Green Mark 2021

In
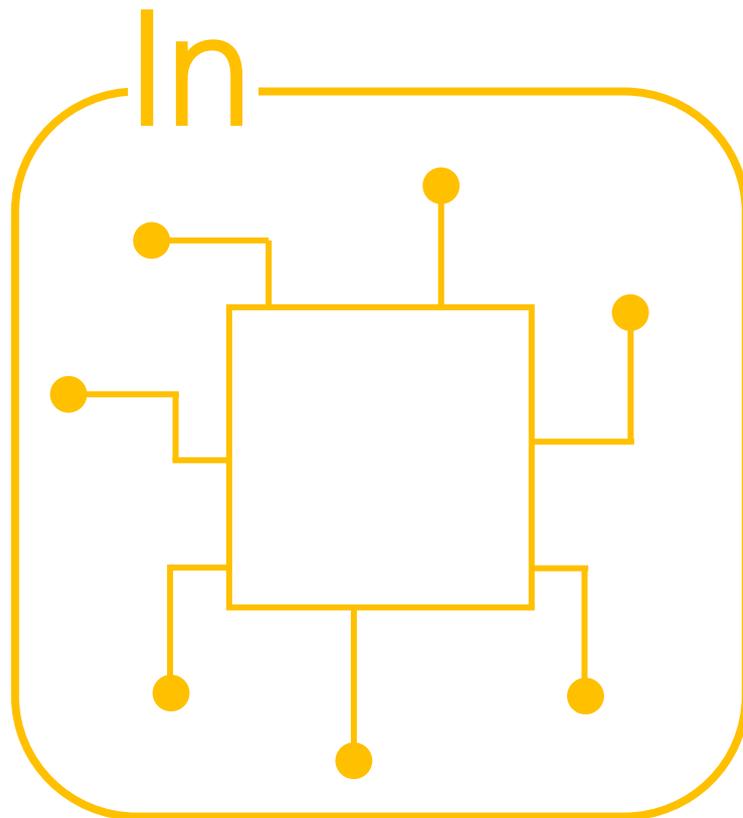
Intelligence

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 Digital Life Cycle	**New**	**Existing**

Use integrated delivery platforms to develop <u>Project Information Model (PIM)</u> with adequate levels of definition of geometry (levels of detail) and facility information (levels of information) to facilitate integrated and digitalized design, construction, operational and retrofit process.

PIM shall be sufficiently developed and detailed for purposes of co-ordination, environmental simulations, statutory submissions, tender and construction documentation as well as forming the basis for conversion into Asset Information 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: a. System clashes through an automatic model checking tool b. Spatial analysis for effective construction, maintenance and future alteration or replacement.	(ii) 2 Points (1 point each for a and b)	
(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	(iii) 1 Point (for re-commissioning or retro-commissioning)

References:

<u>ISO 19650–1</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and principles
<u>ISO 19650-2</u> Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 2: Delivery phase of the assets
<u>CDE Data Standard</u> defines what information is required for a building project and how it can be structured to facilitate sharing and collaboration among project team members using a Common Data Environment

IN1.2 Common Data Environment for Operations and Maintenance		
Use of a common data environment for operations and maintenance (CDE O&M), which is a single source of information used to collect, manage, and disseminate information facilitating collaboration between FM team members and helps avoid duplication and mistakes. ==**Prerequisite**== Non-residential projects (New and Existing) that submit Green Mark application after 31 May 2023, <u>must</u> score minimum 1 item from IN1.2 to attain the Intelligence Badge. (i) <u>Performance Dashboard</u> 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
(ii) 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 sub-systems 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. *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* [this link](#)*.*	(iii) 0.5 Point	(iii) 1 Point
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.	*Non-Residential*	*Non-Residential*
(i) Share basic information – follow Common Energy Dashboard data requirements to share basic information and data.	(i) 0.5 Points	(i) 0.5 Points
(ii) Share additional information – follow Common Energy Dashboard data requirements to share additional information and data. *Note: The copy of Common Energy Dashboard data requirements could be downloaded at* [this link](#)*.*	(ii) 1 Point	(ii) 1 Point
IN1 Integrated	Cap at 5 Points	

