Management requirements within a 'new building' rating tool can only be packaged as 'optional requirements' because it is a fact that NOT all building developers would be willing to defer the conferment of green building rating to a date that is one year after building completion.

BEAM Plus NB	LEED	BREEAM	China Three Star
Integrated Design & Const. Mgt (IDCM)	Integrative Process (IP)	Management (Man)	-
	-	-	Intelligent Operation
Sustainable Site (SS)	Sustainable Sites (SS)	Land Use & Ecology (LE)	Land Saving & Utilization
			Service Facility
			Environmental Liveability
		Pollution (Pol)	
	Location & Transport (LT)	Transport (Tra)	Transit & Accessibility
Materials & Waste (MW)	Materials & Resources (MR)	Waste (Wst)	Material Saving & Green Materials
		Materials (Mat)	
			Durability
Energy Use (EU)	Energy & Atmosphere (EA)	Energy (Ene)	Energy Saving & Utilization
Water Use (WU)	Water Efficiency (WE)	Water (Wat)	Water Saving & Utilization
Health & Wellbeing (HWB)	Indoor Environmental Quality (EQ)	Health & Wellbeing (Hea)	Health & Comfort
-	-	-	Safety
-	-	-	Property Management
Inno. & Additions (IA)	Innovation (IN)	Innovation (Inn)	Promotion & Innovation

Figure 2 Comparison of aspects within the rating tools

Another observation is: Within Integrated Design and Construction Management (IDCM), BEAM Plus has included contents related to intelligent operation, which are also present in Three Star, but are not present in LEED and BREEAM. This reflects that both Hong Kong and Mainland China have a higher emphasis on implementing smart buildings.

Comparison of aspect weightings

The Secretariat has carried out a mapping study, i.e. the clauses of BEAM Plus are mapped to the most relevant clauses in the other three rating standards. To facilitate calculation of aspect weightings and subsequent comparison, the credits are re-grouped according to a unified common framework of aspects. The result is given in Figure 3.

MAN=Management; SA=Site Aspects; MW=Materials & Waste; EU=Energy Use; WU=Water Use; HSW=Health, Safety & Wellbeing; CC=Climate Change; SMT=Smart Building Provisions; POS=Post Occupancy Stage Assessment
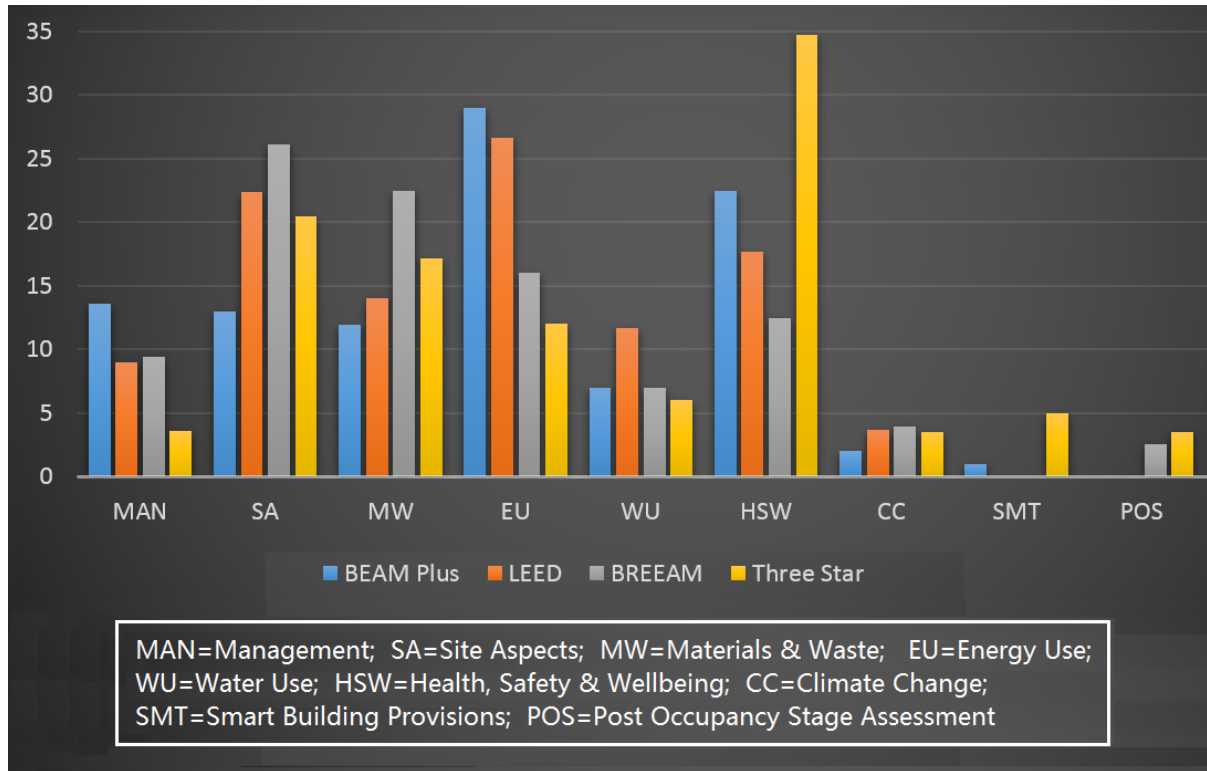
Figure 3 Score weight allocations to different aspects

