



Green Mark 2021

# Maintainability Framework

For New Residential Buildings (RB)



#### **Maintainability (New Residential Building) Revision Log**

<b>S/N</b>	<b>Brief description of changes</b>	<b>Effective date</b>
01	First issue (Version 1.0)	01 Nov 2021
02	Second issue with minor updates (Version 1.1)	01 Nov 2021

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CRITERIA		Points Allocation	
<b>Section 0 – GENERAL</b>			
0.1	General Project Requirement	3	
	<i>Sub-total score for Section 0</i>	3	
<b>Section 1 – ARCHITECTURAL EXTERIOR</b>			
1.1	General Façade	Part A	0.5
	<i>Part A: Subtotal of 1.1</i>		0.5
1.2	Cladding system: Tile / Stone / Metal / Others	Part B: Façade System	4
1.3	Curtain Wall: Glazing / Others		4
1.4	Masonry, Lightweight Concrete Panels, and Precast Components		4
	<i>Part B: Subtotal of 1.2 to 1.4)</i>		4 (Max)
1.5	Façade Features / other façade considerations	Part C: Façade Ancillaries	3
1.6	Entrance lift lobby / integrated drop-off points at blocks		2
1.7	Exposed corridors, , lift lobbies, and Link Bridges		2
1.8	Roof		-
	<i>Part C: Subtotal of 1.5 to 1.8</i>		7
	<i>Sub-total score for Section 1 (Part A + Part B+ Part C)</i>		11.5
<b>Section 2 – ARCHITECTURAL INTERIOR</b>			
2.1	Floors		2.5
2.2	Walls and Partitions		1
2.3	Ceilings		4
2.4	Common toilets		7
2.5	Basement		4
	<i>Sub-total score for Section 2</i>		18.5
<b>Section 3- MECHANICAL</b>			
3.1	Air Conditioning System-Direct Expansion System (DX Units)		2
3.2	Air Conditioning System - Variable Refrigerant Flow (VRF) System		-
3.3	Air Distribution System		1

3.4	Domestic Water Supply	-
3.5	Sanitary System	3
3.6	Fire Protection System	1
3.7	Swimming Pool System	3
	<i>Sub-total score for Section 3</i>	10
<b>Section 4 - ELECTRICAL</b>		
4.1	Lighting System	1.5
4.2	Power Distribution System	3
4.3	Extra Low Voltage (ELV) System	3
4.4	Lightning Protection System	1
4.5	Vertical Transportation System	2
4.6	Carpark Entry System	-
	<i>Sub-total score for Section 4</i>	10.5
<b>Section 5 - LANDSCAPE</b>		
5.1	Softscape	1
5.2	Hardscape	3.5
5.3	Vertical Greenery	-
5.4	Roof and Sky Terraces	1
5.5	Water Retaining Structure	3
5.6	Standalone Structures	2
	<i>Sub-total score for Section 5</i>	10.5
<b>Section 6 - FACILITIES</b>		
6.1	Outdoor games court	2
	<i>Sub-total score for Section 6</i>	2
<b>Section 7 – SMART FM</b>		
7.1	Innovation features in labour-saving/maintenance-free	5
	<i>Sub-total score for Section 7</i>	5
<b>Overall Maintainability Points</b>		<b>71</b>

## ASSESSMENT APPROACH

### Category 1 (Cat 1)

**Assessment:** Full points for solutions only with 100% applicability in area of application or number of instances.

### Category 2 (Cat 2)

**Assessment:**

- a. Apportioned points for solutions with 15% to 85% coverage (partial or apportioning) in area of application or number of instances.
- b. Full points for solutions with >85% coverage in area of application or number of instances.
- c. No points for solutions with <15% coverage in area of application or number of instances.

**o GENERAL**

Design Factor	General Requirements		
Access + Material + Detailing	Promote inclusion of Design for Maintainability (DfM) at planning and design stage (3 points)	Points Available	Points scored
	<ul style="list-style-type: none"> <li>a. Promote Integrated design approach and stakeholder engagement at planning and key design stages.</li> <li>i) Conduct at least 3 design charrettes during the concept/ detail design stage involving minimally 3 stakeholders from the following groups:                             <ul style="list-style-type: none"> <li>o Building owner/ representative</li> <li>o Facilities manager (FM)/operator</li> <li>o Design consultants (minimally one representative each from the various disciplines - architecture, mechanical and electrical, landscape, quantity surveyor, etc.)</li> <li>o Other specialist consultant (i.e. Environmentally sustainable design, lighting specialist, material specialists, façade access consultants, etc.)</li> </ul> </li> </ul>	Prerequisite	
	<ul style="list-style-type: none"> <li>ii) Design for maintainability report, as part of the O&amp;M manual, outlining the key maintainability considerations and provisions.</li> </ul>	1 (Cat 1)	
	<ul style="list-style-type: none"> <li>b. Use of Life Cycle Cost (LCC) approach to identify solutions with better economic and maintainability benefit throughout the building life span.</li> <li>i) Undertake project-specific LCC analysis on adopted LCC-related Solutions listed in this appraisal system for                             <ul style="list-style-type: none"> <li>o At least 5 solutions (1 point)</li> <li>o More than 10 solutions (2 points)</li> </ul> </li> </ul>	2 (Cat 1)	

