



# DESIGN REFERENCE GUIDE

TOWNSHIP

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# 1. About GreenRE

GreenRE Sdn Bhd is a wholly owned subsidiary of the Real Estate and Housing Development Association (REHDA). The GreenRE rating tool has been developed for the purposes as mentioned herein and may be subject to updating and/or modification in the future.

Any sale, modification, reproduction, display or distribution of GreenRE criteria or any copies thereof is not allowed without GreenRE Sdn Bhd's prior written consent. This may be obtained in writing to the following address or via email to [info@greenre.org](mailto:info@greenre.org)

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## 2. Introduction

The GreenRE assessment scheme was established in 2013 and is a recognized green building rating system tailored for the tropical climate. GreenRE sets parameters and establishes indicators to guide the design, construction and operation of buildings towards increased energy effectiveness and enhanced environmental performance.

The intent of this Design Reference Guide for Township (referred to as “this Guideline”) is to establish environmentally friendly practices for the planning, design and construction of office interior, which would help to mitigate the environmental impact of building interior for new offices, existing operating offices and existing offices undergoing renovation. This tool is dedicated for township other than retail and hospitality.

This Guideline is not intended to abridge safety, health, environmental or related requirements contained in other applicable laws, codes or policies administered by relevant authorities. Where there is a conflict between a requirement of this Guideline and such other regulations affecting the design, construction and operation of the project, the building regulations shall take precedence.

## 3. Revision Log

Revision	Description	Date Effective
1.0	Issued for Implementation	1st June 2015
2.0	Issued for Implementation	June 2023 (Reference Guide)

## 4. Certification Process

The GreenRE Township Certification process is as follows:



### Application

- Submittal of application with relevant supporting documents for certification upon finalization of township design



### Pre-Assessment

- A pre-assessment audit will be conducted to give the project team a better understanding of the criteria and evaluation of the certification level sought.



### Actual Assessment

- Actual assessment to be conducted once the design and documentary evidences (e.g. approved plan) are ready. After the actual assessment, our assessors will review the documents submitted and formalize report to management within four weeks.
- Assessment process includes design and documentary reviews to verify if the township meets:
  - i. The intents of the criteria
  - ii. The pre-requisite requirement for GreenRE Bronze, Silver, Gold and Platinum rating where applicable.
  - iii. Letter of award showing the GreenRE rating will be issued at this stage.



### Site Verification

- Site verification to be conducted upon every phases completion.
- Refer to page 6 for pre-requisite requirements.
- A certificate will be issued at this stage.

## 5. GreenRE Township Rating System

### OVERVIEW:

The GreenRE Township criteria consist of six (6) environmental impact categories namely:

1. **Part 1 – Energy Efficiency:** This category focuses on the approach that can be used in the infrastructure and public amenities to optimise the energy efficiency of the township.
2. **Part 2 – Water Management:** This category focuses on the selection of fittings for public amenities and strategies towards efficient water usage and management.
3. **Part 3 – Material & Waste Management:** This category focuses on the design, practices and selection of materials and resources that would reduce the environmental impacts and waste management strategies.
4. **Part 4 – Environmental Planning:** This category focuses on the design strategies that would enhance the indoor environmental quality which include air quality, thermal comfort, acoustic control, and daylighting.
5. **Part 5 – Green Buildings and Green Transport:** This category focuses on the public transportation network and availability of green rated buildings within the township.
6. **Part 6 – Community and Innovation:** This category focuses on the community involvement and innovative features available for the benefit of the community.

These environment impact categories are broadly classified under two main grouping namely (I) Energy Related Requirements and (II) Other Green Requirements. Energy Related Requirements consist of Part 1- Energy Efficiency where credits are allocated for the various energy efficient designs, practices and features used. A minimum of 10 credits must be obtained from this group to be eligible for certification.

Other Green Requirements consist of Part 2 - Water Management; Part 3 – Material & Waste Management; Part 4 - Environmental Planning; Part 5 - Green Buildings and Green Transport, and Part 6 – Community and Innovation. A minimum of 50 credits must be obtained from this grouping to be eligible for certification.

## 6. GreenRE Award Rating



Score:  
101 and above

GreenRE Platinum



Score:  
91 to  $\leq$  1000

GreenRE Gold



Score:  
76 to  $\leq$  90

GreenRE Silver

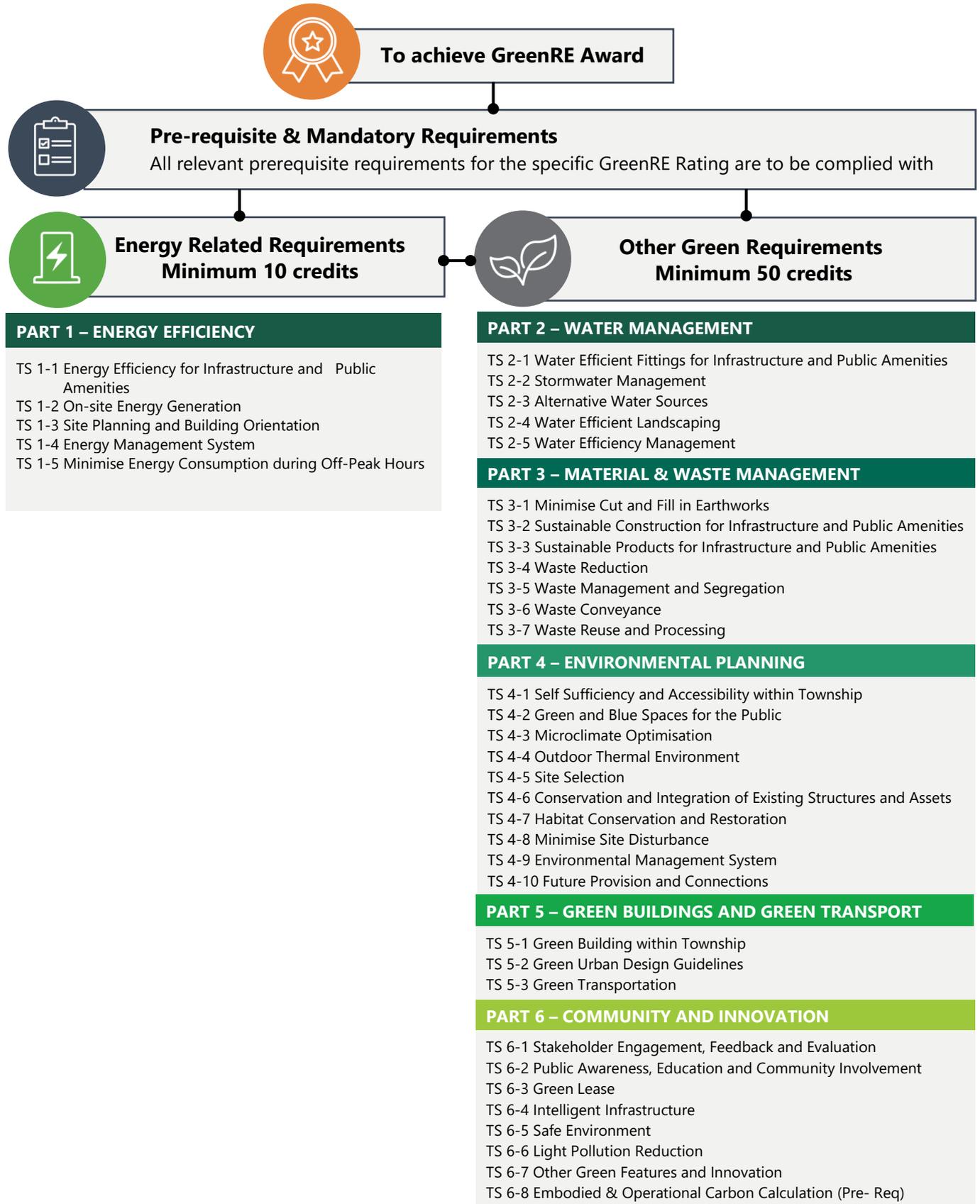


Score:  
60 to  $\leq$  75

GreenRE Bronze

## 7. GreenRE Assessment Criteria

### 7.1 Framework - GreenRE for Township



## 7.2 Credit Allocation for Township Criteria

Category		Credits Allocations	
<b>(I) Energy Related Requirements</b>			
Minimum 10 credits	<b>Part 1: Energy Efficiency</b>		
	TS 1-1 Energy Efficiency for Infrastructure and Public Amenities	8	
	TS 1-2 On-site Energy Generation	6	
	TS 1-3 Site Planning and Building Orientation	10	
	TS 1-4 Energy Management System	5	
	TS 1-5 Minimise Energy Consumption During Off-Peak Hours	1	
<b>Category Score for Part 1 – Energy Efficiency</b>		<b>30</b>	
<b>(II) Other Green Requirements</b>			
Minimum 50 credits (Part 2 to 6)	<b>Part 2: Water Management</b>		
	TS 2-1 Water Efficient Fittings for Infrastructure and Public Amenities	4	
	TS 2-2 Stormwater Management	8	
	TS 2-3 Alternative Water Sources	4	
	TS 2-4 Water Efficient Landscaping	2	
	TS 2-5 Water Efficiency Management	3	
	<b>Category Score for Part 2 – Water Management</b>		<b>21</b>
	<b>Part 3: Material and Waste Management</b>		
	TS 3-1 Minimise Cut and Fill in Earthworks	3	
	TS 3-2 Sustainable Construction for Infrastructure and Public Amenities	7	
	TS 3-3 Sustainable Products for Infrastructure and Public Amenities	5	
	TS 3-4 Waste Reduction	2	
	TS 3-5 Waste Management and Segregation	4	
	TS 3-6 Waste Conveyance	2	
	TS 3-7 Waste Reuse and Processing	4	
	<b>Category Score for Part 3 – Material and Waste Management</b>		<b>27</b>
	<b>Part 4: Environmental Planning</b>		
	TS 4-1 Self Sufficiency and Accessibility Within Township	5	
	TS 4-2 Green and Blue Spaces for the Public	3	
	TS 4-3 Microclimate Optimisation	4	
	TS 4-4 Outdoor Thermal Environment	9	
	TS 4-5 Site Selection	5	
	TS 4-6 Conservation and Integration of Existing Structures and Assets	1	
	TS 4-7 Habitat Conservation and Restoration	7	
	TS 4-8 Minimise Site Disturbance	2	
	TS 4-9 Environmental Management System	6	
TS 4-10 Future Provision and Connections	2		
<b>Category Score for Part 4: Environmental Planning</b>		<b>44</b>	
<b>Part 5: Green Buildings and Green Transport</b>			
TS 5-1 Green Buildings Within Township	20		
TS 5-2 Green Urban Design Guidelines	4		
TS 5-3 Green Transport Within Township	11		
<b>Category Score for Part 5: Green Buildings and Green Transport</b>		<b>35</b>	
<b>Part 6: Community and Innovation</b>			
TS 6-1 Stakeholder Engagement, Feedback and Evaluation	6		
TS 6-2 Public Awareness, Education and Community Involvement	7		
TS 6-3 Green Lease	2		
TS 6-4 Intelligent Infrastructure	3		
TS 6-5 Safe Environment	1		
TS 6-6 Light Pollution Reduction	2		
TS 6-7 Other Green Features and Innovation	5		
TS 6-8 Operational and Embodied Carbon Calculation	3		
<b>Category Score for Part 6: Community and Innovation</b>		<b>29</b>	
<b>GreenRE Township Score:</b>		<b>186 (MAX)</b>	

### 7.3 Pre-requisite Requirements for GreenRE Township



#### GREEN BUILDING WITHIN TOWNSHIP

At least 10% by GFA of all buildings in the township or 5,000 m<sup>2</sup> (whichever is higher) to achieve corresponding GreenRE rating.

GreenRE Township Rating	At least 10% by GFA of all buildings in township or 5,000m <sup>2</sup> (whichever is higher)
GreenRE Bronze	GreenRE Bronze
GreenRE Silver	GreenRE Silver
GreenRE Gold	GreenRE Gold
GreenRE Platinum	GreenRE Platinum



#### MINIMUM SYSTEM EFFICIENCY AND ENERGY MONITORING (IF USING TOWNSHIP COOLING SYSTEM)

- i. Where District Cooling System is being utilized in the township, the total system (chilled water plant) efficiency must achieve a minimum of **0.8 kW/RT** for **GreenRE Silver, Gold and Platinum** awards.
- ii. Permanent instrumentation for monitoring of the district cooling system efficiency to be provided in accordance with the following requirement:
  - a. The installed instrumentation shall have the capability to calculate resultant plant efficiency (i.e. kW/RT) within 5% of its true value and in accordance with ASHRAE Guide 22 and AHRI 550/590.
  - b. The location and installation of the measuring devices to meet the manufacturer's recommendation.
  - c. Data acquisition system to have a minimum resolution of 16 bit.
  - d. All data logging with capability to trend at 1 minute sampling time interval.
  - e. Flow meters to be provided for chilled-water and condenser water loop and shall be of ultrasonic / full bore magnetic type or equivalent.

- f. Temperature sensors with minimum accuracy of  $\pm 0.05$  °C at 0 °C. All thermo-wells shall be installed in a manner which ensures that the sensors can be in direct contact with fluid flow. Provisions shall be made for each temperature measurement location to have two spare thermo-wells located at both sides of the temperature sensor for verification of measurement accuracy.
- iii. Annual submission of building energy consumption data and operating system efficiency of the district cooling system to GreenRE.



**MINIMUM SCORE FOR GREENRE GOLD AND PLATINUM TOWNSHIP RATING**

Achieve minimum score for the following criteria:

Criteria	GreenRE Township Rating	
	Gold	Platinum
TS 3-2 Sustainable Construction for Infrastructure and Public Amenities	≥ 3 Credits	≥ 4 Credits
TS 3-3 Sustainable Products for Infrastructure and Public Amenities	≥ 2 Credits	≥ 3 Credits
Part 4 – Environmental Planning	≥ 15 Credits	≥ 21 Credits



TS 6-8(a) & (b) & (c) calculation of operational and embodied carbon



Additional Pre- Requisite for Industrial Park/ Township as follow:

**i. TS 2-2 - Stormwater Management**

Compliance with DOE requirements for discharge to public drainage to be shown.

**ii. TS 3-5 – Waste Management & Segregation**

Waste management policy for hazardous and non-hazardous waste to be implemented.

## MANDATORY REQUIREMENTS

All the building in the township boundary certification to show compliance on the UBBL -38A as follow:



### BUILDING ENVELOPE - OTTV

- The OTTV of the building envelope for a commercial building, having a **total air-conditioned area exceeding 4000 m<sup>2</sup> and above should not exceed 50 W/m<sup>2</sup>.**



### ROOF

- In the **case of an air-conditioned building**, the concept of Roof Thermal Transfer Value (RTTV) is applied if the roof is provided with skylight and the entire enclosure below is fully air-conditioned.
- For roofs with skylight, the maximum recommended RTTV is 25 W/m<sup>2</sup>.

