

Green Mark 2021



Intelligence

The Intelligence section looks at the adoption of relevant smart technologies and systems within the building design, construction, retrofit and operation that enable a fully integrated, automated, intelligent, responsive and aware building to delight its users.

The GM 2021 Intelligence section (In) has been created looking at the core principles of a smart building, looking at integration of systems, processes and technology, the collection of relevant data and the analytics of this with a view to direct response to improve aspects of the building performance from energy optimisation, health and wellbeing to spatial optimisation and user experience.

We are exploring recognition of robust smart building certification systems, and similar to the Resilience and Health and Wellbeing Section allowing them to be used in lieu of the criteria listed below.



Helps projects meet targets under the following SDGs



INTELLIGENCE			
IN1 Integrated		Green Mark Points	
IN1.1 Digita	al Life Cycle	New	Existing
Use integr Information geometry (I information construction	ated delivery platforms to develop <u>Project</u> <u>Model (PIM)</u> with adequate levels of definition of evels of detail) and facility information (levels of) to facilitate integrated and digitalized design, n, operational and retrofit process.		
PIM shall purposes statutory documenta into Asset I	be sufficiently developed and detailed for of co-ordination, environmental simulations, submissions, tender and construction tion as well as forming the basis for conversion nformation Models (AIM).		
(i)	PIM developed in accordance with Singapore CDE Data Standard that align with the Principles of ISO 19650-2018	(i) 2 Points	(i) 2 Points
(ii)	Use of spatial model co-ordination platform basing on PIM for spatial analysis including identifying:	(ii) 2 Points (1 point each for a	
	a. System clashes through an automatic model checking tool	and b)	
	b. Spatial analysis for effective construction, maintenance and future alteration or replacement.		(iii) 1 Point (for re-
(iii)	Digital building commissioning, performance and defect co-ordination platform basing on PIM to track, co-ordinate and manage the commissioning of systems and the tracking of defects and their rectification	(iii) 1 Point	commissioning or retro- commissioning)
References:			
ISO 19650– buildings and modelling (information r ISO 19650-2 buildings and modelling (information r CDE Data S building proj and collabor Data Enviror	 Organization and digitization of information about divid engineering works, including building information BIM) - Information management using building nodelling - Part 1: Concepts and principles Organization and digitization of information about divid engineering works, including building information BIM) - Information management using building nodelling - Part 2: Delivery phase of the assets <u>Standard</u> defines what information is required for a ect and how it can be structured to facilitate sharing ation among project team members using a Common iment 		

IN1.2 Common Data Environment		
Use of a common data environment (CDE), which is a single source of information used to collect, manage, and disseminate information facilitating collaboration between project team members and helps avoid duplication and mistakes.		
 Performance Dashboard to monitor the different aspect of building assets' performance and operations from a single dashboard built on top of the CDE. 	(i) 1 Point	(i) 2 Point
 Data Management and Integration with a platform that connects and manages asset and facility data, operational data, and real-time equipment data extracted from different subsystems based on an <u>open protocol</u> (e.g. OPC, BACNET, MODBUS, DLMS, published REST/SOAP APIs and etc.) 	(ii) 1 Point	(ii) 2 Point
(iii) <u>Data Accessibility and Security</u> - information stored in the CDE platform can be accessed by facilities teams in a secured manner to facilitate operation and maintenance activities from anywhere and anytime.	(iii) 0.5 Point	(iii) 1 Point
Note: The Common Energy Dashboard (CED) data requirements mentioned in section IN 1.3 set the requirements for building energy efficiency aspect under CDE. The copy of CED data requirements can be downloaded at <u>this link</u> .		
IN1.3 Voluntary Disclosure of Building Energy Performance Data		
Sharing of non-sensitive information and data related to building energy performance to the Super Low Energy Building (SLEB) Smart Hub ¹ on a voluntary basis, to enable dynamic energy performance benchmarking and Green Mark energy data reporting in a smart and automatic way.	<u>Non-Residential</u>	<u>Non-Residential</u>
 Share basic information – follow Common Energy Dashboard data requirements to share basic information and data. 	(i) 0.5 Points	(i) 0.5 Points
 Share additional information – follow Common Energy Dashboard data requirements to share additional information and data. 	(ii) 1 Point	(ii) 1 Point
Note: The copy of Common Energy Dashboard data requirements could be downloaded at <u>this link</u> .		
IN1 Integrated	Cap at 5	5 Points

¹ Super Low Energy Building Smart Hub (<u>www.sleb.sg</u>) is Singapore's first digital knowledge centre for green buildings in the region, feature-filled with smart analytic tools, datasets, a directory and also the largest green building database in Singapore.