## 1 ARCHITECTURAL EXTERIOR

Design Factor	1.1	General Façade (0.5 points)		
Detailing	1.1.1	Reduce risk of water ingress and streaking on façade (0.5 points)	Points Available	Points scored
	a.	Design for drip edges/grooves to mitigate streaking on exterior soffits and vertical façade surfaces e.g. leading edge of flashing, sills, overhangs or other horizontal projecting façade elements.	Prerequisite	
	b.	Design all top surface of walls to slope away from the external face of façade.	0.5 (Cat 1)	
Detailing + Access	1.1.2	Access for maintenance of façade (prerequisite)	Points Available	Points scored
	a.	Ensure entire façade is accessible for maintenance.	Prerequisite	
Access	1.1.3	Access for maintenance of façade and roof of sky bridges (prerequisite)	Points Available	Points scored
	a.	Ensure the roof and façade of skybridge are accessible for maintenance.	Prerequisite	
<p>Part B: Façade Systems - Section 1.2 to 1.4  <i>(For singular façade system, points can be scored for 1.2, 1.3 or 1.4. In case project comprises multiple façade systems, points will be apportioned on an area basis)</i></p>				
Design Factor	1.2	Cladding – Tile / Stone / Metal / Others (4 points)		
Detailing + Material	1.2.1	Reduce risk of water ingress and streaking on façade (Up to 4 points)	Points Available	Points scored
	a.	For streaking: Specify metals of similar properties or separators between different metal components on the exposed face of the façade to mitigate risk of bi-metallic corrosion.	Prerequisite	
LCC	b.	For water ingress – design for pressure-equalised (rain-screen) system, comprising:		
	i)	Ventilation openings of adequate dimensions to ensure pressure-equalisation of the cladding cavity		
	ii)	Drainage system to positively drain out water		
	iii)	Air cavity with a fully sealed internal backing wall behind the cladding	2.5 (Cat 1)	

LCC	c.	For water ingress – In face-sealed cladding: specify silicone or modified silicone sealant that is compatible and with adequate adhesion properties to the substrate.	1 (Cat 1)	
LCC	d.	For streaking – specify sealant type that has non-stain, non-bleed properties.	0.5 (Cat 1)	
	e.	For water ingress – specify gasket type EPDM or TPE.	1 (Cat 1)	
	f.	For water ingress - design for double layer protection at façade interface, coping etc.	0.5 (Cat 2)	
		<b>Advanced effort:</b> For water ingress – Specify anti-carbonation coating or waterproofing layer onto the backing wall behind the cladding	1(Bonus) (Cat 1)	
Design Factor	1.3	Curtain Wall (4 points)		
Detailing + Material	1.3.1	Reduce risk of water ingress and streaking on façade (Up to 4 points)	Points Available	Points scored
	a.	For streaking: Specify metals of similar properties or separators between different metal components on the external face of facade to mitigate risk of bi-metallic corrosion.	Prerequisite	
LCC	b.	For water ingress – design for pressure-equalised system comprising: i) Ventilation openings of adequate dimensions to ensure pressure equalisation of the cavities ii) Drainage system to positively drain out water iii) Internal air-seal layer to pressurise internal cavities and minimise risk of water penetration	2 (Cat 1)	
LCC	c.	For water ingress - specify silicone sealant that is compatible and with adequate adhesion properties to the substrate	1 (Cat 1)	
LCC	d.	For streaking – specify sealant type that has non-stain, non-bleed properties.	0.5 (Cat 1)	
	e.	For water ingress – specify gasket type EPDM or TPE.	1 (Cat 1)	
	f.	For water ingress – design for double layer protection at façade interface, coping etc.	0.5 (Cat 2)	



Design factor	1.4 Masonry, Lightweight Concrete Panels, and precast elements (4 points)			
Detailing	1.4.1	Reduce risk of water ingress and efflorescence formation (2 points)	Points Available	Points scored
		a. For efflorescence: specify mortar materials to be salt free.	Prerequisite	
		b. For water ingress: design movement joints in large continuous areas, or between different building components, to minimise the risk of damage to façade, weather seal, and waterproofing joints.	Prerequisite	
		c. For water ingress in pre-cast component joints: specify silicone or modified silicone sealant on weather-exposed joints, that is compatible and with adequate adhesion properties to the substrate.	1 (Cat 1)	
LCC		d. For efflorescence: Specify clear coat, with good resistance to water absorption, on façade surface. e.g. fair-faced or pigmented concrete. <i>(OR)</i> Specify paint with good resistance to water absorption, complying with SS500 or equivalent.	1 (Cat 1)	
Material	1.4.2	Reduce risk of façade flaking/peeling/cracking/blistering (Up to 2 points)	Points Available	Points scored
		a. Specify for integral colours (i.e. directly mixed into the cement) or post-applied stains (impregnator) with inorganic pigments for surfaces which do not require painting.	2 (Cat 2)	
LCC		b. Specify paint finish: Top coat: Paint with good resistance to water absorption complying with SS500 or equivalent. <i>(OR)</i> Mineral paint	1 (Cat 2)	
Part C: Section 1.5 to 1.8				
Design Factor	1.5 Façade Features / other façade considerations (3 points)			
Access	1.5.1	Direct access to all protruding façade features, e.g. canopies, sunshades, niches, fins, ledges, BIPV, façade screens etc (prerequisite)	Points Available	Points scored
		a. Ensure every part of all façade features is accessible for maintenance.	Prerequisite	