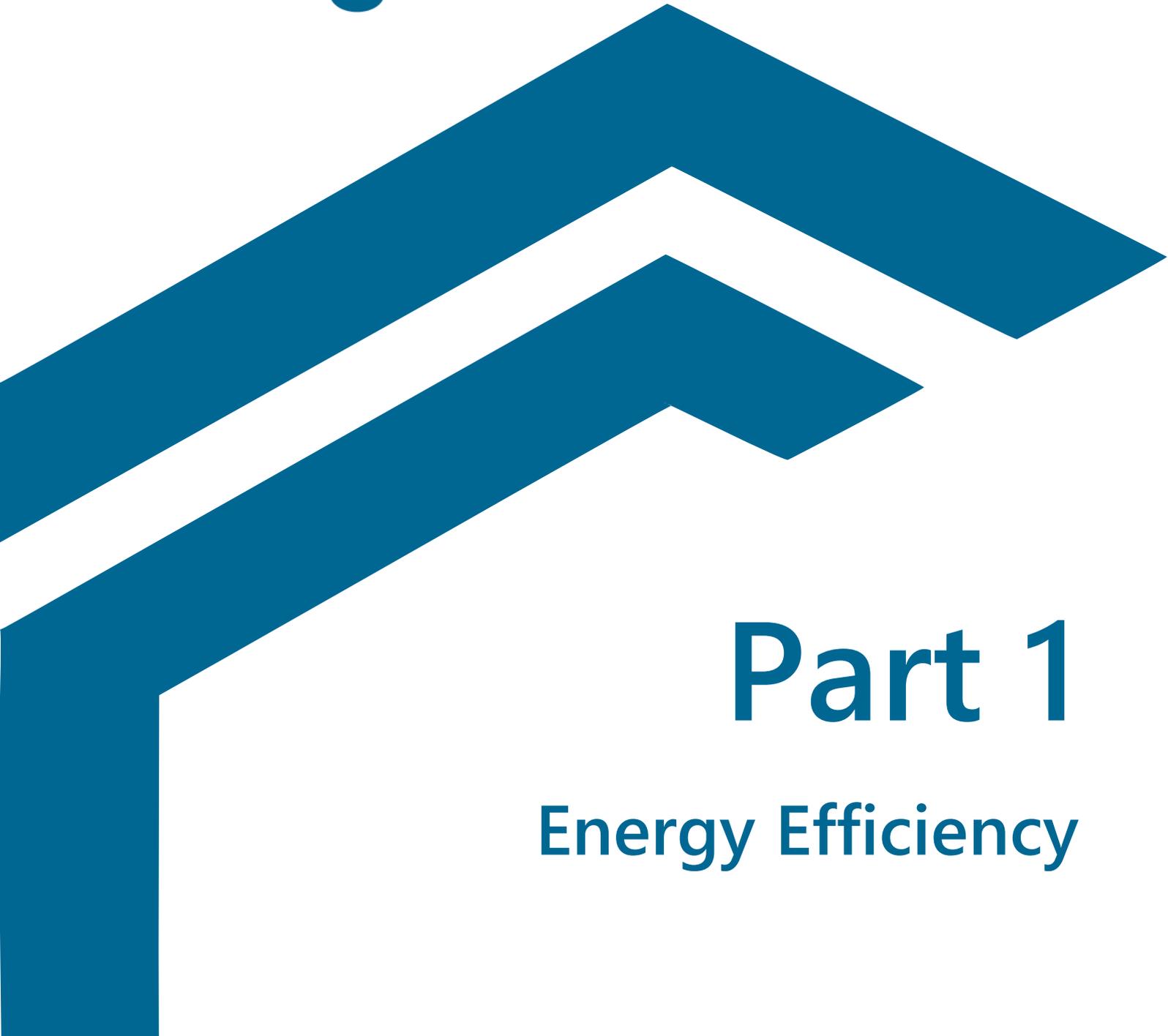
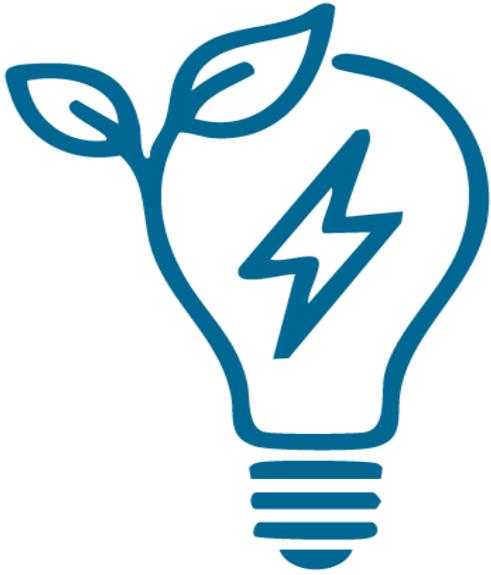


### ROOF – U-VALUE

- **The roof of the building** shall not have a thermal transmittance (U-Value) greater than that tabulated in Table 2-1.

Roof Weight Group	Maximum U-Value (W/m <sup>2</sup> K)
Light (Under 50 kg/m <sup>2</sup> )	0.4
Heavy (Above 50 kg/m <sup>2</sup> )	0.6

Table 2-1 Maximum U-Value for Roof (W/m<sup>2</sup>K)



# Part 1

## Energy Efficiency



# Part 1 – Energy Efficiency

## TS 1-1 ENERGY EFFICIENCY FOR INFRASTRUCTURE AND PUBLIC AMENITIES

**Baseline:** Minimum efficiency requirement of mechanical and electrical systems as stated in MS1525:2014 or equivalent local standards, or based on conventional systems, etc.

Baseline building energy efficiency index (EEI) based on national standard.

The mechanical and electrical systems to be included in the calculation shall include (but not limited to) the following:

- Street lighting / landscape lighting / carpark lighting / electric signage
- Water pumps
- Mechanical fans
- Lifts / escalators

**Pre-requisite Requirements:**

*Minimum System Efficiency and Energy Monitoring (if using District Cooling System)*

- i. *Where District Cooling System is being utilised in the township, the total system (chilled water plant) efficiency must achieve a minimum of 0.8 kW/RT for GreenRE Silver, Gold and Platinum awards.*
- ii. *Permanent instrumentation for monitoring of the township cooling system efficiency to be provided in accordance with the following requirement:*
  - a. *The installed instrumentation shall have the capability to calculate resultant plant efficiency (i.e. kW/RT) within 5% of its true value and in accordance with ASHRAE Guide 22 and AHRI 550/590.*
  - b. *The location and installation of the measuring devices to meet the manufacturer's recommendation.*
  - c. *Data acquisition system to have a minimum resolution of 16 bit.*

## GREENRE CREDITS

0.15 credits for every percentage of saving over the total energy consumption for infrastructure and public amenities (Excludes energy consumption for those under GreenRE for Buildings)

Credits awarded = 0.15 x (% improvement)

(Up to 8 credits)

- d. All data logging with capability to trend at 1 minute sampling time interval.
  - e. Flow meters to be provided for chilled-water and condenser water loop and shall be of ultrasonic / full bore magnetic type or equivalent.
  - f. Temperature sensors with minimum accuracy of  $\pm 0.05$  °C at 0 °C. All thermo-wells shall be installed in a manner which ensures that the sensors can be in direct contact with fluid flow. Provisions shall be made for each temperature measurement location to have two spare thermo-wells located at both sides of the temperature sensor for verification of measurement accuracy.
- iii. Annual submission of building energy consumption data and operating system efficiency of the district cooling system to GreenRE.

**TS 1-2 ON-SITE ENERGY GENERATION**

**GREENRE CREDITS**

- Encourage the on-site generation of energy for self-supply in the common areas of the township (e.g. street lighting, landscape lighting, etc).
- a. Energy generation by efficient combined system such as co-generation, tri-generation, etc.
  - b. Generation of renewable energy.
  - c. Energy recovery or regeneration.

Credits scored for every percentage replacement of electricity (based on total annual township energy consumption) by systems:

- 10% – 2 credits
- 15% – 4 credits
- >20% – 6 credits

[Total 6 credits]

**TS 1-3 SITE PLANNING AND BUILDING ORIENTATION**

**GREENRE CREDITS**

- Minimise the heat gain / loss by use of passive solar strategies to reduce the energy demand.
- a. 50% or more of the plot have one axis within plus minus 22.5 degree of geographical north / south, and north / south length is at least as long or longer than the east / west length
- OR

- a. Plot coverage

0.1 credit for every percentage improvement in the plot coverage

Credits awarded = 0.1 x (% improvement)

OR

b. 50% or more of the project building GFA have one axis of each building is at least 1.5 times longer than the other, and the longer axis is within 22.5 degrees of geographical north / south axis

b. GFA coverage

0.15 credit for every percentage improvement in the GFA coverage

Credits awarded = 0.15 x (% improvement)  
(Up to 4 credits)

c. Reduction of the area of the west facing elevation of buildings, or application of inter-block shading strategies to west / east facing facades

50% - 1credit  
90% - 2 credits  
(based on the No. of the public building)

d. Planning of buildings layout and massing to avoid blocking prevailing wind

50% - 1credit  
90% - 2credits  
(based on the No. of the public building)

e. Natural ventilation and day-lighting for public spaces

2 credits  
[Total 10 credits]

**TS 1-4 ENERGY MANAGEMENT SYSTEM**

**GREENRE CREDITS**

Design and incorporate energy monitoring and/or control system to facilitate energy consumption monitoring and management for public facilities

a. Provide with sub-metering with remote metering capability for subsystems > 15 kW or with electric loads > 100 kVA

2 credits

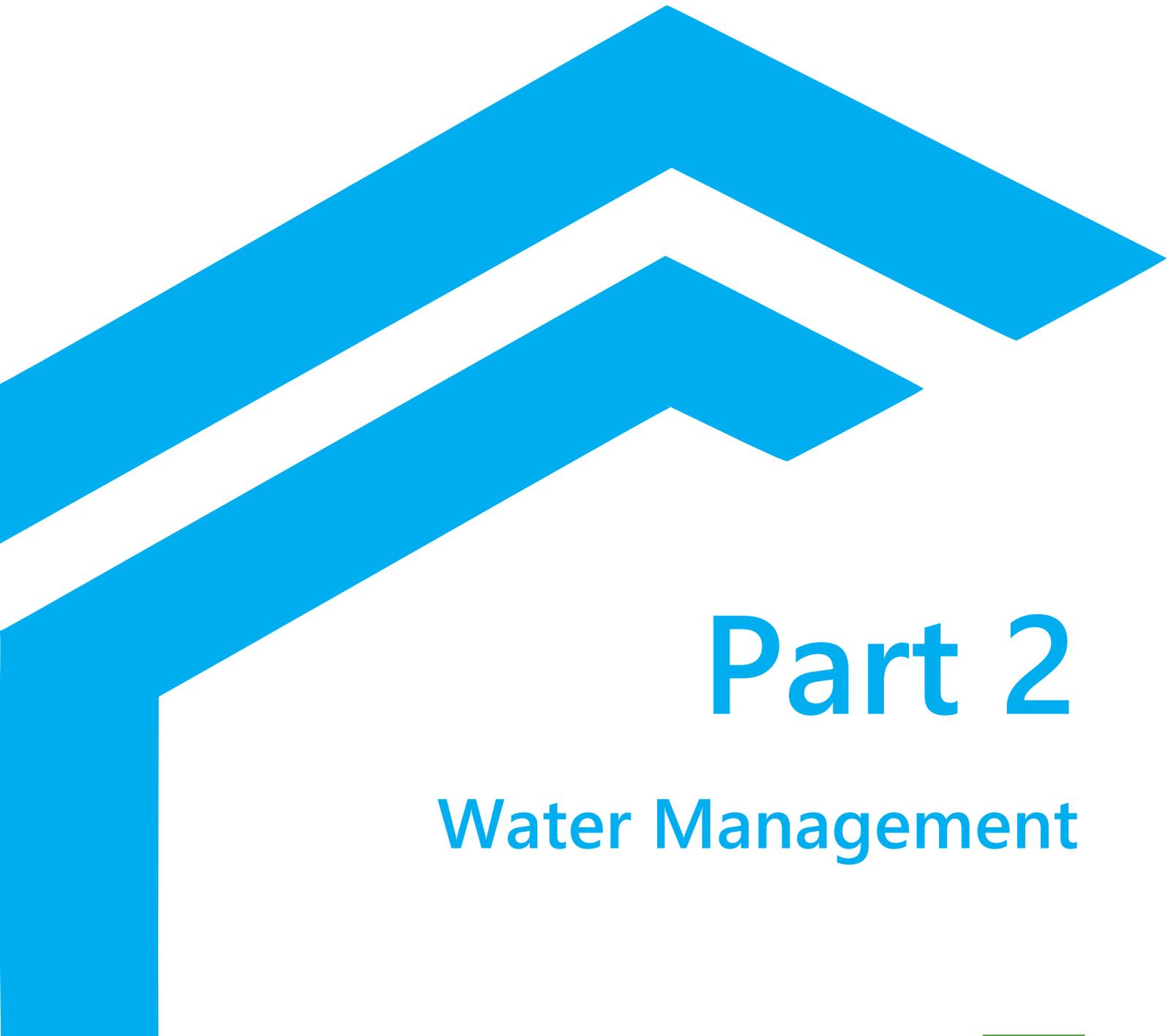
b. Provide with township level energy monitoring and automatic control systems for applicable energy consuming systems

0.5 credit for each control system (minimum of 90% coverage of the system capacity) to public facilities, such as motion or photo sensors for lighting control, etc.  
(Up to 2 credits)

c. Provide with energy management plan at design stage such as setting targets, developing measures and strategies

1 credit  
[Total 5 credits]

<b>TS 1-5 MINIMISE ENERGY CONSUMPTION DURING OFF-PEAK HOURS</b>	<b>GREENRE CREDITS</b>
<p>Design and incorporate energy optimisation plan (e.g. for night operation and weekends where there is little occupancy) to ensure only the essential energy consuming devices are running e.g. the system configuration optimised for night loads</p>	<p>1 credit</p>
<p><b>PART 1 – ENERGY EFFICIENCY CATEGORY SCORE:</b></p>	<p>Sum of GreenRE credits obtained from TS 1-1 to 1-4:  <b>30 Credits Maximum</b>  <b>[Minimum 10 credits]</b></p>



# Part 2

## Water Management



# Part 2 – Water Management

## TS 2-1 WATER EFFICIENT FITTINGS FOR INFRASTRUCTURE AND PUBLIC AMENITIES

Encourage the use of water efficient fittings covered SPAN’s Water Efficiency Products Labelling Scheme (WEPLS) or equivalent water labelling schemes.

- Basin taps and mixers
- Flushing cisterns
- Shower taps, mixers or showerheads
- Sink/ bib taps and mixers
- Urinals and urinal flush valves

## GREENRE CREDITS

Rating based on WEPLS		
Efficient	Highly Efficient	Most Efficient
1	2	4

Credits awarded based on the number and water efficiency rating of the fitting type used.