From the chart, it can be seen that BEAM Plus allocates a higher degree of importance to design and construction management (MAN) as well as energy use (EU) than the other three rating standards. In the areas of health and wellbeing (HSW), BEAM Plus allocates the second heaviest weight among all rating tools.

If one carries out a clause-by-clause comparison, it would be found that BEAM Plus has certain relative strengths over other rating standards. These include a set of advanced or comprehensive features like digital facility management interface, document management system for project/facility management, BIM integration, considerations for buildability and O&M, active living, biophilic design, twin-tank system, biological contamination and universal accessibility. BEAM Plus also possesses special credits related to Hong Kong's high-density built environment such as air ventilation assessment (AVA), building separation and setback, clothes drying facilities and indoor vibration control, as well as credits related to its hot and humid subtropical climate, such as intra-urban heat island study, provision of shading and outdoor thermal comfort analysis. All these features represent some of the best practices that have potential for extending applications to other similar cities that bear the same density and climate as Hong Kong.

Concluding remarks

This benchmarking study finds that although the different green building rating systems have a common environmental aim, there are significant differences in their emphasis and methodologies. Owing to these differences, direct comparison of ratings under those methods is highly difficult.

If, in the process of future rating tool development, more common metrics can be adopted, the rating tools around the world may achieve a sufficient degree of parity that would enhance their usefulness. Recently, the European Commission has published the 'Level(s)' reporting standard (2020 edition), which is a common EU framework of core sustainability indicators for office and residential buildings. The 'Level(s)' standard can serve as a good reference for all rating tool drafters.

Appendix A

A table mapping the clauses of BEAM Plus NB (v2.0) to LEED, BREEAM and China Three Star is given in Appendix A for readers' reference.

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Appendix A

Mapping between the Clauses of BEAM Plus NB v2.0, LEED v4.1 BD+C, BREEAM UK NC 2018 and China Three Star 2019