	b.	Ensure all glass features and their structure (e.g. glazed canopies) are able to withstand the maintenance-related loads.	Prerequisite	
Detailing	1.5.2	Reduce risk of corrosion of exposed steel structures (1 point)	Points	Points scored
	a.	Design to avoid direct contact of a steel base with the ground (raised by at least 100mm) to mitigate corrosion and entrapment of moisture and dirt.	1 (Cat 2)	
Detailing	1.5.3	Reduce risk of water ingress in open joint cladding ( <i>i.e. cladding serving as a decorative feature and not as a water barrier</i> ) (1 point)	Points Available	Points scored
	a.	For features such as open-joint cladding: provide flashings at regular intervals (not exceeding 3 floors) to positively drain out the cladding cavities and prevent the accumulation of water.	1 (Cat 1)	
Detailing	1.5.4	Reduce risk of tile/stone from detaching off façade (1 point)	Points Available	Points scored
	a.	Design for mechanically-fixed individual tile/stone panels with stainless steel fixings.	1 (Cat 1)	
Design Factor	1.6	Entrance Lift Lobby/integrated drop-off point at blocks (2 points)		
Detailing	1.6.1	Reduce risk of water ingress at entrances (2 points)	Points Available	Points scored
	a.	Design for raised internal level of at least 100mm from the external datum.	Prerequisite	
LCC	b.	Design canopy/overhang (minimally 1:50 slope) to shelter against wind-driven rain with canopy angled at least 45° to the entrance line or with drop panel if canopy/overhang does not shelter to entrance line.	2 (Cat 2)	
		<b>Advanced efforts:</b> Numerical simulation (wind-driven rain penetration) studies specific to location and context of surroundings for corridors/entrances.	1 (Bonus)	
Design Factor	1.7	Exposed Corridors, Lift Lobbies and Link Bridges (2 points)		
Detailing	1.7.1	Reduce water ponding in the exposed corridors, lift lobbies and link bridges caused by wind driven rain (1.5 points)	Points Available	Points scored
LCC	a.	Design for corridor slope to nearest drain outlet to be not gentler than 1:80.	Prerequisite	
	b.	Design for vertical rain protection louvres along the corridor and link bridges	1.5 (Cat 1)	

		<b>Advanced efforts:</b> Simulation studies specific to location, context of surroundings for corridors/entrances	1 (bonus)	
Detailing	1.7.2	Reduce risk of water ingress into lift shaft (0.5 point)	Points Available	Points scored
	a.	Design for floor to slope up at threshold of lift door openings.	0.5	
Design Factor	1.8	Roof (Prerequisite)		
Detailing	1.8.1	Reduce risk of water ponding on roofs (Prerequisite)	Points Available	Points scored
	a.	For concrete flat roofs - Design slope not gentler than 1:150 with scupper drains/gutter.	Prerequisite	
	b.	For metal sheet profiles – Design slope to manufacturer’s specifications (OR) Design slope for different sheet profiles based on the roof pitch table (refer to table in technical guide). (OR) Design slope for different sheet profiles determined by rainwater drainage capacity calculation.	Prerequisite	
Material + Detailing	1.8.2	Reduce risk of waterproofing failure/decay on concrete roofs. (Prerequisite)	Points Available	Points scored
	a.	Specify bitumen/polymer elastomer preformed waterproofing membrane (design for overlap and proper termination of waterproofing membrane). (OR) Specify water based/solvent based liquid applied waterproofing membrane.	Prerequisite	
Material + Detailing	1.8.3	Reduce risk of corrosion on metal roofs (Prerequisite)	Points Available	Points scored
	a.	Specify metal of similar properties or separators between different materials to mitigate risk of bi-metallic corrosion between roof and other metal components or accessories.	Prerequisite	