OR

Based on the water saving compared to baseline model (Not rated fitting)

- 20% - 1 credit
- 30% - 2 credits
- 40% -3 credits
- 50% - 4 credits

[Total 4 credits]

## TS 2-2 STORMWATER MANAGEMENT

Encourage the treatment of stormwater run-off before discharge to public drains

Provisions of the stormwater management features or design features as recommended in Urban Stormwater Management Manual for Malaysia (MASMA) design guidelines

Pre-requisite: For Industrial Parks / Townships, compliance with DOE requirements for discharge to public drainage to be shown.

## GREENRE CREDITS

Credits scored based on the % of runoff from impervious areas within the site

**OPTION A** – Applicable only for the whole township including public realm, infrastructure and individual land parcels.

- 10-35% = 2 credits
- 35-50% = 5 credits
- >50% = 8 credits

OR

**OPTION B** – Applicable for the whole township excluding individual land parcels.

- 25-50% = 2 credits
- 50-70% = 5 credits
- >70% = 8 credits

[Total 8 credits]

<p><b>TS 2-3 ALTERNATIVE WATER SOURCES</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Collection and use of alternative water sources for non-potable use such as irrigation, washing and water features to reduce use of potable water. Water sources can include rainwater, greywater and recycled water from approved sources.</p> <p>Credits will be pro-rated based on the effectiveness of use</p>	<p>100% of replacement using non-potable water = 4 credits</p> <p>75% of replacement using non-potable water = 3 credits</p> <p>50% of replacement using non-potable water = 2 credits</p> <p>30% of replacement using non-potable water = 1 credits</p> <p>[Total 4 credits]</p>
<p><b>TS 2-4 WATER EFFICIENT LANDSCAPING</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Reduce the water demand by selecting drought resistant plants in landscaping design</p>	<p>50% - 1 credit</p> <p>80% - 2 credits</p> <p>[Total 2 credits]</p>
<p><b>TS 2-5 WATER EFFICIENCY MANAGEMENT</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Design and incorporate water efficiency management plans to reduce the demand of water by public facilities and in common areas</p>	
<p>a. Provide the use of private water meters and leak detection system to monitor the major water usage e.g. irrigation, water features and swimming pools, etc</p>	<p>1 credit for provision of individual sub meters; 2 credits for sub-meters linked to township management system</p>
<p>b. Targets to improve public area water performance should be set. To show intent, measures and implementation strategies of water efficiency improvement plans over the next three years</p>	<p>1 credit</p> <p>[Total 3 credits]</p>
<p><b>PART 2 – WATER EFFICIENCY CATEGORY SCORE</b></p>	<p>Sum of GreenRE credits obtained from TS 2-1 to 2-5: 21 credits Maximum</p>



# Part 3

## Material and Waste Management



# Part 3 – Material and Waste Management

<b>TS 3-1 MINIMISE CUT AND FILL IN EARTHWORKS</b>	<b>GREENRE CREDITS</b>
<p>Encourage reduction in the quantity of excavated materials removed or transported into the township by optimising the use of cut and fill material removed during earthworks/ land preparation works for the township</p>	
<p>a. Reusing of at least 50% of the topsoil</p>	<p>1 credit</p>
<p>b. Reusing of at least 50% cut and fill material</p>	<p>2 credits [Total 3 credits]</p>
<b>TS 3-2 SUSTAINABLE CONSTRUCTION FOR INFRASTRUCTURE AND PUBLIC AMENITIES</b>	<b>GREENRE CREDITS</b>
<p>Encourage recycling and the adoption of designs, practices and materials that are environmentally friendly and sustainable in the construction of infrastructure and public amenities</p>	
<p>a. Use of sustainable and recycled materials</p> <ul style="list-style-type: none"> <li>Green Cements with approved industrial by-product (such as Ground Granulated Blast Furnace Slag (GGBS), silica fume, fly ash) to replace ordinary Portland Cement (OPC) by at least 10% by mass for superstructural works.</li> </ul>	<p>2 credits</p>

- Recycled Concrete Aggregates (RCA) and Washed Copper Slag (WCS) from approved sources to replace coarse and fine aggregates for concrete production of main building elements

**Note:** For structural building elements, the use of RCA and WCS shall be limited to maximum 10% replacement by mass of coarse/ fine aggregates respectively or as approved by the relevant authorities.

Extent of Coverage: The total quantity used (in tonnage) for replacement of coarse or fine aggregates must not be less than the minimum usage requirement that is

$$[0.03 \times \text{Gross Floor Area (GFA in m}^2)]$$

Quantity of RCA / WCS	Credits Allocated
≥ 0.5 times (0.5X) minimum usage requirement	1
≥ 1X minimum usage req.	2
≥ 1.5X minimum usage req.	3
≥ 2X minimum usage req.	4

(Up to 4 credits for TS 3-2(a)(i) and (a)(ii))

- b. Recycle or salvage of non-hazardous construction waste by weight

- 1 credit for 10%
- 2 credits for 20%
- 3 credits for 30%

Or

Or

- c. Recycled content in construction materials other than part TS3-2(a) that has been made from pre and/or post-consumer materials

- 2 credits for 10%
- 3 credits for 15%
- (Up to 3 credits)

**Pre-requisite Requirement:**

Minimum score under this criterion:

GreenRE Gold ≥ 3 credits

GreenRE Platinum ≥ 4 credits

[Total 7 Credits]

**TS 3-3 SUSTAINABLE PRODUCTS FOR INFRASTRUCTURE AND PUBLIC AMENITIES**

**GREENRE CREDITS**

Promote use of environmentally friendly products that are certified under by approved local certification body and are applicable to infrastructure works and public amenities (including street furniture)

Weightage based on the extent of environmental friendliness of products		
Good	Very Good	Excellent
1	1.5	2

Credits scored based on the weightage and the extent of coverage and impact

**Pre-requisite Requirement:**

Minimum score under this criterion:

GreenRE Gold  $\geq 2$  credits

GreenRE Platinum  $\geq 3$  credits

1 credit for high impact item

0.5 credit for low impact item

[Total 5 credits]

**TS 3-4 WASTE REDUCTION**

**GREENRE CREDITS**

Minimise waste generation in a sustainable manner, covering all kinds of waste including commercial waste (e.g. paper waste), construction waste, etc

1 credit for each item monitored and reduced

(Up to 2 credits)

[Total 2 credits]

**TS 3-5 WASTE MANAGEMENT AND SEGREGATION**

**GREENRE CREDITS**

Encourage waste recycling within township to reduce waste going to landfill. Promote proper disposal of waste and provide waste management infrastructures

- a. Provision of at least one recycling station at the township level dedicated to the separation, collection and storage of recyclable materials such as paper, glass, plastics and metals
- b. Provision of at least one drop-off point for potentially hazardous waste such as paints, solvents, batteries
- c. Provision of litter receptacles with integrated recycle containers at public areas (including at public amenities)
- d. Develop a community waste strategy and education programme e.g. promotional materials such as posters, circulars and provision of recycling bags to promote waste sorting, collecting and recycling of waste

1 credit for every item of requirement that is met

[Total 4 Credits]

Pre-requisite: For Industrial Parks / Townships, waste management policy for hazardous and non-hazardous waste to be implemented.

<b>TS 3-6 WASTE CONVEYANCE</b>	<b>GREENRE CREDITS</b>
<p>Reduce the negative impact on environment during waste conveyance, such as use of odourless pneumatic conveyance system, specific waste transport design to minimise the disturbance</p>	<p>1 credit for low impact applications 2 credits for high impact applications [Total 2 Credits]</p>
<b>TS 3-7 WASTE REUSE AND PROCESSING</b>	<b>GREENRE CREDITS</b>
<p>Encourage use of environmentally friendly waste processing system</p>	
<p>a. Provision of local composting (kitchen and garden wastes) /chipping facilities within the boundary of the development and / or at strategic locations. Compost should be made available to local users (building occupiers, owners, residents, maintenance firms)</p>	<p>Up to 2 credits</p>
<p>b. Use of organic waste for energy generation e.g. through bio-methanisation</p>	<p>Up to 2 credits</p>
<p>c. Waste water recycling treatment plant</p>	<p>2 credits for high impact applications, 1 credit for low impact applications [Total 4 Credits]</p>
<b>PART 3 –WASTE EFFICIENCY CATEGORY SCORE:</b>	<p>Sum of GreenRE credits obtained from TS 3-1 to 3-5: <b>27 Credits Maximum</b></p>



# Part 4

## Environmental Planning



# Part 4 – Work Place Health and Wellbeing

## TS 4-1 SELF-SUFFICIENCY AND ACCESSIBILITY WITHIN TOWNSHIP

Ensure that a diverse range of facilities needed to meet daily needs are suitably incorporated in the masterplan and can be accessed suitably to minimise vehicle trips or distance travelled. Increase the accessibility to key facilities by ensuring that they are sited in accordance to the local planning guidelines

*[In the absence of local planning guidelines, the following standards/ catchment radius shall apply:*

- *Basic Retail (e.g. Hawker centres, local shops, markets) 400m*
- *Community & Leisure Facilities (e.g. 3G exercise facilities, hardcourts, swimming pools, children's playground) 400m*
- *Health Facilities (Pharmacy / GP / Polyclinic, Dentist) 400m*
- *Educational facilities (e.g. Primary Schools, Secondary Schools excluding tertiary institutions) 800m*
- *Communal facilities (e.g. Child care centres/ pre-schools/ kindergartens, elder care centres, community centre, Resident's committee centre, public squares) 800m*
- *Employment Centres (e.g. mixed rental Offices / Light industry) 800m*
- *Residential areas (e.g. mixed income housing)*
- *Other supporting amenities (Post office, ATM, Postal box) 800m*
- *Place of worship 1000m]*
- *Hotels (only for commercial townships)*

## GREENRE CREDITS

1 credit for each facility applicable to the masterplan and easily accessible by public transport

(Up to 5 credits)

[Total 5 credits]

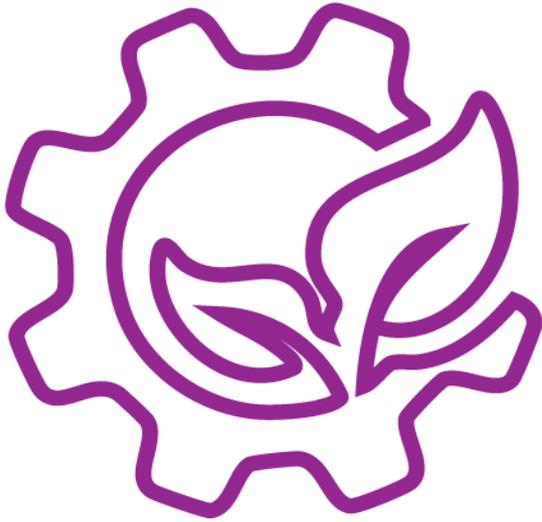
<p><b>TS 4-2 GREEN AND BLUE SPACES FOR THE PUBLIC</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Provide sufficient green and blue spaces for residents and occupants</p> <ul style="list-style-type: none"> <li>a. Parks, green spaces or water body at least 800 m<sup>2</sup> within 400m walking distance</li> <li>b. Interconnectivity of green / blue spaces for public and biodiversity</li> <li>c. Adopt native plant strategies in landscape design - must demonstrate that &gt;60 % of the trees and shrubs are native</li> </ul>	<p>1 credit for every item of requirement that is met [Total 3 Credits]</p>
<p><b>TS 4-3 MICROCLIMATE OPTIMISATION</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Promote design optimisation, including site planning and building massing, for better microclimate, such as use of natural planting and water body to optimise microclimate, through modelling and simulation, verifying by field measurements of major climate data before and after the development:</p> <ul style="list-style-type: none"> <li>• Solar analysis (sun path OR solar insolation simulation)</li> <li>• Ambient temperature simulation</li> <li>• Wind Speed</li> <li>• Wind Direction</li> </ul>	<p>1 credit each for design optimisation 1 credit each for field measurement [Total 4 Credits]</p>
<p><b>TS 4-4 OUTDOOR THERMAL ENVIRONMENT</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Encourage to use any combination of following strategies to improve the outdoor thermal comfort and reduce heat island effect</p> <ul style="list-style-type: none"> <li>a. Design and simulate to enable air flow through the development (CFD analysis or wind tunnel testing)</li> <li>b. Use of building vegetation, vegetated walls and green roofs (minimum 20% of the plot area)</li> <li>c. Street sidewalks/ pedestrian walkways shaded over 40%</li> </ul>	<p>2 credits for (a) 1 credit each for (b) to (i) (Up to 6 credits)</p>

- d. Provide shade for open structures such as covered walkways, vine pergolas > 50%
- e. Use of permeable paving materials with Solar Reflectance Index (SRI) > 29 for at least 50% of the hardscape area (Gravel and wood chippings also encouraged to hardscape areas)
- f. Open grid pavement system (at least 50% pervious) for pedestrian paths at green spaces > 40%
- g. Provide shading for open air carparks > 50%
- h. Avoid building heat exhaust to pedestrian walkways - Exhausts if fronting the public realm must be >5m above pedestrian walkways
- i. Any other suitable strategy

TS 4-5 SITE SELECTION	GREENRE CREDITS
a. Avoid use of land with high agricultural or ecological value.	1 credit for (a) (at least 90% of the township area)
b. Use of brownfield sites or reclaimed land, reducing the use of greenfield sites	For (b) Area of site which is previously built-on: 100% - 1 credit 50% - 0.5 credit
c. Proper remediation measures carried out on contaminated land to restore the land for use	1 credit for (c)
d. Flood risk assessment – demonstrate that the buildings are located in an area of low probability of flooding OR the development is appropriately flood resilient and resistant including safe access and escape routes	2 credits if 100% of buildings are in an area of low probability of flooding / non-flood plain, OR demonstrates flood mitigation and escape routes 1 credit for 75% of buildings 0.5 credit for 50% of buildings [Total 5 Credits]
<p><i>Notes:</i></p> <ul style="list-style-type: none"> <li>• <i>There must be no vulnerable building uses in the flood plain area such as emergency dispersal depots (police, fire, ambulance), or installations holding, using or containing hazardous substances.</i></li> <li>• <i>Infrastructure and services planning for overall platform levels, roads, drainage and sewerage must be demonstrated.</i></li> </ul>	