	BEAM Plus NB v2.0 - 2019		LEED v4.1 (BD+C) - 2020			BREEAM UK NC - 2018		China Three Star - 2019	
MAN	**MANAGEMENT**								
	IDCM P1	Engage Project BEAM Pro	INN		Engage LEED AP				
	IDCM 1	Engage additional GB personnel in design team				Man 01 c,d	Involve BREEAM AP in design stages		
	IDCM 6	Engage additional GB personnel in construction team				Man 03 b	Involve BREEAM AP on site		
	IDCM P2	Prepare an Environmental Mgt Plan							
						Man 03 a	Contractors operate an Environmental Mgt System.		
	IDCM P3	No virgin wood in temporary works				Man 03 p	Sustainable timber is used during construction process.		
	IDCM 2	Obtained ND cert; or prepare for future BI/EB cert	LT	ND	Locate project in an ND certified site				
	IDCM 3a	Integrated design process	IP	IP	Early analysis of inter-relationships among systems	Man 01 a	Project delivery planning, involve related stakeholders		
			EA	FCV	Develop Owner's Proj Req and Basis of Design				
			SS	SA	Conduct wide-aspect site survey before design				
						Man 01 b	Stakeholder consultation - interested parties		
	IDCM 3b	Consider buildability							
	IDCM 3c	Consider future O&M						4.1.3	Safety of devices on external walls
	IDCM 5	Commissioning	EA	FCV	Engage CxA, set O&M req and Ongoing Commissioning Program	Man 04 a-c	Commissioning		
			EA	EC	Complete commissioning activities - systems plus building envelope				
	IDCM 11	O&M manual & energy mgt manual				Man 04 d1	Technical user guide for facilities managers		
	IDCM 12	Operator training & chemical storage							
	IDCM 7	Reduce site pollution during construction	SS	CAPP	Prevent pollution during construction activity	Man 03 c2	Responsible construction management - second part		
						Man 03 d	Monitor resource consumption & CO_2 emissions	9.2.7 a	Construction carbon emission estimation
								9.2.8 a	Sustainable/green construction certificate or rating
	IDCM 10	Care for workers, neighbours and trees				Man 03 c1	Responsible construction management - first part		
	IDCM 15	Project team / FM team Document Mgt Sys							
	IDCM 16	BIM						9.2.6	BIM for design, construction and O&M
	IDCM 17	Signage, manuals, newspapers, other educational elements				Man 04 d2	Non-technical user guide for building occupiers	6.2.13 b1	Exhibitions / user manuals for education
	IDCM 4	Life cycle costing (LCC) for HW, Ltg and AC systems only	IP	IP	LCC touched upon in IP chapter - p.8 (analyst), p.9 (energy cost per area)	Man 02	Full LCC, including envelope, finishes and landscaping	3.1.3 & 5	Economic analysis, green finance reporting
			EA	EA	Energy cost covered in "Optimize energy performance" Table 1 - Cost PCI				
SA	**SITE ASPECTS**								
	SS 2a	Amenities within 500 m	LT	SDDU	Locate project in areas with extg density			6.2.3	Services & facilities within 1000 m, incl. EV charging fac.
								6.2.4	Recreational open spaces within walkable distances
	SS 2b	Shared amenities for public use							
	SS 3a	Meet urban design guidelines							
	SS 3b	Conserve cultural heritage						9.2.2	Preserve regional culture
			LT	HPS	Brownfield reme / Project in disadvantaged community / Affordable housing				
			LT	SLP	Use previously developed land / Avoid building on sensitive lands	LE 01	Use previously occupied land / Remediate contaminated land	7.2.1	Reduce land consumption (e.g. m² per person)
								7.2.2	Utilise underground (UG) spaces
								7.2.3	Use mechanised, multi-storey or UG car park

Appendix A - Mapping between the Clauses of BEAM Plus NB v2.0, LEED v4.1 BD+C, BREEAM UK NC 2018 and China Three Star 2019 (cont'd)