## 2 ARCHITECTURAL INTERIORS & COMMON AREAS

Design Factor	2.1 Floors (2.5 points)			
Material	2.1.1	Reduce risk of damage to floors in common areas within the building (1.5 points)	Points Available	Points scored
LCC	a.	Specify flooring materials with minimum Mohs hardness value of 7 at areas of high pedestrian traffic such as lobbies, corridors, and connecting walkways.	1.5 (Cat 2)	
Material	2.1.2	Reduce maintenance works in common areas within the building (1 point)	Points Available	Points scored
LCC	a.	Specify flooring material – e.g. homogenous tiles – with water absorption rate not exceeding 0.5 % to reduce settling of stains at areas of high pedestrian traffic such as lobbies, corridors, and connecting walkways.	1 (Cat 2)	
Design Factor	2.2 Walls and Partitions (1 point)			
Material	2.2.1	Reduce risk of stains on wall surfaces in common areas (up to 1 point)	Points Available	Points scored
LCC		Specify for finishing to be: <ul style="list-style-type: none"> <li>a. water-resistant wall materials, e.g. laminate, vinyl, and tile (1 point); or</li> <li>b. Stain-resistant paint or hydrophobic paint (0.5 point)</li> </ul>	1 / 0.5 (Cat 2)	
Design Factor	2.3 Ceilings (4 points)			
Access	2.3.1	Access to services within double slab areas for maintenance purposes (2 points)	Points Available	Points scored
	a.	Provide double slabs with minimum clear headroom of 1.8m.	Prerequisite	
	b.	Provide double slabs with minimum clear headroom of 2 m.	2 (Cat 2)	
Detailing	2.3.2	Access to services within the ceiling in common areas such as clubhouse, function rooms, common corridors and lobbies (up to 1 point)	Points Available	Points scored
	a.	Specify for open ceiling design.	1 (Cat 2)	

LCC	b.	Specify for suspended modular ceiling system that is easily demountable.	0.5 (Cat 2)	
Access	2.3.3	Access to ceiling for maintenance (prerequisite)	Points Available	Points scored
	a.	Provide access to all parts of the ceiling (including weather-exposed ceiling) for general maintenance.	Prerequisite	
Material	2.3.4	Reduce risk of warping /deterioration of ceiling panel system that are weather-exposed, at locations such as sky terraces, drop-off porches, corridors and lobbies. (up to 1 point)	Points Available	Points scored
LCC	a.	Specify suspended metal panel modular ceiling system, e.g. baffle metal panels and metal mesh panels.	1 (Cat 2)	
LCC	b.	Specify moisture-resistant suspended non-metallic modular ceiling panels with water absorption rate not exceeding 5 %.	1 (Cat 2)	
	c.	Specify for open ceiling design.	1 (Cat 2)	
<b>Design Factor</b>	<b>2.4</b>	<b>Common toilets (7 points)</b>		
Detailing + Material	2.4.1	Reduce risk of mould and fungus formation on walls in toilets (up to 1 point)	Points Available	Points scored
LCC		Specify wall finishes with a. tiles e.g. glazed ceramic tiles or homogenous tiles. (1 point) b. anti-mould top-coat (0.5 point)	1 / 0.5 (Cat 2)	
Detailing + Material	2.4.2	Reduce risk of damage to toilet cubicle partitions and enable ease of cleaning (1 point)	Points Available	Points scored
	a.	Specify water-resistant, partition panels with water absorption rate not exceeding 5 %, e.g. phenolic panels.	0.5 (Cat 1)	
	b.	Design for raised partition walls with minimum of 150 mm gap from the finished floor level.	0.5 (Cat 1)	
Detailing	2.4.3	Reduce risk of water spill on floor, and splashing and soap dripping on the counter and floor (3.5 points)	Points Available	Points scored
	a.	Water spill on floor – Design for full vanity washbasin with counter-top to slope away from the user.	1.5 (Cat 1)	

	b.	Water spill on floor – Design for soap and tissue dispenser within arm’s reach of each faucet. (Points can be scored only after scoring solution (a))	0.5 (Cat 1)	
	c.	Soap dripping on counter/floor – Design of soap dispenser location to be vertically mounted directly above basin or integrated bin.	1 (Cat 1)	
	d.	Water splash on counter/floor – Specify depth of basins to be minimally 175 mm to avoid excessive splashing.	0.5 (Cat 1)	
Detailing	2.4.4	Reduce the need to replace entire mirror glass pane when damaged (0.5 point)	Points Available	Points scored
	a.	Design for individual, modular mirror panes with standard sizes that are easy to replace.	0.5 (Cat 1)	
Material	2.4.5	Reduce degradation of false ceiling system in toilets (up to 1 point)	Points Available	Points scored
LCC	a.	Specify moisture-resistant suspended non-metallic modular ceiling panels with water absorption rate not exceeding 5 %.	1 (Cat 2)	
LCC	b.	Specify suspended metal panel modular ceiling system, e.g. baffle metal panels, aluminium trellis, and metal mesh.	1 (Cat 2)	
Design Factor	2.5	Basement (4 points)		
Detailing + Material	2.5.1	Reduce risk of water ingress/seepage in basement (up to 4 points)	Points Available	Points scored
LCC	a.	Specify for positive side waterproofing on the retaining wall, e.g. sheet-membrane systems, vapour barriers.	Prerequisite	
LCC	b.	Design for cavity wall with raised kerb of minimally 200mm and with water and mould-resistant wall layer on the inside, e.g. moisture-resistant calcium silicate board.	2 (Cat 1)	
	c.	Specify for positive side waterproofing for the base slab, e.g. sheet-membrane systems, vapour barriers.	1 (Cat 1)	
LCC	d.	Specify negative side waterproofing for walls	1 (Cat 1)	
	e.	Specify integral liquid water proofing admixture in the concrete.	1 (Cat 1)	

