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The Singapore Building and Construction Authority (BCA) Green Mark scheme was launched in 2005 and is an internationally recognized green building rating system tailored for the tropical climate. Green Mark sets parameters and establishes indicators to guide the design, construction and operation of buildings towards increased energy effectiveness and enhanced environmental performance.

Climate: Buildings should demonstrate emissions reduction and resilience to the effects of climate change.	
Resources: As stewards of the earth's resources, buildings should use resources in an efficient manner to reduce its environmental footprint over the building life cycle.	
Wellbeing: Liveable built environments are vital for our health and well-being.	
Ecology: Buildings should consider their wider impact on the biosphere through the integration of nature and protection of natural systems including flora and fauna.	

BCA Green Mark Award Rating Scores

Green Mark Rating	Green Mark Score
Green Mark Platinum	70 and above
Green Mark Gold ^{PLUS}	60 to < 70
Green Mark Gold	> 50 to < 60

	Requirements	Points	Credits where Paint may contribute
Part 1	Climatic Responsive Design	30	
1.1	Leadership	10	
1.2	Urban Harmony	10	
1.2a	Sustainable Urbanism	5	1
1.3	Tropicality	10	
2	Building Energy Performance	30	
2.1	Energy Efficiency	7	
2.2	Renewable Energy	8	
3	Resource Stewardship	30	
3.1	Water	8	
3.2	Materials	18	
3.2b	Embodied Carbon	2	0,5
3.2c	Sustainable Products	8	
(i)	Functional Systems	12,5	1
(ii)	Singular Sustainable Products outside of Functional Systems	2	
3.3	Waste	4	
4	Smart and Healthy Building	30	
P.11	Low Volatile Organic Compound (VOC) Paints	Prerequisite	Prerequisite
4.1	Indoor Air Quality	10	
4.2	Spatial Quality	10	
4.3	Smart Building Operations	10	
Part 5	Advanced Green Efforts	20	
5.1	Enhanced Performance	15	
5.2	Demonstrating Cost Effective Design	2	1
5.3	Complementary Certifications	1	
5.4	Social Benefits	2	
	Total	140	3,5

1. Climatic Responsive Design

1.2 Urban Harmony

1.2a Sustainable Urbanism

(iii) Urban Heat Island (UHI) Mitigation

Guidance Notes: The site plan (2D plan area in m²) can be used to calculate the site coverage of UHI mitigation measures such as:

- Green and blue spaces for landscaping and roof
- Roofing materials or coatings or cool paints with high Solar Reflectance Index (SRI) > 40
- Unshaded hardscape areas with SRI > 39, inclusive of unshaded carparks, internal roads, plazas and pedestrian walkways
- Permeable paving strategies such as gravel or open paving systems
- Other performance based strategies that demonstrate UHI effect mitigation

Documentation Requirements

(A) Design Stage

Material schedules or specifications of the roof and hardscape finishes with corresponding SRI values. Where such values are not provided, calculations in accordance to ASTM E1980 – 11 may be used supported by solar reflectance and thermal emittance specifications

(B) Verification Stage 1

Delivery orders of the hardscape materials and roof finishes supported by technical specifications providing the SRI or solar reflectance and thermal emittance values

3. Resource Stewardship

3.2b Embodied Carbon

BCA's Carbon Calculator is a tool to help developments identify their carbon debt and quantify their environmental impact and embodied energy, as well as allow benchmarking of projects over time. A maximum of 2 points can be scored for the use of BCA Carbon Calculator to compute the embodied carbon footprint of the development:

- Declaration of Concrete, Glass and Steel – 1 point
- Declaration of additional materials –Up to 1 point (0.25 pt per material)

Provide Own Emission Factors with Source Justification (Advanced Green Efforts)

Up to 1 point can be scored for the provision of own material emission factors (0.25 pt per material).

Compute the Carbon Footprint of the Entire Development (Advanced Green Efforts).

Paint may contribute with 0.25 points for internal paints and 0.25 points for external paints, altogether 0.5 for paints.

2 points can be scored for computation of the carbon footprint of the entire development and a detailed carbon footprint report based on all the materials used within the development.

Technical guide: Examples of additional materials that can be declared: Aluminium, [paint](#), timber flooring, ceramic tiles etc.

3.2c Sustainable Products

The environmental performance of materials covered here includes their recycled content and environmental impact during production and resource extraction. The intent is to encourage the specification of resource efficient and environmentally friendly products for use in the fit-out of a building, taking a functional system approach to focus on greening major fit-out materials whilst allowing for flexibility in design as well as recognizing designs with optimal/ minimal material use. Applicable to non-structural building components. Structural components are excluded.