BEAM Plus NB v2.0 - 2019			LEED v4.1 (BD+C) - 2020			BREEAM UK NC - 2018		China Three Star - 2019	
SA									
	SS 1a	Access to public transport	LT	QT	Access to quality transit	Tra 01	Transport assessment & travel plan	6.1.2	Have access to public transport
								6.2.1	Convenient access to public transport
	SS 1b	Pedestrian-oriented transport planning	LT	RPF	Minimize car parking	Hea 07 a	Safe access for pedestrians	4.2.5	Separate pedestrians & car traffic
	SS 1c	Cycling facilities	LT	BF	Bicycle facilities	Hea 07 a	Safe access for cyclist	6.1.4	Suitable location for bicycle park
						Tra 02 a	Transport options implementation (cyclists' facilities)		
	SS 1d	EV charging facilities	LT	EV	EV charging facilities	Tra 02 b	Transport options implementation (EV charging facilities)	6.1.3	EV charging facilities
						Tra 02 c	Transport options implementation (others, e.g. car sharing)		
	SS 7	Ecological conservation / enhancement	SS	PRH	Conserve natural areas and restore damaged areas	LE 02	Ecological survey; determine outcome	8.2.1	Preserve, restore or compensate the original ecology
						LE 03	Planning & measures on site; managing negative impacts		
						LE 04	Ecological change and enhancement		
						LE 05 b	Landscape & ecology management plan		
	SS P1	At least 20% site greenery						8.1.3	Greenery amount & design meet planning requirements
	SS8a2a3,b	Greenery + bldg setback & separation						8.2.3	Site greenery exceeds minimum requirements
								9.2.4	Design Leaf Area Index (LAI) exceeds requirement
			SS	HIR	Vegetation roof / PV roof / cool roof with SRI material			8.2.9	Vegetation roof / PV roof / cool roof with SRI material
	SS 8a1	Shading to non-roof impervious surfaces						8.2.9	Shading by albedo materials / trees, road surface selection
	SS 8d	Intra UHI study							
	SS 8c	AVA						8.2.8 (2)	Summer wind environment (incl. window pressure differentials)
	SS 9	Wind amplification study						8.2.8 (1)	Winter wind environment (incl. wind pressures on bldg facades)
	SS 10a	Shaded route to nearby amenity							
	SS 10b	Passive open spaces achieve thermal comfort						8.1.2	Outdoor thermal environment meets relevant standard
								8.2.6	Outdoor acoustic environment meets relevant standard
	SS 4	Neighbourhood daylight access						8.1.1	Do not reduce daylight standard in adjacent bldgs
	SS 5	Noise control for bldg equipment				Pol 05	Noise pollution from fixed installations in the project	8.1.6	No pollution sources incl. gas, liquid, waste, .. exceed limits
	SS 6	Light pollution control (day and night)	SS	LPR	Light pollution reduction	Pol 04	Night-time external lighting pollution reduction	8.2.7	Light pollution control (day and night)
						Pol 02	Boilers, cogen, space heaters - Local air pollution		
						Pol 03 c	Protect watercourse from pollution		
MW	**MATERIALS AND WASTE**								
	IDCM 8	C&D waste recycling	MR	CDWMp	C&D waste management plan	Wst 01	Construction waste management; diversion from landfill		
			MR	CDWM	Divert 50-75% of C&D waste				
	MW P1	Minimum waste handling facilities	MR	SCRR	Storage & collection of recyclables	Wst 03	Operational waste facilities, inc. facilities within homes	8.1.7	Municipal waste collection and sorting facilities
	MW 12	Enhanced waste handling facilities							
	MW 6	Bldg products contain recycled content	MR	SRM	Material reuse and recycled content	Wst 02	Use of recycled aggregates	7.2.17 (2)	Bldg products contain recycled content
								7.2.17 (1)	Use products that can be recycled or reused
	MW 11	Adaptable and flexible designs				Wst 06	Design for disassembly & functional adaptability	4.2.6	Enhance adaptability of building
						Wst 04	Minimise finishes to allow room for user fitting-out		