## 3

## MECHANICAL

Design Factor	3.1 Air-Conditioning System – Direct Expansion System (DX units) (2 points)			
Access	3.1.1	Access to AC ledge for Condenser Unit (CU) maintenance (prerequisite)	Points Available	Points scored
	a.	Provide operable windows/opening with minimum opening size of 900 mm (H) x 600 mm (W).	Prerequisite	
	b.	The bottom of the windows/opening for CU access should be located no higher than 1.1 meter from the finished floor level within the unit.	Prerequisite	
Access	3.1.2	Access space around the AC ledge for maintenance of condenser unit (1 point)	Points Available	Points scored
	a.	The safety barrier (such as railing) must be provided around the service ledge with minimum height of 1 meter.	Prerequisite	
	b.	Adequate working space must be provided for service and maintenance <ul style="list-style-type: none"> <li>i) The outdoor units must not be stacked</li> <li>ii) Minimum clear space in front of the CU: 350 mm</li> <li>iii) Minimum clear space at the back of CU: 200 mm</li> <li>iv) Minimum clear space to the side of CU with control panel: 350 mm</li> <li>v) Minimum clear space to the side of CU without control panel: 100mm</li> </ul>	Prerequisite	
	c.	Provide minimum 600mm by 600mm clear landing space for maintenance crew	1 (Cat 1)	
Detailing	3.1.3	Reduce risk of air short circuit due to the poor location of AC ledge /condenser unit (1 point)	Points Available	Points scored
	a.	AC ledge must be in a well-ventilated space for effective flow of air (CFD simulation is required if CU is facing enclosed space such as air well).	Prerequisite	
	b.	The free opening for louver screens or railings must be minimum 70% with louver angle not more than 30 degrees.	1 (Cat 1)	

Design Factor	3.2 Air Conditioning System – Variable Refrigerant Flow (VRF) (prerequisite)			
Access	3.2.1	Access to VRF outdoor units (prerequisite)	Points Available	Points scored
		a. For single VRF outdoor unit installation: Note: Provide access space as specified in the Technical Reference.	Prerequisite	
		b. For collective VRF outdoor unit installation: Note: Provide access space as specified in the Technical Reference.	Prerequisite	
		c. For floor-by-floor VRF outdoor unit installation Note: Provide access space as specified in the Technical Reference.	Prerequisite	
Design Factor	3.3 Air Distribution System (1 point)			
Detailing	3.3.1	Access to FCU mounted at heights (i.e. lobby space, clubhouse) (1 point)	Points Available	Points scored
		<p>a. Locate FCU less than 3m from FFL for easy access and maintenance.</p> <p>(OR)</p> <p>b. Provide clear access route for Mobile Elevated Work Platforms (MEWP) to reach the lobby, atrium space from the nearest door entrance.</p> <ul style="list-style-type: none"> <li>○ Provide clear access with entrance door/ opening of 1.8 m width x 2.4 m height and working base of 1.8 m width x 2 m length if the mounting height is less than or equal to 10.5 m.</li> <li>○ Provide clear access with entrance door/ opening of 2 m width x 2.8 m height and working base of 2 m width x 2 m length if the mounting height is greater than 10.5 m.</li> </ul> <p>(OR)</p> <p>Provide alternative access (e.g. maintenance platform, access from top floors etc.) without having to access from the floor.</p>	1  (Cat 1)	



Design Factor	3.4	Domestic Water Supply (prerequisite)		
Access	3.4.1	Access space for maintenance of water tank (prerequisite)	Points Available	Points scored
		<ul style="list-style-type: none"> <li>a. Provide minimum clear width of 1.2m access walkway to water tank from the nearest staircase or lift.</li> <li>b. Provide minimum access space to the water tank for regular maintenance. <ul style="list-style-type: none"> <li>i) For panel tank (FRP/Stainless steel), provide minimum 600 mm clear space around the tank.</li> <li>ii) For RC tank, provide minimum 600 mm clear access to the access door.</li> </ul> </li> <li>c. Provide minimum 1m clear headroom above the water tank (applicable to water tank with top access).</li> </ul>	Prerequisite	
Design Factor	3.5	Sanitary System (3 points)		
Access + Detailing	3.5.1	Access provision and design detailing for sanitary pipes for ease of maintenance (2 points)	Points Available	Points scored
		<ul style="list-style-type: none"> <li>a. Provide cleaning eyes with viewing panel for better maintenance.</li> </ul>	1 (Cat 1)	
		<ul style="list-style-type: none"> <li>b. Specify hubless elbows for sanitary stacks with horizontal transfers.</li> </ul>	1 (Cat 1)	
Access	3.5.2	Provide adequate access space for maintenance of ejector pump (prerequisite)	Points Available	Points scored
		<ul style="list-style-type: none"> <li>a. Provide minimum 600mm clear space on 1 side of the ejector pump for regular maintenance.</li> <li>b. Provide minimum 1.5m clear headroom above finished floor level at the top of ejector pit to facilitate overhaul maintenance or replacement.</li> </ul>	Prerequisite	
Detailing	3.5.3	Reduce risk of chokes in the sanitary pipe (1 point)	Points Available	Points scored
		<ul style="list-style-type: none"> <li>a. Provide at least 75% of the risers with continuous vertical run without any offsets to reduce the additional bends/joints. <i>Note: Above requirement is applicable only to all typical floors in building.</i></li> </ul>	1 (Cat 1)	