A maximum of 8 points can be scored for (i) and (ii).

(i) Functional Systems

Points can be awarded for the specification and use of green products certified by approved local certification bodies, namely the Singapore Green Building Council and the Singapore Environment Council, within the 6 main functional system categories of the building as follows:

Non-Speculative Buildings/ Speculative Buildings with Tenanted Areas Included

Functional System Category	External Wall	Internal Wall	Flooring	Doors	Ceiling	Roofing
Base Group (Coverage: ≥ 60%)	1 pt	1 pt	1 pt	1 pt	0.5 pt	0.5 pt
Finishes Group (Coverage: ≥ 60%)	2 pt	2 pt	2 pt	0.5 pt	0.5 pt	0.5 pt

Speculative Buildings with Tenanted Areas Excluded

Functional System Category	External Wall	Internal Wall	Flooring	Doors	Ceiling	Roofing
Base Group (Coverage: ≥ 80%)	1 pt	0.5 pt	0.5 pt	0.5 pt	0.25 pt	0.5 pt
Finishes Group (Coverage: ≥ 80%)	2 pt	1 pt	1 pt	0.25 pt	0.25 pt	0.5 pt

(ii) Singular Sustainable Products outside of Functional Systems

Where sustainable hardscape, building services and M&E products certified by an approved local certification body are used, 0.25 point can be scored per product for ≥ 80% of the applicable use, maximum of 2 points.

Sustainable Products with Higher Environmental Credentials (Advanced Green Effort), up to 2 points can be scored for the use of products certified to higher tiers of environmental performance (per product).

Singapore Green Building Product Certification Rating	Points per product (≥ 80% of the applicable use)
Very Good (2-ticks)	0.25
Excellent (3-ticks)	0.5
Leader (4-ticks)	1.0

Products are grouped within respective Groups - Base or Finishes Group - to form a holistic system. The Base Group will be a pre-requisite for its respective Finishes Group; i.e. the Base Group for the respective system shall achieve the score before the Finishes Group qualifies for scoring.

The area coverage is determined as a system stacked; i.e. the spread of area where the base group qualifies, the same area will be evaluated whether the finishes installed qualifies. All products under each Group (where used during building operation) shall all be green certified to score for the respective grouping. The tables below list broad examples of the applicable products in respective group and functional systems. The list is non-exhaustive:

External Wall Functional System

Group	Typical Products	Points
Base Group	Curtain wall, integrated wall system, wall panels, blocks, metal cladding, waterproofing, sealant, adhesives, jointing, grouting, pointing, (fixing brackets may be excluded)	1
Finishes Group	<ul style="list-style-type: none"> All external face finishes including skim coats, external paints (including primers), external coatings, corner beads, corner protectors All internal face finishes including skim coat, internal paint, corner beads, corner protectors, fabrics, wall papers, wall tiles etc. 	2
<i>Notes:</i> Where a product is not required for use within the grouping, it may be considered to have met the requirement. Excludes structural walls, external architectural aesthetic features and openings. Areas are taken on both sides of the walls.		

Internal Wall Functional System

Group	Typical Products	Points
Base Group	Lightweight wall panels, drywalls, blocks, waterproofing, jointing, wall grouting, boarding insulation (fixing frame may be excluded)	1
Finishes Group	All finishes including plastering, skim coat, corner beads, corner protectors, fabrics, wall papers, wall tiles, tiles grouting vinyl, laminates, veneers, adhesives, paint etc.	2
<i>Notes:</i> Where a product is not required for use within the grouping, it may be considered to have met the requirement. Areas are taken on both sides of the walls.		

Flooring Functional System

Group	Typical Products	Points
Base Group	Levelling base, floor screed, waterproofing	1
Finishes Group	<ul style="list-style-type: none"> Raised floor systems (Insulation, underlay, carpets/ carpet tiles) Floor finishes including underlays, coatings, grouting, pointing, skirting, adhesives, carpets, vinyl's, tiles, laminate flooring, timber flooring, marble flooring etc. 	2

Notes:
Where a product is not required for use within the grouping, it may be considered to have met the requirement.
Excludes structural floor slab

Door Functional System

Group	Typical Products	Points
Base Group	Glass door, door leaf, door finishes including laminates, paint and veneers/ vinyl sheets, varnish, coatings	1
Finishes Group	Door accessories, i.e. door frame, door frame finishes, ironmongery	0.5

Notes:
Where a product is not required for use within the grouping, it may be considered to have met the requirement.
The Finishes Group here refer to the door accessories and not the door finishes.