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	BEAM Plus NB v2.0 - 2019		LEED v4.1 (BD+C) - 2020			BREEAM UK NC - 2018		China Three Star - 2019	
MW	MW 1	Building reuse	MR	BLCIR	Reuse existing building			9.2.3	Re-use existing buildings
						Mat 06	Set targets & report on opp to optimise use of materials		
								7.1.9	Reduce the amount of decorative elements
								7.2.15	Use high-strength structural materials
	MW 2	Modular & standardised design						7.1.8	Do not use seriously irregular shapes in bldg form/layout
	MW 3	Off-site prefabrication						7.2.15 (2)(3)	Use semi-precast slabs
								7.1.10	Use off-site premixed materials
								9.2.5	Use steel/wood structure / Use MiC construction method
								7.2.14	Integrate fitting-out works into bldg construction
								7.2.16	Fit-out works & MEP industrialised (e.g. dry walls, whole volume kitchen)
								9.2.8 b	Reduce waste in concrete or reinforcement / use of aluminium formwork
								7.2.15 (2) (2)	Use more bolted connections instead of site welding
	MW 5	Use sustainable timber in the project	MR	SRM	Wood products (FSC)	Mat01/03 p	All timber must be legal & sustainable		
	MW 7	Reduce GWP & ODP substances	EA	FRM	No CFC use	Pol 01 a	Refrigerant impact assessment		
			EA	ERM	Assess refrigerant impact & comply	Pol 01 b	Refrigerant leakage detection / sealing		
	MW 8	Use regionally produced materials				Mat 03 a	Sus Procure Plan, e.g. procure products locally where possible	7.1.10	Use materials that are made within 500 km
	MW 9a	Use certified green products	MR	EPD	Products meet disclosure criteria + reduce LCI or embodied carbon	Mat 02	Specify products with a recognised EP Declaration	7.2.18	Use certified green products
			MR	SRM	Extended Producer Resp / Bio-based materials	Mat 03 b	Structure & finishes meet Responsible Sourcing Cert Scheme		
	MW 9b	Use rapidly renewable materials	MR	MI	Material ingredient reporting + optimization				
	MW 10	Conduct LCA for bldg structure	MR	BLCIR	LCA for structure & enclosure, with reduced impacts in 3 aspects	Mat 01 a	LCA for superstructure and substructure		
	MW 4a	Select durable materials						4.2.7	Bldg products have enhanced durability
								4.2.8	Structure adopts a 100-year design life
	MW 4b	Protect the building from damage				Mat 05 a	Protect the building from damage		
	MW 4c	Protect the building from degradation				Mat 05 b	Protect the building from degradation	4.2.9	Use durable external and internal finishes
								4.1.6	Waterproofing at bathrooms, ext walls and roofs
EU	ENERGY USE								
	EU 1	Passive design				Ene 04 a	Implement passive design measures	7.2.4	Improve performance of bldg envelope
	EU 7	Clothes drying facilities							
	EU 5	Renewable energy system	EA	RE	On-site or Off-site RE energy offset	Ene 04 c	Specify Low & Zero Carbon (LZC) technologies	7.2.9	Utilise renewable energy
								7.1.1	Conduct energy-saving design based on full considerations
								7.1.2	Reduce HVAC loads, perform zoning and set part-load parameters
								7.1.3	Determine setpoints with transition across zones
								7.1.4	Suitably design lighting and related zoning
	EU P1	Exceed Bldg Energy Code by 2%-3%	EA	MEP	Comply with ASHRAE 90.1-2016			7.2.5	COP or EER of HVAC is better than GB standards

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BEAM Plus NB v2.0 - 2019			LEED v4.1 (BD+C) - 2020			BREEAM UK NC - 2018		China Three Star - 2019	
EU	EU 2	Annual CO$_2$ reduction	EA	OEP	GHG emission reduction	Ene 01 a	Undertake energy modelling & achieve energy performance ratio	7.2.8	Overall building energy use reduction
			EA	OEP	Energy cost reduction	Ene 04 b	Use free cooling strategy in AC system		
						Ene 06	Lift and escalator systems	7.1.6	Energy-efficient lift and escalator systems
								7.2.6	Reduce energy lost in air ducts and water pipes
								7.2.7	Reduce energy use in electric and lighting systems
						Ene 03	External lighting		
						Ene 05	Food refrigeration/cold storage systems		
						Ene 07	Laboratory systems		
	EU 3	Peak electricity demand reduction	EA	GH	Reduce peak load, load shedding/shifting, storage strategy, etc				
	EU 4a1	Energy consumption metering	EA	BLEM	Install meters and commit to sharing with USGBC	Ene 02 a	Sub-metering by end-use categories	7.1.5	Sub-metering by end-use categories
	EU 4a2	Performance metering (to BMS)	EA	AEM	Advanced energy metering				
	EU 4b	Metering for tenant areas				Ene 02 b	Sub-metering of tenancy / high-load areas		
	EU 6	AC unit installation positions							
	EU 8	Use energy-labelled appliances				Ene 08	Energy-efficient eqt (incl. pools, laundries, IT areas, healthcare)		
WU	**WATER USE**								
	WU P1	Achieve 10% potable water saving	WE	OWIW	Reduce irrigation by 30% and indoor water use by 20%				
	WU 1	Achieve extra potable water saving	WE	IWUR	Reduce indoor water use by 25-50%	Wat 01 a	Overall water usage, incl. greywater & rainwater recycling system	7.2.10	Sanitary fitments comply with suitable grades
								7.1.7 (2)	Install PRV for high-pressure zones
			WE	WM	Install water meters at water subsystems	Wat 02 a	Install water sub-meters with output to BMS or equivalent	7.1.7 (1)	Water sub-metering
	WU 2	Water-efficient irrigation	WE	OWUR	Reduce irrigation by 50%	Wat 04 a	Pools, irrigation, vehicle wash, etc.	7.2.11	Irrigation & AC water adopt suitable tech
								7.2.12	Landscape water conservation
	WU 3	Water efficient appliances						7.1.7 (3)	Use water-efficience compliant products
	WU 4	Leak detection in tank rooms				Wat 03 a	Leak detection in mains pipes and in buildings		
						Wat 03 b	Zone control device for each WC area		
	WU 5	Twin-tank system							
	WU 6	Cooling tower water use	WE	CTPWU	Cooling tower or Process water use reduction	Wat 04 b	Cooling towers, etc.		
	WU 7	Flushing water use reduction							
	WU 8	Water recycling / rainwater harvesting						7.2.13	Non-traditional water for various purposes
HSW	**HEALTH, SAFETY AND WELLBEING**								
	HWB P1	Meet ASHRAE Standard 62	EQ	MIAQ	Meet ASHRAE Standard 62				
	IDCM 9	Construction IAQ management	EQ	CIAQM	Construction IAQ management	Hea 02 p	Implement an overall IAQ Plan		
	HWB 1	Active living facilities						6.2.5	Active living facilities
	HWB 2	Biophilic design (visual quality study)							
			EQ	QV	View to outside and flor, fauna or sky	Hea 01 c	Provide an adequate view to the outdoor		
			SS	OS	Create exterior open space w/landscape	Hea 07 b	External amenity area for bldg users		
	HWB 3a	Barrier-free access						6.1.1	Barrier-free access routing
								6.2.2	All-age design for public spaces + Lift for stretcher
								8.1.5	Install suitable signage within buildings