<p><b>TS 4-6 CONSERVATION AND INTEGRATION OF EXISTING STRUCTURES AND ASSETS</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Conservation, preservation or restoration of historic remains, or buildings, or natural spaces or views that characterise and have local or community importance</p> <p><i>Note: Gazetted buildings will not be included.</i></p>	<p>1 credit [Total 1 Credit]</p>
<p><b>TS 4-7 HABITAT CONSERVATION &amp; RESTORATION</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Determine the ecological value of the habitats in and around the site in order to conserve and enhance the biodiversity and prevent deforestation</p>	
<p>a. Conduct an Environmental Impact Assessment or Biodiversity Impact Assessment to identify habitats, migration routes and potential damage from the development, including justification of developmental benefits versus the potential ecological losses and mitigation measures</p>	<p>2 credits for (a)</p>
<p>b. Species protection plan or plans to increase the local species diversity</p>	<p>1 credit for (b)</p>
<p>c. Prevent the loss of greenery in the township: Greenery area to be calculated on plan before and after project construction.</p>	<p>Part (c) No change – 1 credit 5% GnP improvement 2 credits 10% GnP improvement 4 credits [Total 7 Credits]</p>
<p><b>TS 4-8 MINIMISE SITE DISTURBANCE</b></p>	<p><b>GREENRE CREDITS</b></p>
<p>Minimise negative impact on the site environment by constraining construction activities.</p> <p>Reduce site clearance and deforestation by conserving at least 20% of the mature trees (Transplanting may be considered)</p>	<p>2 credits [Total 2 Credits]</p>

<b>TS 4-9 ENVIRONMENTAL MANAGEMENT SYSTEM</b>	<b>GREENRE CREDITS</b>
<p>Encourage the planning, design and management integration to adopt an environmentally friendly management system and practices during development</p>	
<p>a. Conduct site analysis and assessment before township development</p>	<p>1 credit</p>
<p>b. Developer, master planner, and major contractor that are ISO 14000 certified</p>	<p>0.5 credit for each party (up to 2 credits)</p>
<p>c. Project team comprises one Certified GreenRE Accredited Professional (GreenREAP)</p>	<p>1.0 credit for GreenREAP</p>
<p>d. Environmental policy with measurable targets &amp; programmes with management review and corrective action records</p>	<p>1 credit</p>
<p>e. For Industrial Parks / Townships, implementation of Pollution Control Plan</p>	<p>1 credit [Total 6 Credits]</p>
<b>TS 4-10 ENVIRONMENTAL MANAGEMENT SYSTEM</b>	<b>GREENRE CREDITS</b>
<p>To actively encourage the future adaptability and flexibility of the site, including expansion</p> <p>Suitable design features have been specified to allow for future installation including:</p> <p>a. Utilities expansion and distribution upgrades (Gas, electricity, water, cooling)</p> <p>b. Transport and infrastructure expansion plans</p> <p>c. Others</p>	<p>1 credit for showing potential of expansion for utilities expansion and distribution.</p> <p>1 credit for demonstration that other elements have been considered.</p> <p>[Total 2 Credits]</p>
<b>PART 4 –ENVIRONMENTAL PROTECTION CATEGORY SCORE:</b>	<p>Sum of GreenRE credits obtained from TS 4-1 to 4-10: <b>42 Credits Maximum</b></p>



# Part 5

Green Buildings and  
Green Transport



# Part 5 – Green Buildings and Green Transport

## TS 5-1 GREEN BUILDINGS WITHIN TOWNSHIP

Encourage the adoption of green building practices in building design, construction and retrofitting within the township (includes buildings assessed under GreenRE for New Developments and GreenRE for Existing Buildings)

Applies to balance of building GFA above pre-requisite.

*Pre-requisite Requirement:*

At least 10% by GFA of buildings in the township or 5,000 sqm (whichever is higher) to achieve the corresponding GreenRE rating.

GreenRE Township Rating	Minimum 10% by GFA of buildings in the township or 5,000 sqm (whichever is higher) to achieve corresponding GreenRE rating
GreenRE Bronze	GreenRE Bronze
GreenRE Silver	GreenRE Silver
GreenRE Gold	GreenRE Gold
GreenRE Platinum	GreenRE Platinum

## GREENRE CREDITS

GreenRE Building Credits (GRBc)

GRB Award Level	Weightage	GRBC = Weightage*GFA percentage %
Platinum	0.20	C1 = 0.20* % GFA of GreenRE Platinum buildings
Gold	0.15	C2 = 0.15* % GFA of GreenRE Gold buildings
Silver	0.10	C3 = 0.10* % GFA of GreenRE Silver buildings
Total	GRBP = C1 + C2 + C3	

[Total 20 credits]

## TS 5-2 GREEN URBAN DESIGN GUIDELINES

Formulation of green urban design guidelines to ensure that key green features at the township level are carried through to development at the individual parcel level

## GREENRE CREDITS

a. For all land parcels in the township

4 credits

b. For all land parcels to be sold to other sub-developers

2 credits

c. For strategic land parcels to be sold to other sub-developers

1 credit

[Total 4 Credits]

## TS 5-3 GREEN TRANSPORT WITHIN TOWNSHIP

## GREENRE CREDITS

### General:

- a. Conduct Traffic Modelling for the township to assess and make improvements to the township master plan
- b. Compact and walkable township pattern for master plan; major building entrances with good access to nearest LRT or bus stops in accordance to local planning guidelines or within a 500m walking distance, with sheltered and connected linkage.

2 credits for (a)

Part (b) will be assessed at Masterplan level to determine the overall efficiency of the township, up to 2 credits.

1 Credit for each Item (c) to (l)

(Up to 7 Credits)

[Total 11 Credits]

### Public Transport:

- c. Transit options connecting outwards from the main LRT nodes
- d. Provide dedicated shuttle services and facilities to mass transit

### Bicycle:

Promote cycling as a real alternative to cars for shorter journeys

- e. Network of bicycle lanes and routes that are safe, well-lit and segregated with direct links to key areas and routes
- f. Provision for secure and sheltered bicycle facilities to public amenities

### Car Parking:

- g. Reduce carpark footprint by employing underground or multi-storey carpark etc.
- h. > 10% of open-air parking spaces can be designated for flexible use when not being used for parking, e.g. market stalls, play areas
- i. Provide hybrid / electric vehicle refuelling / recharge stations

Pedestrian:

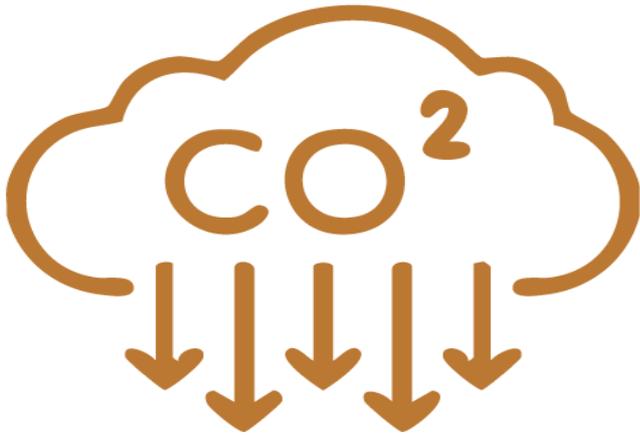
- j. Universal design features (barrier-free accessibility) to improve the accessibility for the physically challenged
- k. Way finding strategies

Cargo Delivery Route and Proximity

- l. Accessible from major highway outlets and /or within proximity to major cargo services (i.e airport, seaport, railway station). Project to be within 10km of these facilities

**PART 5 – OTHER GREEN BUILDINGS AND GREEN TRANSPORT CATEGORY SCORE:**

Sum of GreenRE credits obtained from TS 5-1 to 5-3:  
**36 Credits Maximum**



# Part 6

Community and  
Innovation



# Part 6 – Carbon Emission of Development

<b>TS 6-1 STAKEHOLDER ENGAGEMENT, FEEDBACK AND EVALUATION</b>	<b>GREENRE CREDITS</b>
<p>a. Conduct residents/ building occupants' satisfaction survey or engage in public consultation exercise to solicit feedback to enhance the quality of the living environment in common facilities / public amenities. Alternatively, provide effective feedback channels (e.g. hotlines, emails, etc) for residents to take ownership of the township</p> <ul style="list-style-type: none"> <li>• At Design Phase</li> <li>• During construction / Post completion</li> </ul>	<p>a. 1 credit for consultation with stakeholders during construction / post completion (based on extent of consultation and community involvement)</p>
<p>b. Public consultation / feedback sessions to include the following key stakeholders:</p> <ul style="list-style-type: none"> <li>• Public sector / government agencies</li> <li>• Community / residents committee</li> <li>• NGOs</li> <li>• Professional bodies</li> <li>• Trade unions</li> </ul>	<p>b. 1 credit for consultation of at least two key stakeholder group</p>
<p>c. Provide a proper evaluation of the feedback / survey</p>	<p>c. 1 credit for providing proper evaluation of feedback/ survey findings</p>
<p>d. Release of findings and feedback received from the public consultation exercise or residents/ building occupants survey, including the list of follow-up actions taken</p>	<p>d. 1 credit for release of findings and feedback received. Additional 2 credits for addressing follow-up actions</p> <p style="text-align: right;">[Total 6 Credits]</p>

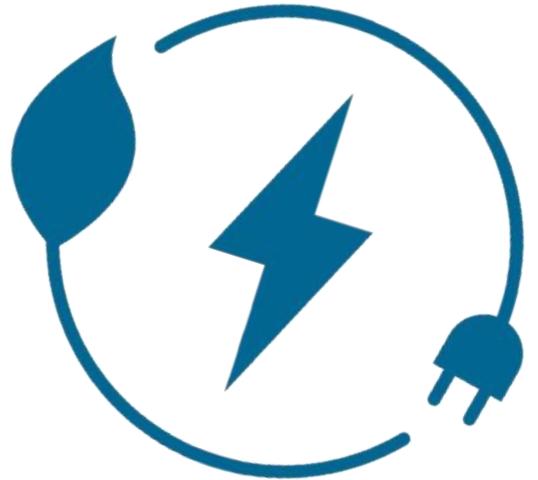
<b>TS 6-2 PUBLIC AWARENESS, EDUCATION AND COMMUNITY INVOLVEMENT</b>	<b>GREENRE CREDITS</b>
<p>To encourage and promote sustainable lifestyle and integration within the township through the production of a dedicated outreach or education programme to increase public awareness on environmental sustainability and green features of the township</p> <p>a. User guide brochures, information portals and facilities (such as visitor centres and exhibits) should be provided where appropriate to facilitate public awareness and education.</p> <p>These areas may include:</p> <ul style="list-style-type: none"> <li>• Online energy efficiency and energy tracker</li> <li>• Refuse collection</li> <li>• Recycling facilities</li> <li>• Water conservation and usage</li> <li>• Environmental technologies and info</li> <li>• Local transport information</li> <li>• Local amenities and local information</li> <li>• Community groups and activities</li> <li>• Religious building locations</li> <li>• Biodiversity of the area</li> </ul> <p>b. Encourage residents/ building occupants to participate in green activities</p>	<p>Up to 2 credits can be scored based on extent of outreach or education programmes and contents.</p> <p>2 credits for at least 1 activity per year            Additional 1 credit for each additional green activity organised per year            (Up to 3 credits)            [Total 7 Credits]</p>
<b>TS 6-3 GREEN LEASE</b>	<b>GREENRE CREDITS</b>
<p>Master developer to encourage green lease as an alternative to regular economic rental models within the township.</p>	<p>2 credits            [Total 2 Credits]</p>

<b>TS 6-4 INTELLIGENT INFRASTRUCTURE</b>	<b>GREENRE CREDITS</b>
<p>a. Provide easy access to high-speed communications infrastructure (digital, fibre optic, etc) and provisions to allow for future growth and maintenance</p>	<p>2 credits</p>
<p>b. Provision of public access to intelligent transport information, including transit routes and schedules, carparking lot availability, amenities nearby, etc. so as to reduce the transport demand</p>	<p>1 credit [Total 3 Credits]</p>
<b>TS 6-5 SAFE ENVIRONMENT</b>	<b>GREENRE CREDITS</b>
<p>Design for good natural surveillance of public spaces</p>	<p>1 credit [Total 1 Credit]</p>
<b>TS 6-6 LIGHT POLLUTION REDUCTION</b>	<b>GREENRE CREDITS</b>
<p>Minimise light trespass from site, only light areas as required for safety and comfort</p>	<p>2 credits [Total 2 Credits]</p>
<b>TS 6-7 OTHER GREEN FEATURES AND INNOVATION</b>	<b>GREENRE CREDITS</b>
<p>Encourage the use of other green features which are innovative and have positive environmental Impact</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>• Dedicated bus and tram lanes on public roads</li> <li>• Car-free township</li> <li>• Use of pre-cast / pre-fabricated construction materials for infrastructure and public amenities</li> <li>• Common services tunnel</li> <li>• Adoption of local labour to ensure economic sustainability</li> </ul>	<p>2 credits for each high impact item 1 credit for each low impact item (Up to 5 credits) [Total 5 Credits]</p>

<b>TS 6-8 OPERATIONAL &amp; EMBODIED CARBON CALCULATION</b>	<b>GREENRE CREDITS</b>
<p>a. Recognise the carbon emission based on operational carbon footprint computation of the building comprising energy [B6] and water consumption [B7].</p>	<p>1 credit</p>
<p>b. Calculation of product stage embodied carbon based on following building materials [A1-A3]:</p> <ul style="list-style-type: none"> <li>• concrete</li> <li>• steel</li> <li>• bricks</li> <li>• cement</li> <li>• Metal / Aluminium</li> </ul>	<p>0.5 credit</p>
<p>c. Calculation of construction stage embodied carbon [A4-A5]</p>	<p>0.5 credit</p>
<p>d. Reduction from reference embodied carbon (for Ready Mix Concrete, Cement, Steel Reinforcement, Bricks, Metal / Aluminium)</p>	<p>&gt;10% 0.5 credit &gt;30% 1 credit (Up to 3 credits)</p>
<p><b>Part 6 – COMMUNITY AND INNOVATION CATEGORY SCORE:</b></p>	<p>Sum of GreenRE credits obtained from TS 6-1 to 6-8 <b>29 Credits Maximum</b></p>

# Energy Related Requirements

## Part 1 – Energy Efficiency



**TS 1-1 Energy Efficiency for Infrastructure and Public Amenities**

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**TS 1-2 On-site Energy Generation**

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**TS 1-3 Site Planning and Building Orientation**

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**TS 1-4 Energy Management System**

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**TS 1-5 Minimise Energy Consumption during Off-Peak Hours**

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## TS 1-1 ENERGY EFFICIENCY FOR INFRASTRUCTURE AND PUBLIC AMENITIES



### OBJECTIVES

Site wide energy modelling or calculation to include energy demand and operating carbon emission of project baseline and proposed design



### APPLICABILITY

Applicable to all infrastructure and public amenities in the township manage by the management (exclude authority scope). The mechanical and electrical system to be included (but not limited to) the following:

- a. Street lighting / landscape lighting / carpark lighting / electric signage
- b. Water pumps
- c. Mechanical Fans
- d. Lifts / Escalators

All public amenities and infrastructure to exclude authority scope.