Design Factor	3.6	Fire Protection System (1 point)		
Access	3.6.1	Access to fire detectors at heights (prerequisite)	Points Available	Points scored
		<p>a. Provide alternative access for the detector maintenance (e.g. maintenance platform) without having to access from the atrium floor.</p> <p><i>(OR)</i></p> <p>Provide clear access route for Mobile Elevated Work Platforms (MEWP) to reach the lobby or atrium space from the nearest door entrance.</p> <ul style="list-style-type: none"> <li>○ Provide clear access with entrance door/ opening of 1.8m width x 2.4m height and working base of 1.8m width x 2m length if the mounting height is less than or equal to 10.5m.</li> <li>○ Provide clear access with entrance door/ opening of 2m width x 2.8m height and working base of 2m width x 2m length if the mounting height is greater than 10.5m.</li> </ul>	Prerequisite	
Material + Detailing	3.6.2	Reduce risk of damage and periodic replacement of fire-rated boards due to exposure to high humidity and water (1 point)	Points Available	Points scored
		<p>a. Specify the use of weatherproof fire-rated materials for services such as kitchen exhaust ducts, wet/dry riser pipes etc.</p>	1 (Cat 1)	
Design Factor	3.7	Swimming Pool System (3 points)		
Access + Detailing	3.7.1	Provide adequate access for filtration pump maintenance (3 points)	Points Available	Points scored
		<p>a. Provide minimum 600 mm clear working/walking space in the filtration pump room for regular maintenance. The access space for replacement of major component must follow manufacture's recommendation.</p>	Prerequisite	
		<p>b. Provide minimum headroom of 2 m for filtration system (Measured from FFL).</p>	2 (Cat 1)	
		<p>c. Provide clear access route with width of minimum 1.2 m from lift lobby or carpark area to the filtration system</p>	1 (Cat 1)	

Design Factor	4.1 Lighting System (1.5 points)		
Access	4.1.1 Access to light fixtures located at heights for maintenance and use of reliable light fixtures (0.5 points)	Points Available	Points scored
	<p>a. Provide access to the light fixtures mounted at heights (i.e. atrium, lobby space).</p> <p>i) Provide alternate access design (e.g. access from mezzanine floor, maintenance platform) without having to access from the atrium floor.</p> <p><i>(AND/OR)</i></p> <p>ii) Provide clear access route for Mobile Elevated Work Platforms (MEWP) to reach the lobby, atrium space from the nearest door entrance.</p> <ul style="list-style-type: none"> <li>○ Provide clear access with entrance door/ opening of 1.8m width x 2.4m height and working base of 1.8m width x 2m length if the mounting height is less than or equal to 10.5m.</li> <li>○ Provide clear access with entrance door/ opening of 2m width x 2.8m height and working base of 2m width x 2m length if the mounting height is greater than 10.5m.</li> </ul> <p><i>(OR)</i></p> <p>Provide pulley system or equivalent system for light fixtures installed at high lobby or atrium space to allow lowering for maintenance.</p>	Prerequisite	
LCC	b. Use reliable light fixtures such as LED light (LM80 B30 L70@ L50,000) which requires less maintenance.	0.5 (Cat 2)	
Material	4.1.2 Reduce risk of light flickering (0.5 point)	Points Available	Points scored
	<p>a. Specify constant DC output type LED driver complying with the following IEC standards to minimise flickering:</p> <ul style="list-style-type: none"> <li>i) IEC 62384</li> <li>ii) IEC 61347 Part 1 and Part 2-13</li> </ul> <p>b. For non-LED light fixtures, electronic ballast to cut off power supply to prevent flickering due to lamp failure.</p>	0.5 (Cat 2)	
Material	4.1.3 Reduce risk of LED light colour shift (0.5 point)	Points Available	Points scored
	a. Specify LEDs tested to IESNA LM-79-19 and LM-80-15 to ensure the LED performance.	0.5 (Cat 2)	

Design Factor	4.2	Power Distribution (3 points)		
Detailing	4.2.1	Reduce risk of water Ingress into electrical room (prerequisite)	Points Available	Points scored
		<p>a. Electrical room must be raised by minimum 100mm against the outside passageway.</p> <p>(OR)</p> <p>Provide minimum 100mm plinth for floor mounted electrical switchboard.</p>	Prerequisite	
Detailing	4.2.2	Reduce risk of unnoticed failure of surge arrestor located in the LT main switchboard (1 point)	Points Available	Points scored
		a. Use of surge arrestor with discharge indicator.	1 (Cat 1)	
Detailing	4.2.3	Reduce risk of failure of main LT switchboard due to overheating (1 point)	Points Available	Points scored
		a. Install heat sensor in the main LT switchboard to alert any abnormal rise in temperature with audible/visual alarm.	1 (Cat 1)	
Detailing	4.2.4	Design to facilitate swimming pool cleaning (1 point)	Points Available	Points scored
LCC		a. Provide at least 1 power point for every 25m length of swimming pool (minimum 1 power point for one swimming pool).	1 (Cat 1)	
Design Factor	4.3	Extra Low Voltage System (3 points)		
Access	4.3.1	Provide access for CCTV camera located at heights (1 point)	Points Available	Points scored
		<p>a. Provide access to cameras located at heights (<math>\geq 3\text{m}</math>) i.e. foldable poles/arms;</p> <p>(OR)</p> <p>Provide clear access route for mobile elevated work platforms (MEWP) to reach the camera for maintenance.</p>	1 (Cat 1)	
Detailing	4.3.2	Provide flexibility for future expansion for CCTV system (1 point)	Points Available	Points scored
		a. Provide minimum 20% spare capacity in network switch to cater for future expansion.	Prerequisite	
		b. Design that allows for future addition of data storage (either local or cloud base data storage).	1 (Cat 1)	