BEAM Plus NB v2.0 - 2019		LEED v4.1 (BD+C) - 2020			BREEAM UK NC - 2018		China Three Star - 2019	
HSW	HWB 3b	Weather protection & family-friendly facilities						
	HWB 4a	Enhanced ventilation (incl. MV & NV spaces)	EQ	EIAQS	Entryway, contam prevent, filtration;	Hea 02 a	Ventilation rate, pathways, filtration & sensors	5.2.10	Good natural ventilation design
					increased rate, CO2 monitoring, source control, etc				
			EQ	LEM	Low-emitting materials	Hea 02 b	Emissions from building products	5.2.2	Emissions from building products
	HWB 4b	Local exhaust for concentrated sources						5.1.2	Avoid spread of concentrated pollutants to other rms
	HWB 5	Odour sensors at refuse rooms							
	HWB 6a	Reverberation time	EQ	AP		Hea 05 c	Room acoustics	5.2.6	Enhance indoor acoustic environment
	HWB 6b	Noise isolation between spaces	EQ	AP		Hea 05 a	Sound insulation	5.2.7	Noise isolation incl impact noise meets GB standard
	HWB 6c	Reduce noise intrusion from outside	EQ	AP		Hea 05 b	Indoor ambient noise levels	5.1.4	Noise isolation meets GB standard
	HWB 7	Indoor vibration control							
	HWB 8	IAQ certification / compliance, incl carparks	EQ	IAQA	IAQ assessment	Hea 02 c	Post-construction IAQ measurement	5.1.1	Indoor air quality meets GB standard
								5.2.1	IAQ parameters meet a supreme level
								5.1.9	CO sensor control provided for basement carparks
								5.1.7	No condensation on inside of building envelope
			EQ	ETSC	Compartmentalization of smoking areas			8.2.4	Outdoor smoking area meets design requirements
	HWB 9	Thermal comfort analysis/measurement	EQ	TC	Meet ASHRAE 55	Hea 04 a	Thermal comfort modelling	5.1.6	Indoor thermal environment meets GB standard
								5.2.9	Indoor thermal environment meets enhanced standard
			EQ	TC	Provide individual controls	Hea 04 c	Thermal zoning and controls	5.1.8	Individual controls for individual rooms
								5.2.11	Adjustable solar shading for thermal comfort
	HWB 10	Quality of artificial lighting	EQ	IL	Lighting quality meets standard	Hea 01 d	Lighting levels, zoning and control	5.1.5	Artificial lighting meets GB standards
				IL	Provide individual controls				
	HWB 11	Daylight availability	EQ	DL	Spatial daylight autonomy	Hea 01 b	Daylight availability	5.2.8 (1,2)	Daylight availability
								8.1.1	Masterplans satisfy daylight standards (e.g. edu, healthcare)
			EQ	DL	Provide glare control devices	Hea 01 a	Control of glare from sunlight	5.2.8 (3)	Control of glare from sunlight
	HWB 12	Prevent Legionnaires' Disease (water & HVAC sys)							
								5.2.3	Hot water, HVAC and landscape water meets quality stds
								5.1.3	Assure water quality and avoid foul air from drainage
								5.2.4	Water tanks meet relevant standard
								5.2.5	Piping and other items have clear labels
	Security					Hea 06	Security of the site & the building		
	Safety							4.1.1	Safe from landslide, floods, chemical, explosion & EMR risks
								4.1.2	Safety of structure and building envelope
								4.1.4	Indoor fixtures are secure, adaptable to structural movements
								4.1.5	Doors and windows secure and able to resist wind & rain
								4.1.7	Means of escape & firemen access
								4.1.8	Adequate safety notices to users
								4.2.1	Anti-earthquake design
								4.2.2	Fall of persons / Fall of objects prevention
								4.2.3	Safety glass, anti-trapping of fingers
								4.2.4	Anti-slip flooring and ramps