Ceiling Functional System

Group	Typical Products	Points
Base Group	Plastering, skim coat (<i>Note where the ceiling is an off form soffit finish, it is deemed to comply</i>)	0.5
Finishes Group	Ceiling boards (excluding framing, fixing and bracing), insulation adhesives, paint finish, coatings	0.5

Note: Where a product is not required for use within the grouping, it may be considered to have met the requirement.
Excludes structural slabs ceiling slabs

Roofing Functional System

Group	Typical Products	Points
Base Group	<ul style="list-style-type: none"> For RC flat roofs: Levelling base, screed, waterproofing, insulation For Framed Roof: Waterproofing, insulation (excluding structural frame) 	0.5
Finishes Group	All finishes including metal sheets, roof tiles, tile grouts, tiles, paints and coatings, adhesives, pointing, skirting	0.5

Notes:
Where a product is not required for use within the grouping, it may be considered to have met the requirement.
Excludes structural roof slabs/ framing. The Roofing Functional System only includes products above/ interspersed between the structural slab/ frame of the roof.

Green certification - Requirements of the Singapore Green Building Label (SGBL)

Item no.	Test	GLS032 criteria	Method detection limit
1	Formaldehyde content	Not detected	0.01%
2	Heavy metals : Mercury, Lead, Cadmium, Chromium	Not detected	0.01%
3	Flash Point @ 61°C	> 61°C	-
4	VOC Content	**	2 g/L
5	Halogenated solvents	Not detected	0.1%
6	Epichlorohydrin	Not detected	0.1%
7	Aromatic solvents	Not detected	0.1%
8	N-methyl pyrrolidone	Not detected	0.1%
9	Alkyl Phenol Ethoxylates	Not detected	0.01%

** For water based coatings (Matt or Low sheen < 50g/L; Semi-gloss < 60 g/L; Gloss < 70g/L)
For solvent based coatings (Solvent paints and stains < 200g/L; Solvent varnishes < 250g/L)

Method of test

- 1) Formaldehyde
 - a. The analysis was conducted based on the VdL-RL 03 : Directive on the determination of the formaldehyde concentration of water dilutable emulsion paints and related products. VdL-RL 03 Clause 4.1 procedure – Free formaldehyde in sample was analysed by UV-Vis Spectrophotometer
- 2) Mercury, Lead, Cadmium and Chromium
 - a. The sample was digested in inorganic acid, followed by analysis using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES)
- 3) Flash point @ 61°C
 - a. By Seta flash
- 4) VOC
 - a. By BS EN ISO 11890-2:2006, Paints and varnishes – Determination of volatile organic compound (VOC) content – Part 2 : Gas-chromatograph method
- 5) Halogenated solvents / Epichlorohydrin / Aromatic solvents
 - a. By Gas Chromatograph – Mass Spectrometry (GC-MS)
- 6) N-methyl pyrrolidone
 - a. By Gas Chromatography with Flame Ionization Detector (GC-FID)
- 7) Alkyl Phenol Ethoxylates
 - a. BS3762:1990 Analysis of formulated Detergent

4. Smart and Healthy Building

Prerequisite 11: Low Volatile Organic Compound (VOC) Paints

Limiting the use of high-emitting building and furnishing materials can improve the indoor environmental quality for the health and well-being of occupants.

Applicable to all indoor paints including primers, sealers, base coats and top coats.

Low VOC paints certified by an approved local certification body shall be used for at least 90% of the total painted internal wall areas.

<p><u>NRB 4-3 Indoor Air Pollutants</u></p> <p>Minimise airborne contaminants, mainly from inside sources to promote a healthy indoor environment.</p> <p>(a) Use of low volatile organic compounds (VOC) paints certified by approved local certification body.</p>	<p>Extent of Coverage : At least 90% of the total internal wall areas</p> <p>1 point</p>
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All coats of paint shall be considered, including primers, sealers, base coats and top coats. The paints shall comply with the following VOC content:

VOC content (water-based) shall be

≤ 25 gL⁻¹ for matt,

≤ 30 gL⁻¹ for low sheen,

≤ 75 gL⁻¹ for semi-gloss

Test methods for paint VOC content shall comply with ISO 17895 or ISO 11890.

5. Advanced Green Efforts

5.2 Complementary Certifications

In Green Mark for Non Residential Buildings NRB:2015, a self-cleaning facade system can get up to 1 point for the effort.