INTELLIGENCE			
IN2 Data Driven		Green Mark Points	
IN2.1 Asse	et Information Model	New	Existing
Use integra date <u>Asset</u> tagging, co managed v single sour	ated platforms to develop an operational up-to- <u>Information Models</u> (AIM) for purposes of asset p-ordination, and maintenance. The AIM is to be vithin a Common Data Environment (CDE) as the rce of asset information.	<u>Non-Residential/</u> <u>Residential</u>	<u>Non-Residential/</u> <u>Residential</u>
(i)	Development and handover of an accurate spatial model of the building or asset which complete and fully up to date inclusive of renovations that would impact building services or layout alterations.	(i) 1 Point	(i) 1 Point
(ii)	Physical and virtual asset information tagging system aligned with common data environment that allows for tracking of maintenance work, repairs, refurbishments or upgrades, replacement, decommissioning, risk assessments, and performance evaluations of the physical asset to be captured.	(ii) 1 Point	(ii) 2 Points
(iii)	Adoption of a common international standard for asset ontology. For example, Brick Schema or Project Haystack.	(iii) 1 Point	(iii) 1 Point
	Note: Asset Ontology helps to standardise semantic descriptions of the physical, logical and virtual assets in buildings and the relationships between them. Please refer to the Bricks Schema for Common Energy Dashboard for building energy efficiency aspect, which can be downloaded at <u>this link</u> .		
References: <u>ISO 19650-3:2020</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 3: Operational phase of the assets			
PAS 1192-3 specifying h created and through the capital work building and	3 (withdrawn) – however provides a good guide on how an Asset Information Model (AIM) should be d how that model should be used and maintained life of the asset up to final disposal. It applies to direct ks, existing assets and acquired assets and to both l infrastructure assets.		
Asset inform	nation model AIM - Designing Buildings Wiki		

IN2.2 Digit	al Twins		
Development of a digital twin of the project that represents the full asset virtually and includes geometric data, asset attributes, management data, asset performance and utilisation data.			
(i)	Asset Digital Twin – the digital twin of the building assets to assist the facility management team to deliver efficient daily operation and maintenance, and to better plan and organize alteration of internal spaces and functions.	(i) up to 2 Points	(i) up to 2 Points
(ii)	System Digital Twin – detailed model based on operational data of individual systems to deep dive into its <u>performance</u> , conduct virtual stress tests and detailed analytics.	(ii) up to 3 Points	(ii) up to 3 Points
(iii)	Process Digital Twin – To model processes and scenarios to find the optimum solution based on actual and simulated data.	(iii) up to 1 Point	(iii) up to 1 Point
	For example: modelling users' movements and journey in a building, looking at production processes in factories and labs.		
References: Smart Cities Twin	Council – Data Leadership Guidance Note – Digital		
IN2 Data Driven		Cap at 5	5 Points

INTELLIGENCE			
IN3 Responsive		Green Mark Points	
IN3.1 Real Time Performance		New	Existing
Real time	asset monitoring and optimisation	<u>Non-Residential</u>	<u>Non-Residential</u>
(i)	Energy - Breakdown of energy consumption by system, such as air conditioning, lighting, ventilation, transportation, receptacle loads.	(i) 1 Point	(i) 1 Point
	Efficiency metrics tracking and analytics for real time optimisation.		
(ii)	Health & Comfort – Provision of permanent calibrated air quality monitoring system with zonal controls	(ii) 1 Point	(ii) 1 Point
(iii)	Space – Space utilisation and optimisation to adapt the building to cater for the occupancy, and to optimise the building services and spaces to adapt.	(iii) 1 Point	(iii) 1 Point
IN3.2 Us	er Experience		
Proactive and mana improve p	collection and use of data to understand, track age the user experience within the building to performance including:		
• L	lse patterns.		
• C ir	comfort (thermal, visual, aural and olfactory, ncluding locational information)		
• 5	ervice requests and time for resolutions		
For the fo	Ilowing groups:		
(i)	Building Occupants	(i) 1 Point	(i) 1 Point
(ii)	Visitors	(ii) 0.5 Point	(ii) 0.5 Point

IN3.3 Data Ethics		
The set of key principles and processes that guide the ethical collection, processing, analysis, and application of data. The project team shall consider the risks such technologies present to the environment, society, and governance. Understanding data bias, privacy protection and the right to be forgotten.		
 A data ethics plan shall be detailed for the building that identifies the various opportunities for the collection, analysis and use of data as well as a risk register that looks at the following risks and how they will be managed and mitigated. a) <u>Personal Privacy</u> b) <u>Risks including data governance, monetarisation of data and data permissions</u> c) Workforce transitioning d) Transparency e) Data bias and data quality 	Up to 2 points (1 point for addressing item a and b, and 1 point for item c, d and e)	Up to 2 points (1 point for addressing item a and b, and 1 point for item c, d and e)
References:		
Crossing the Threshold, A primer for sustainable digitalisation in real estate and cities.		
Global trends in Data Capture and Management in Real Estate and Construction (RICS)		
The use and value of commercial property data.		
Artificial Intelligence: What it means for the built environment		
IN3 Responsive	Cap at 5	5 Points

IN - INNOVATION		
	Green Mark Points	
	New	Existing
Where projects can demonstrate substantial performance to a specific Intelligence indicator or outcome innovation points can be awarded on a case by case basis. Points shall be awarded based on the strength of evidence of benefits and potential impact.	Up to 2 Points	Up to 2 points
Process:		
 At Design / Pre-retrofit stage The project team is to submit a concise summary that articulates: The nature of the environmental benefit of their intervention Justify the impact of the intervention through detailed calculations and comparisons with industry norms Substantiate the calculations and comparisons with evidence and data. At Verification (As Built/ In Operation): Details of the implemented intervention including measurements and monitoring of the environmental performance including lessons learnt if the intervention does not perform as expected		
Example:		
 Encourage the Use of Singapore Green Building Council certified smart building products or product with equivalent certification that allows integration with the Common Data Environment (CDE). 		
IN3 Innovation	2 Point	ts total



Developed by:



With inputs from IDD IFM Workgroup Members