### BASELINE STANDARD

As specified in the MS1525: 2019



### REQUIREMENTS

- a. 0.15 credits for every percentage of saving over the total energy consumption for infrastructure and public amenities (Excludes energy consumption for those under GreenRE for Buildings)

Credits awarded =  $0.15 \times (\% \text{ improvement})$

(Up to 8 credits)



## PREREQUISITE REQUIREMENTS

- Minimum System Efficiency and Energy Monitoring (if using District Cooling System)
- Where District Cooling System is being utilised in the township, the total system (chilled water plant) efficiency must achieve a minimum of 0.8 kW/RT for GreenRE Silver, Gold and Platinum awards.
- Permanent instrumentation for monitoring of the township cooling system efficiency to be provided in accordance with the following requirement:
- The installed instrumentation shall have the capability to calculate resultant plant efficiency (i.e. kW/RT) within 5% of its true value and in accordance with ASHRAE Guide 22 and AHRI 550/590.
- The location and installation of the measuring devices to meet the manufacturer's recommendation.
- Data acquisition system to have a minimum resolution of 16 bit.
- All data logging with capability to trend at 1 minute sampling time interval.
- Flow meters to be provided for chilled-water and condenser water loop and shall be of ultrasonic / full bore magnetic type or equivalent.
- Temperature sensors with minimum accuracy of  $\pm 0.05$  °C at 0 °C. All thermo-wells shall be installed in a manner which ensures that the sensors can be in direct contact with fluid flow. Provisions shall be made for each temperature measurement location to have two spare thermo-wells located at both sides of the temperature sensor for verification of measurement accuracy.
- Annual submission of building energy consumption data and operating system efficiency of the district cooling system to GreenRE.



## DOCUMENTARY EVIDENCES

### **Energy Improvement**

- Extracts of tender specification showing provision of related mechanical & electrical features, relevant chiller system & its permanent monitoring instrumentation.
- Detailed calculations of the overall improvement in equipment/system efficiency of the air-conditioning plants, street lighting/landscape lighting, water pumps, mechanical fans and lift / escalator.
- All related layout and schematic drawings for air-conditioned system, lighting, water pumps, mechanical fans and lift / escalator.

- Calculation of the Energy Efficiency Index (EEI) using the pre-determined daily usage pattern and in the prescribed tabulated format.
- Detail calculation including operation hours for the estimated energy load for each component in the building etc.: lighting, air conditioning system, pump, receptacle load.
- Technical product information on the energy efficient features.



## REFERENCES

- MS1525: 2019 - Energy Efficiency and Use of Renewable Energy for Non-Residential building – Code of Practice
- Local Planning guideline



## WORK EXAMPLE

Background Info:

System / Equipment	Total Design Annual Township Electricity Consumption (kWh)/year	Total Baseline Annual Township Electricity Consumption (kWh)/year
Lighting (Public Spaces)	3,094,380	5,341,392
Lighting (Street lighting)	236,321	314,822
Exterior Lighting	405,800	560,713
Air-conditioned Plant	7,924,425	8,990,361
Air System Fans	632,293	735,980
Mechanical Ventilation Fans	207,571	220,173
Lifts	792,966	801,368
Escalators	45,865	46,117
Receptacle Equipment *(16W/m <sup>2</sup> )	3,936,517	3,936,517
Domestic Water Pump Systems	226,088	248,932
Hot Water Systems	93,789	102,810
Others	-	-
Total:	17,596,015	21,299,185

Table TS 1-1.1: Total Township Electricity Consumption per year

## TS 1-2 ON-SITE ENERGY GENERATION



### OBJECTIVES

Encourage the onsite generation of energy for self-supply in the common area of the township



### APPLICABILITY

Applicable to common area or public infrastructure



### REQUIREMENTS

Up to 6 credits scored for replacement of electricity (based on total annual township energy consumption) by systems:

- a. Energy generation by efficient combined system such as co-generation, tri generation and etc
- b. Generation of renewable energy
- c. Energy recovery or regeneration

% Replacement of electricity (based on total annual township energy consumption)	Credits
10%	2
15%	4
>20%	6



## DOCUMENTARY EVIDENCES

- Summary brief on the target on-site energy generation for the approved Masterplan.
- Calculation of percentage replacement of electricity (based on total annual township energy consumption) by systems.
- Architectural plan showing location of on-site generation / renewable energy system & extent of its implementation on Approved Masterplan.
- Technical product information of on-site generation / renewable energy system if applicable.



## WORKED EXAMPLE

Background Info:

The township providing solar panel as on-site energy generation. Solar specific yield is 1316.9 kWh/kWp/yr based on solar simulation result.

Total township energy consumption:

System / Equipment	Total Annual Township Electricity Consumption (kWh)/year	Baseline
Lighting (Public Spaces)	3,094,380	5,341,392
Lighting (Street lighting)	236,321	314,822
Exterior Lighting	405,800	560,713
Air-conditioned Plant	7,924,425	8,990,361
Air System Fans	632,293	735,980
Mechanical Ventilation Fans	207,571	220,173
Lifts	792,966	801,368
Escalators	45,865	46,117
Receptacle Equipment *(16W/m <sup>2</sup> )	3,936,517	3,936,517
Domestic Water Pump Systems	226,088	248,932
Hot Water Systems	93,789	102,810
Others	-	-
Total:	17,596,015	21,299,185

Table TS 1-2.1: Total Township Electricity Consumption per year

<b>PV capacity specified</b>	1750.00	kWp
<b>Annual specific yield</b>	1316.9	kWh/kWp/yr
<b>Annual renewable energy generated</b>	405605.2	kWh/yr
<b>Percentage energy replacement</b>	13	%

*Table TS 1-2.2: Percentage Replacement of Electricity (based on total annual township energy consumption):*

Credit claimed: 2 credits



## TS 1-3 SITE PLANNING AND BUILDING ORIENTATION



### OBJECTIVES

Minimise the heat gain/loss by use of passive solar strategies to reduce the energy demand



### APPLICABILITY

Applicable to the whole building in the township



### REQUIREMENTS

- a. 50% or more of the plot have one axis within plus minus 22.5 degree of geographical north / south, and north / south length is at least as long or longer than the east / west length

#### (a) Plot coverage

0.1 credit for every percentage improvement in the plot coverage

Credits awarded =  $0.1 \times (\% \text{ improvement})$

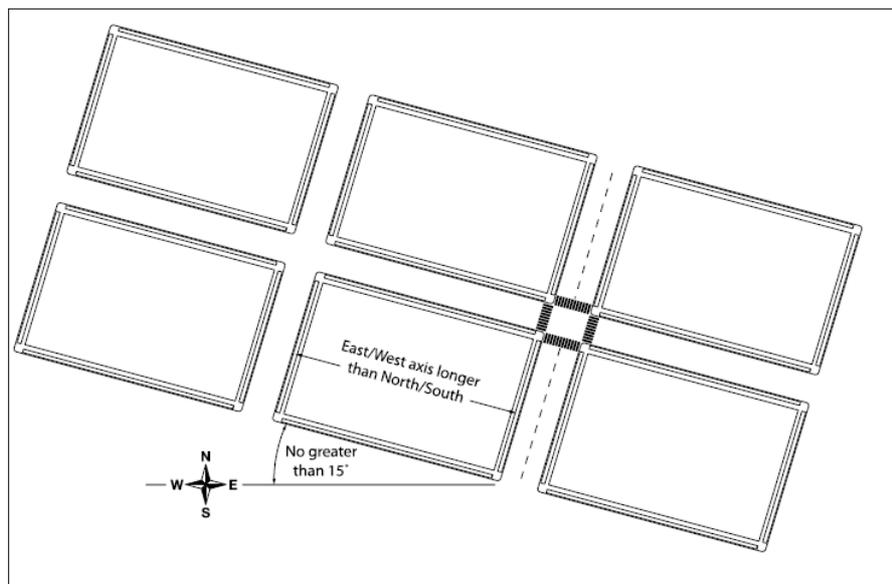


Figure 1. Solar-oriented plot with east-west lengths equal to or greater than north-south lengths, and east-west axis within 15 degrees of geographic east-west

Or

b. 50% or more of the project building GFA have one axis of each building is at least 1.5 times longer than the other, and the longer axis is within 22.5 degrees of geographical north / south axis.

(b) GFA coverage

0.15 credit for every percentage improvement in the GFA coverage

Credits awarded = 0.15 x (% improvement)

(Up to 4 credits)

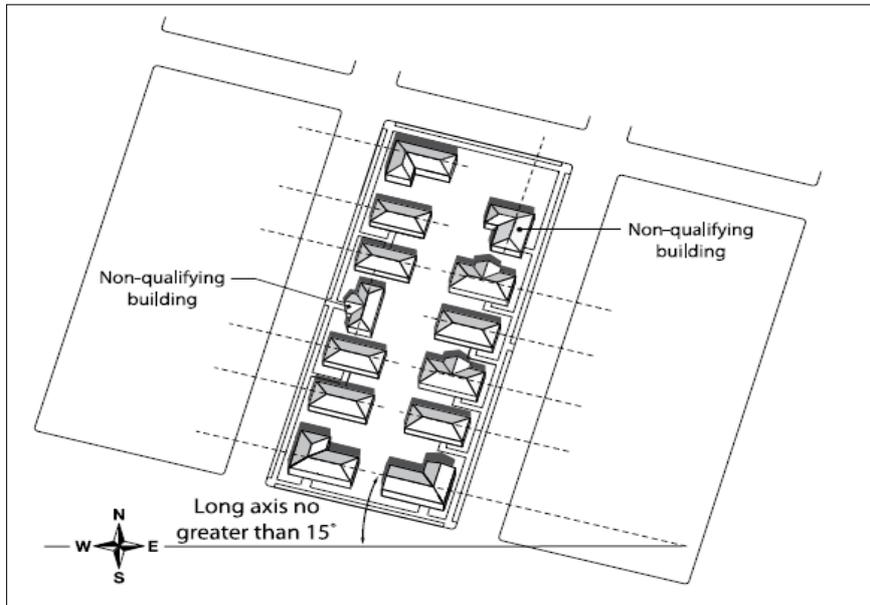


Figure 2. Solar-oriented building plot with east-west lengths equal to or greater than north-south lengths, and east-west axis within 15 degrees of geographic east-west

c. 2 credits for reduction of the window area of the west facing elevation of buildings, or application of inter block shading strategies to west / east facing facades by at least 50%

The building must comply with the Window Wall Ratio less than 0.5 at the East and West Façade or minimise west facing façade by having inter block strategies for East and West facing facade. Where, the design of building not there, to incorporate in the Urban Design Guideline (UDG)

The requirement calculated by the % of number of the building in the township

50% - 1 credit

90% - 2 credits

d. 2 credits for proper planning of buildings layout and massing to avoid blocking prevailing wind

Proof with the wind simulation study before and after the development and incorporate in the UDG with recommended building characteristic to minimize disruption to prevailing wind

The requirement calculated by the % of number of the building in the township.

50% - 1 credit

90% - 2 credit

e. 2 credits for provision of natural ventilation and day-lighting for common area in the public building. At least more than 80% of applicable space.



## DOCUMENTARY EVIDENCES

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- Architectural plan detailing plot or building orientation to required axis, supported by calculation on potential percentage improvement.
- All elevation drawing showing area of façade, supported by calculation detailing percentage of reduction in west facing façade.
- Report or any documentation which includes proposed planning, strategy and implementation of building layout and massing to avoid blocking prevailing wind.
- Architectural plan showing location of natural ventilation & day lighting for public spaces supported by calculation on its extent of coverage.



## REFERENCES

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MS 1525:2019 –Energy Efficiency and Use of Renewable Energy for Non Residential Building - Code of Practice



## TS 1-4 ENERGY MANAGEMENT SYSTEM



### OBJECTIVES

Design and incorporate energy monitoring and/or control system to facilitate energy consumption monitoring and management for public facilities.



### APPLICABILITY

All public amenities and infrastructure.



### REQUIREMENTS

- a. 2 credits for provision of sub-metering with remote metering capability for sub-systems > 15 kW or with electric loads > 100 kVA
- b. Up to 2 credits can be scored for provision of the energy level monitoring and automatic control system for applicable energy consuming system. 0.5 credit for each control with at least 90% coverage of the system capacity
- c. 1 credit can be scored with provision with energy management plan at design stage such as setting target, developing measures and strategies



### DOCUMENTARY EVIDENCES

- Extract of tender specification plan showing location & area of coverage of sub meter/ automatic control system.
- Schematic drawing showing the provision of the submeter comply to the requirement
- All related drawings showing the compliance to energy management system.
- Technical product information on sub meter, remote metering system, automatic control system and all applicable features.
- Calculation on the extent of coverage for each control system.
- Provision of energy management plan at design stage.



**WORKED EXAMPLES**

Type of energy monitoring and automatic control system	Function	Coverage area (%)	Credit score
Energy Management and Control System (EMCS)	Metering, monitoring, and interactive control	All street lighting, public spaces, clubhouse, guardhouse	0.5
Digital power meter with timer	Metering and control	All landscape lighting	0.5
<b>Total Credit</b>			<b>1</b>

*Table TS 1-4.1: Provision of the Monitoring and Control System Coverage*



## TS 1-5 MINIMISE ENERGY CONSUMPTION DURING OFF-PEAK HOURS



### OBJECTIVES

Design and incorporate energy optimisation plan to ensure only the essential energy consuming devices are running.



### APPLICABILITY

All public amenities and infrastructure.



### REQUIREMENTS

1 credit can be scored with the provision of the energy optimisation plan to ensure only the essential energy consuming device are running such as scheduled sensor on the street lighting



### DOCUMENTARY EVIDENCES

- Provision for energy optimization plan detailing strategy and its implementation.
- Calculation on potential saving from baseline on said energy optimization plan.
- Proof of evidence showing the optimisation plan been implemented during actual operation of the township.



### REFERENCES

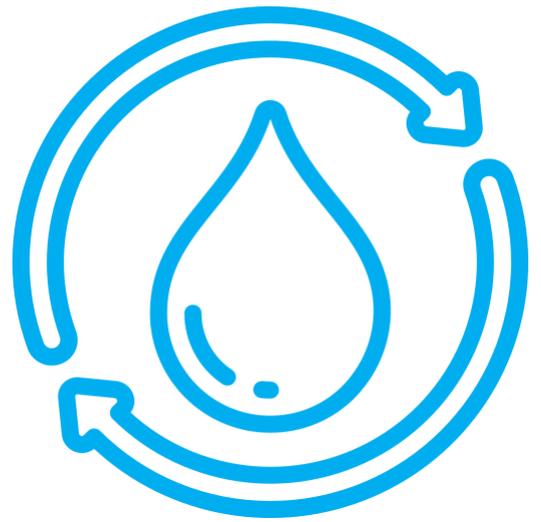
Sample Calculation on potential saving based on the energy optimization plan in township:

Type of energy optimization	Total energy consumption without the system (kWh/year)	Total energy consumption with the system (kWh/year)	% of savings
Occupancy sensor	477,411.46	405,800	15%

Table TS 1-5.1: Calculation of potential saving

# Other Green Requirements

## Part 2 – Water Management



**TS 2-1 Water Efficient Fittings  
for Infrastructure and Public Amenities**

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**TS 2-2 Stormwater Management**

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**TS 2-3 Alternative Water Sources**

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**TS 2-4 Water Efficient Landscaping**

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**TS 2-5 Water Efficiency Management**

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# TS 2-1 WATER EFFICIENT FITTINGS FOR INFRASTRUCTURE AND PUBLIC AMENITIES



## OBJECTIVES

Reduce to use of potable water by using water efficient fittings covered under the Water Efficiency Products Labelling Scheme (WEPLS) or Water Efficiency Labelling Scheme (WELS).