Detailing	4.3.3	Reduce risk of damage to outdoor camera and other equipment due to lightning surge (1 point)	Points Available	Points scored
	a.	Provide surge arrestor to all outdoor cameras. <i>Note: The surge protection must be provided at power source (AND/OR) at network switch.</i>	1 (Cat 1)	
Design Factor	4.4	Lightning Protection System (1 point)		
Detailing	4.4.1	Reduce risk of damage of air termination tape at roof parapet wall due to operation of façade maintenance system such as gondola	Points Available	Points scored
	a.	Avoid damage to the lightning protection system by proper design and installation of façade maintenance system.	1 (Cat 1)	
Design Factor	4.5	Vertical Transportation (2 points)		
Access	4.5.1	Access to lift motor room for maintenance	Points Available	Points scored
	a.	Provide permanent access (staircase with handrail) to the lift motor room.	Prerequisite	
Detailing	4.5.2	Reduce lift downtime and enhance reliability (2 points)	Points Available	Points scored
LCC	a.	Provide lift predictive maintenance. <i>Note: Monitor key parameters such as vibration, acceleration, levelling, door jams, gaps, noise, and jerk etc.</i>	2 (Cat 1)	
Design Factor	4.6	Car Park Entry System (prerequisite)		
Detailing	4.6.1	Reduce security manpower required to manually open/close carpark gantries	Points Available	Points scored
	a.	The EPS antenna must be properly located at the entrance and exit barriers to accurately read the registered car information to avoid the manual opening of the barrier.	Prerequisite	

## 5 LANDSCAPE

Design Factor	5.1 Softscape (1 point)			
Detailing + Material	5.1.1	Reduce labour-intensive irrigation for landscape (up to 1 point)	Points Available	Points scored
	a.	Design for water points with maximum 15m radius from each point.	Prerequisite	
LCC	b.	Specify rain sensor and auto-irrigation with timers.	1 (Cat 2)	
LCC	c.	Specify for auto-irrigation with timers. <i>(points cannot be scored if already scored in b)</i>	0.5 (Cat 2)	
		<b>Advanced Effort:</b> Implement remote monitoring system for landscape irrigation along with water metering for irrigation.	1 (bonus) (Cat 1)	
Design Factor	5.2 Hardscape (3.5 points)			
Detailing + Access	5.2.1	Access for maintenance of underwater lighting systems (up to 2 points)	Points Available	Points scored
LCC	a.	For shallow water bodies, design for easily replaceable lighting system within the underwater structure but above the water line.	1 (Cat 1)	
LCC	b.	For swimming pools/shallow water bodies, design lighting fixture within a depth of 500mm and along the perimeter <i>(calculated from base of light to finished floor level for in-ground pool/ to point of access for above-ground pool)</i>	1/0.5 (Cat 1)	
Material	5.2.2	Reduce risk of damage/degradation to outdoor landscape furniture (up to 0.5 point)	Points Available	Points scored
	a.	Specify for engineered wood with water absorption rate not exceeding 0.5%.	0.5 (Cat 2)	
	b.	Specify for anti-corrosion coating or stainless steel or aluminium for metal selections.	0.5 (Cat 2)	
Access	5.2.3	Access for maintenance beneath decking (1 point)	Points Available	Points scored
	a.	Design decks with demountable fixture system for maintenance of services beneath and for general cleaning.	1 (Cat 1)	

Design Factor	5.3 Vertical Greenery (Prerequisite)			
Access	5.3.1	Access to all parts of vertical greenery for maintenance and replacement of perished plants	Points Available	Points scored
LCC	a.	Provide direct maintenance access to all vertical greenery, both indoor and outdoor, e.g. catwalk, ladder, access corridor, MEWP, etc.	Prerequisite	
Design Factor	5.4 Roof, Sky Terraces, and Planter boxes on building edge/façade (1 point)			
Detailing + Access	5.4.1	Access for landscape on roof and sky terraces (1 point)	Points Available	Points scored
	a.	Provide direct maintenance access to landscape on all roof and sky terraces.	Prerequisite	
	b.	For planters more than 1.8 m wide, provide minimally 300mm obstruction free maintenance pathway inside the planter box.	Prerequisite	
	c.	For trees: Provide 5 m clear pathway from building edge to tree trunk.	1 (Cat 2)	
Design Factor	5.5 Water retaining structure (3 points)			
Access + Material	5.5.1	Reduce risk of water leakage from swimming pools/water bodies (up to 2 points)	Points Available	Points scored
	a.	Specify prefabricated water retaining structures, e.g. fiberglass reinforced or stainless-steel pool.	2 (Cat 1)	
	b.	For concrete pools - specify Integral liquid waterproofing admixture in concrete mixes and additional layer of waterproofing layer on the inside of the pool.	2 (Cat 1)	
Access	5.5.2	Access provision for maintenance of infinity pools (1 point)	Points Available	Points scored
	a.	Provide maintenance access of minimally 600mm with safety barrier along the water flow edge.	1 (Cat 1)	
Design Factor	5.6 Standalone structures (2 points)			
Detailing + Material	5.6.1	Reduce water ponding and degradation of outdoor standalone structures, e.g. pavilions (up to 1 point)	Points Available	Points scored