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[1] Super Low Energy Building Smart Hub (www.sleb.sg) 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.
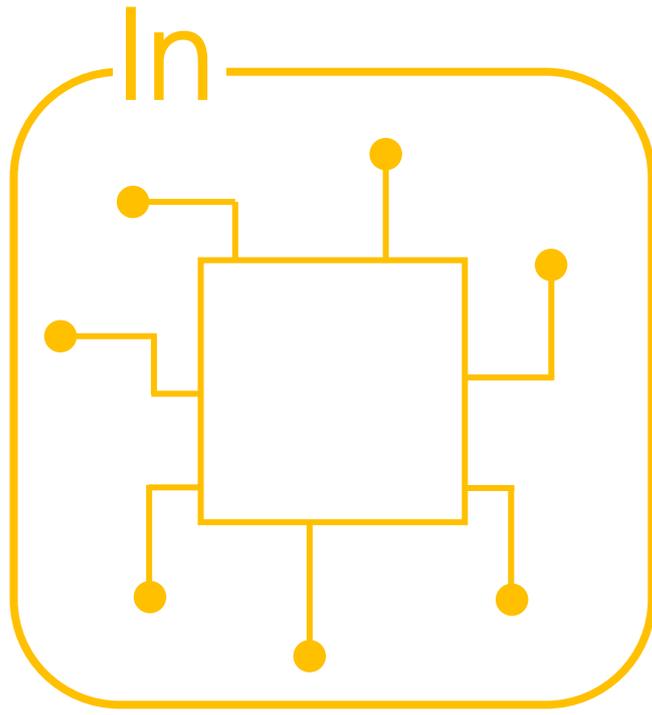
INTELLIGENCE		
IN2 Data Driven	**Green Mark Points**	
IN2.1 Asset Information Model	**New**	**Existing**
Use integrated platforms to develop an operational up-to-date <u>Asset Information Models</u> (AIM) for purposes of asset tagging, co-ordination, and maintenance. The AIM is to be managed within a Common Data Environment (CDE) as the single source of asset information.	*<u>Non-Residential/ Residential</u>*	*<u>Non-Residential/ 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.		
(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.	(i) 1 Point (ii) 1 Point	(i) 1 Point (ii) 2 Points
(iii) Adoption of a common international standard for asset ontology. For example, Brick Schema or Project Haystack. *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>.*	(iii) 1 Point	(iii) 1 Point
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 (withdrawn) – however provides a good guide on specifying how an Asset Information Model (AIM) should be created and how that model should be used and maintained through the life of the asset up to final disposal. It applies to direct capital works, existing assets and acquired assets and to both building and infrastructure assets. <u>Asset information model AIM - Designing Buildings Wiki</u>		

IN2.2 Digital 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. For example: modelling users' movements and journey in a building, looking at production processes in factories and labs.	(iii) up to 1 Point	(iii) up to 1 Point
References: Smart Cities Council – Data Leadership Guidance Note – Digital Twin		
IN2 Data Driven	Cap at 5 Points	

INTELLIGENCE		
IN3 Responsive	**Green Mark Points**	
IN3.1 Real Time Performance	**New**	**Existing**
Real time asset monitoring and optimisation (i) Energy - Breakdown of energy consumption by system, such as air conditioning, lighting, ventilation, transportation, receptacle loads. Efficiency metrics tracking and analytics for real time optimisation. (ii) Health & Comfort – Provision of permanent calibrated air quality monitoring system with zonal controls (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.	*Non-Residential* (i) 1 Point (ii) 1 Point (iii) 1 Point	*Non-Residential* (i) 1 Point (ii) 1 Point (iii) 1 Point
IN3.2 User Experience		
Proactive collection and use of data to understand, track and manage the user experience within the building to improve performance including: • Use patterns. • Comfort (thermal, visual, aural and olfactory, including locational information) • Service requests and time for resolutions For the following groups: (i) Building Occupants (ii) Visitors	(i) 1 Point (ii) 0.5 Point	(i) 1 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) Personal Privacy
   b) Risks including data governance, monetarisation of data and data permissions
   c) Workforce transitioning
   d) Transparency
   e) Data bias and data quality
 	
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
	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)

IN3 Responsive	Cap at 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. 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).*	Up to 2 Points	Up to 2 points
IN3 Innovation	2 Points total	

Developed by:

With inputs from IDD IFM Workgroup Members