## APPLICABILITY

Within Township and Public Amenities such as follows and not limited to:

- Public toilets in garden/landscape/recreational park area
- Guardhouses
- Clubhouse
- Sales Gallery
- Recreational Park etc



## BASELINE STANDARD

As specified under Water Efficiency Products Labelling Scheme (WEPLS)



## REQUIREMENTS

a. Up to 6 credits can be scored based on the number and water efficiency rating of the fitting type used;

Rating based on WELS /WEPLS		
Efficient	Highly Efficient	Most Efficient
1	2	4

Or

b. Up to 4 credits can be scored based on the water saving compared to baseline model (not rated fitting)

20% - 1 credit

30% - 2 credits

40% -3 credits

50% - 4 credits

Baseline flow rate for the fittings as follow:

	Fittings Type	Flowrate
1	Water Closet	6 litre/ flush
2	Urinal	6 litre / flush
3	Sink / Basin Tap	8 litre / minute
4	Bib Tap	8 litre / minute
5	Shower Tap	10 litre / minute
6	Kitchen Sink	8.33 litre / minute
7	Ablution Tap	8.00 litre / minute



## DOCUMENTARY EVIDENCES

- Extracts of the tender specification showing all the water fitting provisions for the development.
- Water fitting schedules showing the numbers, types and the approved rating of the proposed fittings in the prescribed tabulated format shown in the Table 2-1.1.
- Schematic drawing of cold water and sanitary plumbing.
- WEPLS product specification or certificate. In the event no product recognition from WEPLS, product catalogue and test report from local or international body that equivalent to the SIRIM standard of testing is required.
- Water saving calculation based on comparison with not rated water fittings using the GreenRE Water Calculator



## REFERENCES

For more information about WEPLS, refer to

[http://www.span.gov.my/index.php?option=com\\_content&view=article&id=580%3Aabout-us1&catid=175%3Awepls&Itemid=457&lang=en](http://www.span.gov.my/index.php?option=com_content&view=article&id=580%3Aabout-us1&catid=175%3Awepls&Itemid=457&lang=en)



## WORKED EXAMPLE

Example of a water fitting schedule showing the numbers, types and the approved rating of the proposed fitting for an office interior as in Table 2-1.1

Ref.	Water Fitting Type	WEPLS rating			Not Rated	Total
		Efficient	Highly Efficient	Most Efficient		
1	Shower taps and mixers	0	45	0	0	45
2	Basin taps and mixers	0	0	55	0	55
3	Sink/bib taps and mixers	0	70	0	0	70
4	Flushing cisterns	0	0	50	0	50
5	Others - Urinals	0	0	0	5	5
Total no. based on rating (A)		0	115	105	5	$\sum A = 225$
Weightage (B)		1	2	4	0	
Total (A x B)		0	230	420	0	$\sum(AxB) = 650$

Table TS 2-1.1: Computation of the percentage of water fittings for clubhouse

$$\begin{aligned}
 \text{Credits scored} &= \sum (A \times B) / \sum A \\
 &= 650 / 225 \\
 &= \underline{2.89 \text{ credits}}
 \end{aligned}$$

## TS 2-2 STORMWATER MANAGEMENT



### OBJECTIVES

Encourage the treatment of stormwater runoff through provision of infiltration or design features before discharge to public drains



### APPLICABILITY

Generally applicable for whole plot/phases in the township



### BASELINE STANDARD

Urban Storm Water Management (MSMA) or/and Department of Environment (DOE) requirement



### REQUIREMENTS

Up to 8 credits scored based on the % of runoff from impervious areas within the site

**OPTION A** – Applicable only for the whole township including public realm, infrastructure and individual land parcels.

10 - 35% = 2 credits

35 - 50% = 5 credits

>50% = 8 credits

**OR**

**OPTION B** – Applicable for the whole township excluding individual land parcels.

25 - 50% = 2 credits

50 - 70% = 5 credits

>70% = 8 credits

**Note:**

1. The treatment of stormwater runoff shall be through provision of infiltration or design features as recommended in Urban Storm Water Management (MSMA).
2. For Industrial Park , to show the requirement of the water discharge to the public drain comply with DOE requirement.

**DOCUMENTARY EVIDENCES**

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- Urban Storm Water Management (MSMA) report showing reduction of post development stormwater peak discharge rate and quantity from exceeding pre-development peak discharge rate and quantity.
- Drainage plan, schematic plan, location plan and details of water features such as the specification of filtration layer, transition layer and drainage layer, sub-soil drainage system, overflow arrangement, plant list etc.

**REFERENCES**

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MSMA – Urban Storm Water Management



## TS 2-3 ALTERNATIVE WATER SOURCES



### OBJECTIVES

Reduce potable water consumption by provision of suitable systems that utilizes rainwater or recycled water for landscape irrigation, general cleaning, flushing toilets and water features.



### APPLICABILITY

Applicable within township development and Public Amenities such as follows:

- Public toilets in garden/landscape/recreational park area
- Guardhouses
- Clubhouse
- Sales Gallery
- Recreational Park



### REQUIREMENTS

Up to 4 credits will be awarded based on the % reduction in total potable water usage of the applicable uses as follows:

% of replacement	Credits
100%	4 credits
≥ 75%	3 credits
≥ 50%	2 credits
≥ 30%	1 credit

Replacement water sources can include rainwater, grey water, ponds within the township boundary and recycled water from approved sources

For rainwater harvesting tank provision, RWHT to be sized in accordance to Guideline for Rainwater Harvesting and Utilisation System (SPAH) and MSMA guidelines. The rainwater tanks are to be optimally sized to cater for outdoor water use only



## DOCUMENTARY EVIDENCES

- Extracts of the tender specification showing how the non-potable water source will be provided.
- Relevant drawings showing the location and design of non-potable water source.
- Calculation showing the percentage of potable water saved for irrigation system.
- Details of the recycled water system.
- Schematic system showing the recycling system

Note: Water calculation template can be download in GreenRE website



## REFERENCES

1. Manual Saliran Mesra Alam Malaysia (MSMA) (2000), Ministry of Natural Resources and Environment
2. "Rainwater – Guideline for Installing A Rainwater Collection and Utilization System",KPKT (1999)
3. "Rainwater Harvesting – Guidebook Planning and Design" Department of Irrigation and Drainage, Ministry of Natural Resources and Environment.

### **Roof Catchment**

Type	m2	Run-off coefficient
Pitched Tile		0.8
Steel Roof	1239	0.9
RC Roof	1110	0.5
Block Pavement		0.7
Gravel Roadway		0.3

Total Catchment Area (m<sup>2</sup>) = 2349

Catchment Area x Run -off coefficient = 1670.1

Type Of System	First Flush System
Equation	Collectible Rainwater = Rainfall x Catchment Area x Run Off Coefficient - (Total Catchment Area x First Flush Diversion)
First Flush Diversion (L/sqm)	1
Tank Size (L)	160,000.00
Total Annual Collected Rain Water (L)	3,880,633.50
Average Daily Collected Rain Water (L)	10,631.87
Irrigation Consumption (L/Day)	44,844.50
Percentage of Reduction (%)	<b>23.71</b>

Table TS 2-3.1: Calculation Rain Water Harvesting System as Alternative Water Source

Water calculation template can be download in GreenRE website

## TS 2-4 WATER EFFICIENT LANDSCAPING



### OBJECTIVES

Reduce the water demand by selecting native plants in landscaping design and recreational park



### APPLICABILITY

Applicable to township development with landscaping and recreational park provision



### REQUIREMENTS

1 credit can be scored at least 50% of the landscape areas consist of native plant or plants that require minimal irrigation

Up to 2 credits if 80% of the landscape areas consist of plants or plants that require minimal irrigation



### DOCUMENTARY EVIDENCES

- Relevant layout plans showing the overall landscape areas and the areas that use native plants or plants that require minimal irrigation.
- Calculation showing the percentage of the landscape areas that use native plants or plants that require minimal irrigation
- Plant species showing the minimum water requirement



### REFERENCES

1. Manual Saliran Mesra Alam Malaysia (MSMA) (2000), Ministry of Natural Resources and Environment
2. "Rainwater – Guideline for Installing a Rainwater Collection and Utilization System", KPKT (1999)
3. "Rainwater Harvesting – Guidebook Planning and Design" Department of Irrigation and Drainage, Ministry of Natural Resources and Environment.
4. The list of drought tolerant or resistant plant species may be obtained from the online website: <http://florafaunaweb.nparks.gov.sg/>

## TS 2-5 WATER EFFICIENCY MANAGEMENT



### OBJECTIVES

Reduce the demand of water by public facilities and in common areas through design and incorporation of water efficiency management plans



### APPLICABILITY

Applicable to sub-metering provisions for major water uses to the township management and plan to improve water performance in public amenities



### REQUIREMENTS

- a. Up to 2 credits for the provision the use of private water meters and leak detection system to monitor the major water usage:
  - 1 credit can be scored for the provision of private-meters for major water uses (e.g., water features, irrigation, public toilets)
  - 2 credits can be scored for the linkage of the submeter to the township management system (TMS) for monitoring and leak detection.
- b. 1 credit can be scored for the provision of the 3 years water efficiency management plans and commitment for water savings accrued from proposed measures.



### DOCUMENTARY EVIDENCES

For 2-1 a(i)

- Schematic drawings of infrastructure/cold-water distribution system showing the location of the sub meters provided.
- List of sub metering and its location.



For 2-6 a(ii)

- Schematic drawing and networked planning showing the location of sub-metering and its linkage to the Township Management System (TMS).
- List of input and output point of the TMS with highlighted the sub-meter point.
- Data logged for smart metering real-time digital display

For 2-6 (b)

- Improvement plans showing the calculation of water saving that can be achieved. Water efficiency management plan report inclusive the intent, reduction setting target, measures and implementation strategies of water efficiency improvement plans over the next three years



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## REFERENCES

MS ISO 37122:2019 – Sustainable Cities and Communities *Indicators for Smart Cities*

# Other Green Requirements

## Part 3 – Materials and Waste Management



**TS 3-1 Minimise Cut and Fill in Earthworks**

**TS 3-2 Sustainable Construction for Infrastructure and Public Amenities**

**TS 3-3 Sustainable Products for Infrastructure and Public Amenities**

**TS 3-4 Waste Reduction**

**TS 3-5 Waste Management and Segregation**

**TS 3-6 Waste Conveyance**

**TS 3-7 Waste Reuse and Processing**

## TS 3-1 MINIMISE CUT AND FILL IN EARTHWORKS



### OBJECTIVES

Encourage reduction in the quantity of excavated materials removed or transported into the township by optimising the use of cut and fill material removed during earthworks/ land preparation works for the township



### APPLICABILITY

Excess cut and fills and its monitoring during earthworks and on-site conservation of natural resources such as topsoil.



### REQUIREMENTS

Up to 3 credits for optimising the cut and fill materials during earthworks activities

- a. 1 credit for reusing of at least 50% of the topsoil
- b. 2 credits for reusing of at least 50% cut and fill material



### DOCUMENTARY EVIDENCES

For 3-1(a)

- Earthworks drawings/contour drawings showing the location of excavated topsoil and location reusing the topsoil
- Soil management plan extract from Environmental Impact Assessment (EIA) report
- Land use strategy
- Calculation by determine the volume over the total site of the township for topsoil usage

For part 3-1(b)

- Earthworks drawings/contour drawings showing the location of cut, fills
- Earthwork plan showing temporary embankment for the excavation soil
- Soil management/excavation plan which specify the depth of the soil and topographical
- survey at ground level to the design level
- Earthwork activities should be recorded with no import and export of soil to the project site
- Calculation of the volume for cut and fill
- Mass Haul Diagram (MHD) indicating the breakdown of cut and fill volume, cut and fills to be moved, balanced and earth soil have to be borrowed



## REFERENCES

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1. Guideline for Slope Design –Jabatan Kerja Raya Malaysia
2. Akta Penyiasatan Kajibumi 1974
3. Environmental Quality Act (EQA)
4. EIA Order 1987

## TS 3-2 SUSTAINABLE CONSTRUCTION FOR INFRASTRUCTURE AND PUBLIC AMENITIES



### OBJECTIVES

Encourage recycling and the adoption of designs, practices and materials that are environmentally friendly and sustainable in the construction of infrastructure and public amenities.



### APPLICABILITY

Applicable for infrastructure and public amenities concrete and cement usage



### REQUIREMENTS

a. Up to 4 credits for the Use of sustainable and recycled materials

- 2 credits for Green Cements with approved industrial by-product (such as Ground Granulated Blast Furnace Slag (GGBS), silica fume, fly ash -PFA) to replace ordinary Portland Cement (OPC) by at least 10% by mass for superstructural works of infrastructure and public building.
- Up to 4 credits for Recycled Concrete Aggregates (RCA) and Washed Copper Slag (WCS) from approved sources to replace coarse and/or fine aggregates for concrete production of main building elements

Extent of Coverage: The total quantity used (in tonnage) for replacement of coarse or fine aggregates must not be less than the minimum usage requirement that is:

$$[0.03 \times \text{Gross Floor Area (GFA in m}^2\text{)}]$$

Quantity of RCA / WCS	Credits Allocation
≥ 0.5 times (0.5X) minimum usage requirement	1
≥ 1X minimum usage req.	2
≥ 1.5X minimum usage req.	3
≥ 2X minimum usage req.	4

b. Up to 3 credits for the provision of:

- Recycle or salvage of non-hazardous construction waste by weight as follow:

1 credit for 10%  
2 credits for 20%  
3 credits for 30%

Or

- Recycled content in construction materials other than part TS3-2(a) that has been made from pre and/or post-consumer materials by weight as follow:

2 credits for 10%  
3 credits for 15%



## PREREQUISITE REQUIREMENTS

Maximum score under this criterion:

GreenRE Gold	≥ 3 credits
GreenRE Platinum	≥ 4 credits



## DOCUMENTARY EVIDENCES

For TS 3-2 (a)

- Extract of tender specification showing the requirement to use green cement/concrete to be procured
- Construction materials with Life Cycle Analysis (LCA) on product carbon footprint showing the ISO 14040 certification or Green Label
- Concrete Mix Design showing the percentage of the recycled content composition
- Calculation of estimated quantity for replacement by mass of green cement/concrete
- To compute extent of coverage for RCA or WCS replacement
- Infrastructure and public amenities structural plan showing the dimension, elevations and sizes of each structure component.