	BEAM Plus NB v2.0 - 2019			LEED v4.1 (BD+C) - 2020				BREEAM UK NC - 2018			China Three Star - 2019	
CC	**CLIMATE CHANGE**											
	SS 11	Flood prevention, e.g. detention tanks						Pol 03 b	Sustainable Drainage System (SuDS) is in place		8.1.4	Design to encourage penetration, retention and re-use of rainwater.
								Pol 03 a	Flood risk assessment + measure (e.g. raise the ground)		8.2.2	Plan & control rainwater flow on the ground and at roofs
				SS	RM	Green infrastructure (GI) & low impact development (LID) practices					8.2.5	Raingarden & pervious paving etc. are utilised to collect rain
	SS 12	Study temperature, rainfall & water level rises						Hea 04 b	Design for future thermal comfort			
								Wst 05	Resilience of structure, fabric, BS and renewable sys			
SMT	**SMART**											
	IDCM 13	Digital FM interface (hourly data)									6.1.5	Automatic monitoring and control of BS equipment
											6.1.6	Establish signal/data network within the development
											6.2.6	Energy data analysis and management system
											6.2.7	IAQ monitoring and display system
											6.2.8	Water flow and quality monitoring system
											6.2.9	Smart home / premises servicing system
	IDCM 14	Occupant engagement platform (e.g. digital display)									6.2.13 b2	Provide experience & sharing platform for occupants
PCV	**POST COMPLETION VALIDATION**											
								Man 05 a	Aftercare support for at least 12 months after occupation			
								Man 05 b	Continuous commissioning over a minimum 12-month period		6.2.12	O&M perf. review, regular inspect, commission, diagnosis, check water quality...
								Man 05 c	Post-occupancy evaluation (POE) at one year after occupation		6.2.13 c	Conduct user survey once every year & continually improve
											6.2.13 a	Conduct green education & safety drills twice every year
								Ene 01 d	Achieve energy monitoring reqmts in post-occupancy stage (exemplary)		6.2.10	Save resource & greenery..ops & em.procedures+Resource-saving motivation
								Wat 02 b	Water monitor enables the iden. of all water consumption for sanitary uses		6.2.11	Actual water use meets GB standard
								LE 05 a	Mgt & maintenance of landscape throughout the project		9.2.4	Measured Leaf Area Index (LAI) exceeds requirement
											9.2.7 b	Analyze carbon emissions during the 1st year of operation
INN	**INNOVATION**											
	IA 1	Innovative designs / multiple aspect achievements		IN	IN	Innovations / pilot credits / exemplary performance, e.g.:		Inn 01	Innovative; or Exemplary performance, e.g.:		9.1	Innovations
						- exemplary performance credit for 100% GHG reduction		Ene 01 c	Beyond zero-carbon / Carbon-negative		9.2.1	Extra reduction of energy
								Wat 01 b	Bigger than 65% improvement over water use baseline		9.2.2	Preserve regional culture
								Mat 01 b	LCA for BS design options, LCA and LCC alignment, 3rd party verification		9.2.9	Inherent Defects Insurances (e.g. 10 years)
								Mat 03 c	BS products meet Responsible Sourcing Cert Scheme			

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