	a. Design for outdoor standalone structures roof slope to be not gentler than 15 degrees for efficient water run-off.	Prerequisite	
	b. Design to avoid direct contact of steel base with the ground (raised by at least 100 mm ) to prevent corrosion and entrapment of moisture and dirt. <i>(Point cannot be scored if already scored in solution 1.5.2)</i>	0.5 (Cat 1)	
	c. Specify for engineered wood with water absorption rate not exceeding 0.5% for timber selections.	0.5 (Cat 1)	
Material	5.6.2 Reduce risk of warping/deterioration of ceiling panel system on standalone structure (up to 1 point)	Points Available	Points scored
	a. Specify suspended modular metal panel, e.g. baffle metal panels and metal mesh panels	1 (Cat 2)	
	b. Specify moisture-resistant suspended non-metallic modular ceiling panels with water absorption rate not exceeding 5%	1 (Cat 2)	
	c. Specify open ceiling design	1 (Cat 2)	



## 6 FACILITIES

Design Factor	6.1 Outdoor Games Court (2 points)			
Detailing	6.1.1	Reduce risk of water ponding on games court (prerequisite)	Points Available	Points scored
	a.	Ensure slope and gradient as per the court guidelines, e.g. For non-porous tennis courts minimum of 1:120 and maximum of 1:100.	Prerequisite	
Detailing + Material	6.1.2	Reduce development of flooring blisters/bubbles (2 points)	Points Available	Points scored
	a.	Design to provide perimeter drain channel to prevent moisture accumulation beneath court surface.	1 (Cat 1)	
	b.	Specify for semi-permeable surface coating to allow for moisture to escape, e.g. acrylic surface coating	0.5 (Cat 1)	
LCC	c.	Specify installation of vapour barrier below the base structural slab to reduce water ingress from beneath the court.	0.5 (Cat 1)	

Design Factor	7.1 Smart FM (Up to total 5 points)		
Detailing	7.1.1 Adopt innovative technologies that improve FM labour efficiency and service delivery. (5 points)	Points Available	Points scored
LCC	<p><b>a. Type 1 – Use of digitised workflow automation optimize the workflow, productivity and service delivery:</b></p> <p><b>Digitalized Workflow Automation:</b> When triggered by a feedback or incident, automatically initiates a process that tracks, monitors, and closes the feedback or incident.</p> <p>Example applications are as follows:</p> <ol style="list-style-type: none"> <li>1. Use of Property Management Software for workflow automation</li> <li>2. Smart visitor management system</li> <li>3. Online facility booking system</li> <li>4. Smart exit lights</li> <li>5. Smart monitoring system for fire extinguishers</li> <li>6. Smart security system such as video analytics for access control</li> <li>7. Smart lighting</li> <li>8. Mobile APP for residents (Example, the APP could be used for booking common facilities, receiving notice from MA, payment of maintenance fees, reporting maintenance issues and etc.)</li> </ol> <p><b>b. Type 2 – Use of data analytics and artificial intelligence for system optimization and predictive maintenance:</b></p> <p style="padding-left: 40px;">i) <b>Diagnostics AI:</b> Able to identify system deviations and diagnose potential causes.</p> <p style="padding-left: 40px;">ii) <b>Predictive AI:</b> Able to diagnose problems and predict future states of assets and systems.</p> <p>Example applications are as follows:</p> <ol style="list-style-type: none"> <li>1. Implement predictive maintenance for equipment i.e. fault detection and diagnostics of water pumps.</li> </ol> <p><b>c. Design for Robotics and Automation (R&amp;A):</b></p> <p>Building infrastructures should be designed to optimise robot capabilities such as their range of mobility, ease of completing tasks, and ability to navigate its work environment. (up to 3 points, 0.5 point for each R&amp;A solution)</p>	1 point for each item (Up to 5 points) (Cat 1)	

	<p>Identifying the robots of interest to be deployed and recognising their corresponding level of autonomy is important in planning for suitable infrastructure that would cater to the robots.</p> <p>Example use of FM robots could include the following:</p> <ul style="list-style-type: none"><li>• Cleaning robot e.g. façade, floor, window</li><li>• Concierge robot</li><li>• Facade inspection robot/drone</li><li>• Landscape management robot e.g. lawn mowers</li><li>• Pest management robot e.g. detection, monitoring, extermination</li><li>• Security robot</li><li>• Waste management robot</li></ul>		
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