For TS 3-2(b)(i)

- Extract of tender specification showing the requirement to recycled non-hazardous construction waste
- Waste Management Plan approved by authorised party
- Bills of Materials
- Identification and making list of construction non-hazardous waste that can be recycled or conserved
- Disposal Waste Inventory and records

For TS 3-2(b)(ii)

- Extracts from the tender specification and drawings showing the requirements to incorporate the environmentally friendly products that are certified and approved by local/international certification body.
- Certification details from approved local/international certification body such as the material certification standards and rating within validity period.
- Technical product information on the sustainable products
- Calculation of products and extent of coverage.
- Declaration of percentage recycled content in the construction materials



## REFERENCES

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1. Policy Guidance on Resource Efficiency – Organization for Economic Co-operation and Development (OECD)
2. MS 14040:2006 Environmental Management - Life Cycle Assessment, Principles and Formwork
3. MS 2673: Construction Solid Waste Management
4. Environmental Quality (Scheduled Waste) 2017
5. Solid Waste and Public Cleansing Management Act 2018 (Act 672)- Scheme for Commercial, Industrial and Institutional Solid Waste
6. JKR/SIRIM 3: 2020 Standard – Environmental Protection and Enhancement Works for Projects
7. Environmental Sustainability in Malaysia 2020-2030 under Kementerian Alam Sekitar dan Air (KASA)- Revised February 2022



**WORKED EXAMPLE**

TS 3-1(a)(i)

Proposed development will use Grade 35, 40, 70 and 80 concrete.

From the concrete design mix the percentage of replacement of OPC by the green cements as follows:

Grade 35 = 15.52 %

Grade 40 = 63%

Grade 70 = 59 %

Grade 80 = 58 %

No	Concrete Grade	Quantity (m <sup>3</sup> )	Percentage of Green Cement (%)	Green Cement Quantity in (m <sup>3</sup> )
1	Grade 35	27,381	15.52	4250
2	Grade 40	448	63	282
3	Grade 70	12,141	59	7163
4	Grade 80	12,155	58	7,050
	Total	52,155		18,745

Overall % Green Cement replacement =  $18,745/52,155 = 35.96\%$

## TS 3-3 SUSTAINABLE PRODUCTS FOR INFRASTRUCTURE AND PUBLIC AMENITIES



### OBJECTIVES

Encourage the use of products that are environmentally friendly and sustainable which certified under approved certification body.



### APPLICABILITY

Applicable to infrastructure works and public amenities (including street furniture)



### REQUIREMENTS

Up to 5 credits are allocated to encourage the use of appropriate environmentally friendly products that are certified by approved local/international certification body. The criterion is only applicable for infrastructure works and public amenities. Credits scored will be based on the extent of use of environmentally friendly product.

The environmentally friendly product proposed must be approved by a valid international or local certification body and is subject to GreenRE's evaluation.

Extent of use of environmentally friendly product	Weightage for Credits Allocation
Low impact	0.5
Medium Impact	1
High Impact	2

Table 3-3.1 : Weightage for credits allocation

The use of environmental friendly products or recycled materials used for infrastructure elements of the development will be considered as high impact (2 credits) on condition that quantities used by percentage are more than 50% (i.e extent of coverage as compared to total quantities used for same intended purpose. If not met, it will be classified as medium impact (1 credit).

Items that are used for all public amenities, common areas, external works and communal facilities are considered as medium impact (1 credit) if quantities used by percentage are more than 80% (i.e extent of coverage as compared to total quantities used for same intended purpose in common areas If not met, it will be classified as low impact (0.5 credit)

Note:

1. The impact categories listed above generally apply to main building elements – i.e internal / external wall, floor, ceiling, roof, doors, etc. Singular products – i.e termite treatment system, playground equipment, gym flooring etc will be classed as low impact. All applications will be subject to GreenRE's evaluation.
2. Same type of the product not allowed to be double claimed for different area application



## PREREQUISITE REQUIREMENTS

Minimum score under this criterion:

GreenRE Gold	≥ 2 credits
GreenRE Platinum	≥ 3 credits



## DOCUMENTARY EVIDENCES

- Extracts from the tender specification and drawings showing the requirements to incorporate the environmentally friendly products that are certified and approved by local/international certification body.
- Certification details from approved local/international certification body such as the material certification standards and rating within validity period.
- Technical product information on the sustainable products
- Schedule of materials
- Calculation of products and extent of coverage



## REFERENCES

1. MyHijau, SIRIM, SGLS, SGBC
2. Malaysian Timber Certification Council (MTCC)
3. Forest Stewardship Council (FSC)
4. Global Eco labelling Network (GEN) <http://www.globalecolabelling.net>
5. Roadmap Environmental Sustainability in Malaysia 2020-2030 under Kementerian Alam Sekitar dan Air (KASA) - Revised February 2022



## WORKED EXAMPLES

Determine if the environmentally friendly products selected are certified with approved local/international certification body. Check if the products used are meant for main building elements, functional spaces or infrastructure and can be considered high impact or medium impact.

Products that are meant for common areas and external works such as toilets, public amenities, lobbies and landscaping areas are considered as medium impact or low impact.

High impact to be grant only for infrastructure works such as street furniture road kerbs, and pre-cast drainage box culvert etc.

Note:

Certain products can have more environmentally friendly features than others. Other than recycled materials, they may have features like low VOC assembly or manufactured with resource efficient processes, durability etc that will render the products more environmentally friendly than others. If the certified products selected are more environmentally friendly and are given a better rating by the approved local/international certification body, a higher weightage can be considered in credit scoring.

Example of a proposed development with the following provisions:

- a. Use of carpets for management office spaces. Product is not certified.
- b. Use of panel boards as internal partitions for more than 50% of the office spaces and the product is rated by an approved certification body.
- c. Precast concrete road kerbs for whole road networks. Product is rated by approved local certification body. – (Singular product)
- d. Use of roof waterproofing coating for clubhouse. Product is rated by approved local certification body.
- e. Use of wooden doors for management office. Product is rated by approved local certification body.

	Products and Extent of coverage	With approved certification	Extent use category	Total credits
a.	Carpets for all management office spaces	No	N/A	0.0
b.	Panel boards as internal partition for more than 50% of office spaces	Yes	Medium	1.0
c.	Precast road kerbs (road networks)	Yes	High	2.0
d.	Roof waterproofing	Yes	Medium	1.0
e.	Wooden doors for all areas in the management office	Yes	Medium	1.0

Table 3-2.3 : Detail calculation for credits scoring

Therefore, credits scored for TS 3-3 = 1.0 + 2.0 + 1.0 + 1.0 = **5.0 credits**

## TS 3-4 WASTE REDUCTION



### OBJECTIVES

Minimise waste generation in a sustainable manner covering all kinds of wastes



### APPLICABILITY

Applicable for each plot in the township



### REQUIREMENTS

Up to 2 credits to minimise waste generation in township level

1 credit for each item monitored and reduced for following items:

- commercial waste (e.g.: paper, plastic, aluminium)
- construction waste (woods/timbers, glass, aluminium)



### DOCUMENTARY EVIDENCES

- Identification of the type of waste materials consumption that can be reused, reduced and recycled
- Calculation with comparative study on types of materials to be used as the replacement
- Waste Management Report
- Inventory or quantity of materials used
- To prescribe the requirement in the Universal Design Guideline (UDG)
- Proof that will be responsibility to minimize the waste will be taken by local authority and commitment for waste record sharing.



## REFERENCES

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1. MS ISO 37122:2019 – Sustainable Cities and Communities *Indicators for Smart Cities*
2. MS 2673: Construction Solid Waste Management
3. Solid Waste and Public Cleansing Management Act 2018 (Act 672)- Scheme for Commercial, Industrial and Institutional Solid Waste
4. Roadmap Environmental Sustainability in Malaysia 2020-2030 under Kementerian Alam Sekitar dan Air (KASA)- Revised February 2022

## TS 3-5 WASTE MANAGEMENT AND SEGREGATION



### OBJECTIVES

Encourage waste recycling within township to reduce waste going to landfill. Promote proper disposal of waste and provide waste management infrastructures



### APPLICABILITY

Generally applicable to the whole township



### REQUIREMENTS

- a. 1 credit for provision of at least one recycling station at the township level dedicated to the separation, collection and storage of recyclable materials such as paper, glass, plastics and metals
- b. 1 credit for provision of at least one drop-off point for potentially hazardous waste such as paints, solvents, batteries
- c. 1 credit for provision of litter receptacles with integrated recycle containers at scattered public areas and accessible by the public (including at public amenities)
- d. 1 credit for developing a community waste strategy and education programme e.g. promotional materials such as posters, circulars and provision of recycling bags to promote waste sorting, collecting and recycling of waste

Note :For Industrial Park, to implement the waste management policy for hazardous and non-hazardous waste.



### DOCUMENTARY EVIDENCES

For TS 3-5 (a), (b) and (c)

- Extracts of the tender specification and drawing showing the location of recycling station, hazardous waste disposal point and litter receptacles with integrated containers at public areas.
- Technical product information of recycling station, hazardous waste disposal points and litter receptacles with integrated containers.

- Site layout plan showing the location of recycling station, hazardous waste disposal points and litter receptacles with integrated containers at public areas.

#### For TS 3-5 (d)

- Community waste strategy to support with timeframe and projection of activity undertake with the list of education program
- Pursue partnership with NGO or government agencies that can influence community to be more mindful of its responsibilities
- Monitor waste activities in community through providing any waste records for data collection such as inventory form and checklist
- To provide sample of poster, signage or any communication media for the said activities



## REFERENCES

1. Guidelines for Source Separation of Municipal Solid Wastes Malaysia; Kementerian Perumahan dan Kerajaan Tempatan (KPKT)-July 2006
2. MS ISO 37122:2019 – Sustainable Cities and Communities Indicators for Smart Cities
3. Roadmap Environmental Sustainability in Malaysia 2020-2030 under Kementerian Alam Sekitar dan Air (KASA)- Revised February 2022



## WORKED EXAMPLES

List of education program for waste recycling within township

- 3Rs program in school (reduce, reuse and recycle)
- No plastic campaign month
- DIY Decorative Planting workshop using wastes (bottles or glass)
- Hazardous waste collection day (batteries, oil filter, aerosol tins, neon bulb)

#### Enhance of Institution to strengthen Government Policies on Waste Minimisation

To set target of recycling rate for the township aligned with government target (30% in year 2023 by KASA):

$$\text{Recycling Rate (\%)} = \frac{\text{Total Quantity of Recyclables Collected (TRC)} \times 100\%}{\text{TRC} + \text{Quantity of Waste Disposed} + \text{Others}}$$

## TS 3-6 WASTE CONVEYANCE



### OBJECTIVES

Reduce the negative impact on environment during waste conveyance



### APPLICABILITY

Applicable to all plot in the township



### REQUIREMENTS

Provision of the odourless pneumatic conveyance system or any specific waste transport design to minimise disturbance. Credit will be given base on impact of application.

- 1 credit for low impact applications:

Loads station or place of generation (landed properties, apartment blocks, commercial facilities, etc.) equipped with pneumatic conveyance system collected by the specific waste transport within the plot

- 2 credits for high impact applications:

Integrated pneumatic conveyance system from loads station (indoor domestic waste and outdoor recycling items) through underground vacuum network to the central waste handling facilities for all plots



### DOCUMENTARY EVIDENCES

- Schematic diagram showing the location of vacuum network/pipeline of collecting domestic waste and recycle item to the conveyance transport system/sealed container
- Location of central waste handling facilities
- Vacuum pipeline network showing the air-intake, discharge valve, inspection chamber and connection from other plots to the central waste handling facilities
- Sealed container showing the mixed waste and recyclable waste and its capacity



## TS 3-7 WASTE REUSE AND PROCESSING



### OBJECTIVES

Encourage use of environmentally friendly waste processing system and way for a township to achieve a level of energy independence



### APPLICABILITY

Applicable to all plots



### REQUIREMENTS

- a. Up to 2 credits for provision of local composting station or provision of compost bin (kitchen and garden wastes) /chipping facilities within the boundary of the development and / or at strategic locations. The Compost should be made available to local users (building occupiers, owners, residents, maintenance firms) and able to meet at least 30% of landscape fertilizer needs.
- b. Up to 2 credits for usage of organic waste (municipal bio-waste, sewage sludge, agricultural residues) for energy generation e.g. through bio-methanisation process
  - 1 credit for high impact: e.g. As fuel for vehicle used/heavy-duty transport
  - 2 credits for low impact: e.g. As fuel for industrial and commercial used

Noted: Energy generated from the waste treatment plant shall be expressed in GJ per year



### DOCUMENTARY EVIDENCES

For 3-7 (a)

- Extract of tender specification and drawings showing provisional of local composting system.
- Technical product information of local composting system.
- Methodology, calculation and specification of composting system for local users.
- Drawing showing the location of the compost bins within the township

For 3-7 (b)

- Extract of tender specification showing provision of organic waste for energy generation and its methodology.
- Sources of organic waste and application of the energy use
- Process flow path from waste to energy plant (WTE) to energy generation



## REFERENCES

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MS ISO 37122:2019 – Sustainable Cities and Communities *Indicators for Smart Cities*

# Other Green Requirements

## Part 4 – Environmental Planning



TS 4-1 Self Sufficiency and Accessibility within Township

TS 4-2 Green and Blue Spaces for the Public

TS 4-3 Microclimate Optimisation

TS 4-4 Outdoor Thermal Environment

TS 4-5 Site Selection

TS 4-6 Conservation and Integration of Existing Structures and Assets

TS 4-7 Habitat Conservation and Restoration

TS 4-8 Minimise Site Disturbance

TS 4-9 Environmental Management System

TS 4-10 Future Provision and Connections



## TS 4-1 SELF-SUFFICIENCY AND ACCESSIBILITY WITHIN TOWNSHIP



### OBJECTIVES

Ensure that a diverse range of facilities needed to meet daily needs are suitably incorporated in the masterplan and can be accessed suitably to minimise vehicle trips or distance travelled. Increase the accessibility to key facilities by ensuring that they are sited in accordance to the local planning guidelines



### APPLICABILITY

Applicable to township's boundary



### BASELINE STANDARD

Local planning guideline



### REQUIREMENTS

Up to 5 credits [In the absence of local planning guidelines, the following standards/ catchment radius shall apply from the entrance of plot.:

- Basic Retail (e.g. Hawker centres, local shops, markets) 400m
- Community & Leisure Facilities (e.g. 3G exercise facilities, hardcourts, swimming pools, children's playground) 400m
- Health Facilities (Pharmacy / GP / Polyclinic, Dentist) 400m
- Educational facilities (e.g. Primary Schools, Secondary Schools excluding tertiary institutions) 800m
- Communal facilities (e.g. Child care centres/ pre-schools/ kindergartens, elder care centres, community centre, Resident's committee centre, public squares) 800m
- Employment Centres (e.g. mixed rental Offices / Light industry) 800m
- Residential areas (e.g. mixed income housing)
- Other supporting amenities (Post office, ATM, Postal box) 800m
- Place of worship 1000m
- Hotels (only for commercial townships)

1 credit for each facility applicable to the masterplan and easily accessible by public transport

Radius will be from the entrance of each plot and more than 50% of the plot comply with the distance in radius.



## DOCUMENTARY EVIDENCES

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Township masterplan showing the location of the facilities with easily accessible by public transport.



## REFERENCES

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1. Transit Oriented Development (TOD), Malaysia
2. Sustainable Development Goal (SDG) 2015-2030- Goal 11 Sustainable Cities and Communities

## TS 4-2 GREEN AND BLUE SPACES FOR THE PUBLIC



### OBJECTIVES

Provide sufficient green and blue spaces for residents and occupants



### APPLICABILITY

Applicable to all plot in the township



### REQUIREMENTS

1 credit for every item of requirement that is met:

- a. Parks, green spaces or water body at least 800m<sup>2</sup> within 400m walking distance from every entrance of the plot available in the township.
- b. Interconnectivity of green / blue spaces for public and biodiversity
- c. Adopt native plant strategies in landscape design - must demonstrate that >60 % of the trees and shrubs are native



### DOCUMENTARY EVIDENCES

For 4-2(a)

- Layout plan showing area of parks, green space or water body within township and demarcation of distance to show compliance to the requirement.

For 4-2(b)

- Layout plan showing interconnectivity between green/blue spaces for public and biodiversity.
- Extract of Environmental Impact Assessment (EIA) report indicating the biodiversity survey and the area showing the interconnectivity between green/blue spaces for public
- Biodiversity Action Plan

For 4-2(c)

- Extract of tender specification and drawings showing provision of at least 60% of trees and shrubs are native.
- Calculation showing the 60% quantity of native plant
- Information of plant specification.
- Site Management Plan (SMP) for maintenance of the native plan



## REFERENCES

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1. Environmental Quality Act (EQA), 1974
2. Dasar Alam Sekitar Negara (DASN)- National Policy on the Environment, Department of Environment, Kementerian Alam Sekitar dan Air (KASA) 2002
3. Sustainable Development Goal (SDG) 2015-2030- Goal 15 Life of Land



## TS 4-3 MICROCLIMATE OPTIMISATION



### OBJECTIVES

Promote design optimisation, including site planning and building massing, for better microclimate, such as use of natural planting and water body to optimise microclimate, through modelling and simulation, verifying by field measurements of major climate data before and after the development



### APPLICABILITY

Applicable to all plots in the township



### REQUIREMENTS

Up to 4 credits for design optimisation or field measurement.

a. 1 credit each for design microclimate optimisation as follows:

- Solar analysis (sun path or solar insolation simulation)
- Ambient Temperature Simulation
- Wind Speed Simulation
- Wind direction Simulation

b. 1 credit each for field measurement:

- Ambient Temperature
- Humidity
- Wind Speed
- Wind Direction



## DOCUMENTARY EVIDENCES

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### For 4-3(a)

- Microclimate optimisation plan detailing strategies for site planning & building massing for better micro climate based on solar analysis or ambient temperature simulation.
- Solar analysis report for sun path or solar insolation simulation before development.
- Site Planning analysis report
- SRI value >29 for hardscape area at public area and roadway within the township
- Building massive planning simulation report showing the orientation of the building and the shape
- Extract from EIA report indicating the water bodies and green space area
- Sea Level Rise report

### For 4-3(b)

- Measurement report before and after the development.
- Extract data logger for physical on-site measurement



## REFERENCES

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1. Environmental Quality Act (EQA), 1974
2. Sustainable Development Goal (SDG) 2015-2030-- Goal 13 Climate Action
3. Roadmap Environmental Sustainability in Malaysia 2020-2030 under Kementerian Alam Sekitar dan Air (KASA)- Revised February 2022
4. Low Carbon Cities Framework (LCCF), Kementerian Alam Sekitar dan Air (KASA)
5. National Climate Change Policy – NRE

## TS 4-4 OUTDOOR THERMAL ENVIRONMENT



### OBJECTIVES

Encourage to use any combination of following strategies to improve the outdoor thermal comfort and reduce heat island effect



### APPLICABILITY

Applicable to all plots



### REQUIREMENTS

Up to 6 credits for the implementation of the strategies to reduce the heat island effect:

- Design and simulate to enable air flow through the development (CFD analysis or wind tunnel testing) – 2 credits
- Use of building vegetation, vegetated walls and green roofs (minimum 20% of the plot area) – 1 credit
- Street sidewalks/ pedestrian walkways shaded over 40% - 1 credit
- Provide shade for open structures such as covered walkways, vine pergolas > 50% - 1 credit
- Use of permeable paving materials with Solar Reflectance Index (SRI) > 29 (Gravel and wood chippings also encouraged to hardscape areas) at least 50% of the hardscape area- 1 credit
- Open grid pavement system (at least 50% pervious) for pedestrian paths at green spaces > 40% -1 credit
- Provide shading for open air carparks > 50% - 1 credit
- Avoid building heat exhaust to pedestrian walkways - Exhausts if fronting the public realm must be >5m above pedestrian walkways - 1 credit
- Any other suitable strategy (1 credit for each)



## DOCUMENTARY EVIDENCES

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- Ventilation simulation or wind tunnel testing reports summarising the analysis and modelling results for township as well as the recommendations for design.
- Extracts of the tender specification showing the design requirement to improve the outdoor thermal comfort and reduce heat island effect.
- Architectural plan showing the design which provide better outdoor thermal comfort and/or reduction of head island effect.
- Technical product information of products if applicable.
- Relevant drawing indicating the applicable area and its coverage



## REFERENCES

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1. Sustainable Development Goal (SDG) 2015-2030-- Goal 13 *Climate Action*

## TS 4-5 SITE SELECTION



### OBJECTIVES

Encourage land use efficiency measures and their feasibility for suitability of development for space optimisation and reduce pressure on undeveloped land



### APPLICABILITY

Applicable to all landform within the township



### REQUIREMENTS

- a. Avoid use of land with high agricultural or ecological value for at least 90% of the land area – 1 credit
- b. Use of brownfield sites or reclaimed land, reducing the use of greenfield sites

Area of site which is previously built-on:

100%	1.0 credit
50%	0.5 credit

- c. Up to 1 credit for proper remediation measures carried out on contaminated land to restore the land for use – 1 credit
- d. Up to for 2 credits for conducting flood risk assessment – demonstrate that the buildings are located in an area of low probability of flooding OR the development is appropriately flood resilient and resistant including safe access and escape routes
  - credits if 100% of buildings are in an area of low probability of flooding / non-flood plain, OR demonstrates flood mitigation and escape routes
  - 1 credit for 75% of buildings are in an area of low probability of flooding / non-flood plain, OR demonstrates flood mitigation and escape routes
  - 0.5 credit for 50% of buildings are in an area of low probability of flooding / non-flood plain, OR demonstrates flood mitigation and escape routes

Note (d):

1. *There must be no vulnerable building uses in the flood plain area such as emergency dispersal depots (police, fire, ambulance), or installations holding, using or containing hazardous substances.*
2. *Infrastructure and services planning for overall platform levels, roads, drainage and sewerage must be demonstrated.*



## DOCUMENTARY EVIDENCES

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### For 4-5 (a)

- Site plan showing township is not located near agricultural or ecological valued site
- Environmental Screening Report showing the physical environment and ecological aspects
- Social Screening Report showing the sociological and economic impact
- Soil Investigation Report
- Geological Report
- Extract of Environmental Impact Assessment (EIA) report on the land details

### For 4-5 (b)

- Relevant documents indicated township site is brownfield or reclaimed land.
- Extract of Environmental Impact Assessment (EIA) report on the land details.
- Official Geographic Information System (GIS) data from JUPEM indicating historical of used land

### For 4-5 (c)

- Extract of tender specification showing remediation measures for restoration of land.
- Site Screening Level (SSL) for contaminated land
- Qualitative Risk Assessment (QRA) report
- Contamination mitigation plan/action plan

### For 4-5 (d)

- Extract of tender specification showing provision of flood risk assessment.
- Flood risk assessment report and recommended contingency plan.



## REFERENCES

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1. Guidelines for Site Investigation Works (JKR)
2. Geographic Information System (GIS), Department of Survey and Mapping Malaysia- JUPEM
3. Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land, DOE Malaysia
4. Environmental Quality Act (EQA), 1974
5. ISO 31000 Risk Management Principle and Guideline, 2009
6. Flood Risk Assessment and Mapping Guideline, National Disaster Management Agency (NADMA), Malaysia

## TS 4-6 CONSERVATION AND INTEGRATION OF EXISTING STRUCTURES AND ASSETS



### OBJECTIVES

Conservation, preservation or restoration of historic remains, or buildings, or natural spaces or views that characterise and have local or community importance



### APPLICABILITY

Applicable to all plot within the township/reclaimed land



### REQUIREMENTS

Up to 1 credit for conservation, preservation or restoration of historic remains, or buildings (not including the gazetted building), or natural spaces or views that characterise and have local or community importance (cultural heritage)

- Historical building e.g. building structures (facades), monuments
- Natural spaces or views e.g. wetlands, submerge-landscape, limestone caves
- Cultural heritage e.g. place of worship, archaeological sites-fossil
- Underwater cultural heritage e.g. shipwreck, coral reef, underwater cities

Note: Heritage assets within the project site shall be retained and restored, to be integrated as part of the project.



### DOCUMENTARY EVIDENCES

- Relevant documents showing conservation existing structures and assets, including information on specific items, photographic evidence and methodology of conservation
- Heritage Impact Assessment Report showing the historical buildings and/or cultural landscape



## REFERENCES

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1. Akta Warisan Kebangsaan 2005 ([www.heritage.gov.my](http://www.heritage.gov.my))
2. Heritage Impact Assessment Development - Town and Country Planning Act 1976 (Act 172)
3. Low Carbon Cities Framework (LCCF), Kementerian Alam Sekitar dan Air (KASA)
4. UNESCO Convention on the Protection of the Underwater Cultural Heritage, 2001
5. MS ISO 37122:2019 – Sustainable Cities and Communities Indicators for Smart Cities
6. Garis Panduan Perancangan Pemuliharaan dan Pembangunan Kawasan Sensitif Alam Sekitar, Warisan Kebudayaan dan Warisan Semulajadi 2017 ([www.townplan.gov.my](http://www.townplan.gov.my)) GP007-A (12)



## TS 4-7 HABITAT CONSERVATION & RESTORATION



### OBJECTIVES

Determine the ecological value of the habitats in and around the site in order to conserve and enhance the biodiversity and prevent deforestation



### APPLICABILITY

Applicable to all plot within the township



### REQUIREMENTS

Up to 7 credits for below requirement:

- a. 2 credits for conduct an Environmental Impact Assessment or Biodiversity Impact Assessment to identify habitats, migration routes and potential damage from the development, including justification of developmental benefits versus the potential ecological losses and mitigation measures
- b. 1 credit for provision species protection plan or plans to increase the local species diversity
- c. Prevent the loss of greenery in the township: Greenery area to be calculated on plan before and after project construction.

No change – 1 credit

5% GnP improvement 2 credits

10% GnP improvement 4 credits

Note:

Biodiversity refers to a variety of plant and animal life in a particular habitat



### DOCUMENTARY EVIDENCES

For 4-7(a)

- Extract of Environmental Impact Assessment (EIA) including justification of development benefit versus potential ecological losses and mitigation measures

- Commitment from developer to implement the mitigation plan

For 4-7(b)

- Biodiversity Action Plan or
- Wildlife Management Plan e.g. wildlife tunnel provision, wetlands conservation or
- Habitat Conservation Plan including native plants and endangered species

For 4-7(c)

- Calculation showing the extent of the greenery provision within township before development.
- Design drawing showing the greenery area before and after construction



## REFERENCES

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1. Low Carbon Cities Framework (LCCF), Kementerian Alam Sekitar dan Air (KASA)
2. MS ISO 37122:2019 – Sustainable Cities and Communities Indicators for Smart Cities
3. Environmental Quality Act (EQA), 1974
4. Wildlife Conservation Enactment 1997
  
5. National Policy on Biodiversity by Ministry of Natural Resources and Environment, Malaysia 2016-2026
6. United Nations Convention on Biological Diversity (CBD)
7. High Conservation Value Forests (HCVF) Toolkit for Malaysia, World Wide Funds (WWF) Malaysia
8. Sustainable Development Goal (SDG) 2015-2030-- Goal 15 Life of Land

## TS 4-8 MINIMISE SITE DISTURBANCE



### OBJECTIVES

Minimise negative impact on the site environment by constraining construction activities



### APPLICABILITY

Applicable within the township



### REQUIREMENTS

2 credits for reducing site clearance and deforestation by conserving at least 20% of the mature trees (with a trunk diameter larger than 28 cm (11 inches))

Transplanting can be considered to achieve the objective of this criteria

Preserve the following trees that are also identified as in good or excellent condition:

- all heritage or champion trees and trees whose dbh exceeds 50% of the state champion dbh for the species;
- a minimum of 75% of all non-invasive trees (including the above) larger than 18 inches (45 centimetres) dbh; and
- a minimum of 25% of all non-invasive trees (including the above) larger than 12 inches (30 centimetres) dbh if deciduous and 6 inches (15 centimetres) dbh if coniferous



### DOCUMENTARY EVIDENCES

- Relevant documents showing constraining construction activities which include reducing site clearance and conservation of mature trees OR
- Site Inventory Analysis on Greenery report conducted by ISA Certified Arborist or local professional specialist



## REFERENCES

---

1. High Conservation Value Forests (HCVF) Toolkit for Malaysia, World Wide Funds (WWF) Malaysia
2. International Society of Arboriculture (ISA)
3. MyCREST Design & Construction Stage v 2.0- Section 2.1 Carbon Sequestration Conservation of Trees with a Minimum Diameter of 28 cm (11 inches)
4. LEED v4 for Neighbourhood Development- Section Minimize Site Disturbance

## TS 4-9 ENVIRONMENTAL MANAGEMENT SYSTEM



### OBJECTIVES

Encourage the planning, design and management integration to adopt an environmentally friendly management system and practices during development



### APPLICABILITY

Applicable for project team of the township



### REQUIREMENTS

Up to 5 credits for the adoption of the following strategies:

- a. Conduct site analysis and assessment before township development- 1 credit
- b. Developer, master planner, and major contractor that are ISO 14000 certified - 0.5 credit for each party (Up to 1.50 credits)
- c. Project team comprises one Certified GreenRE Accredited Professional (GreenRE AP) – 1 credit
- d. Environmental policy with measurable targets & programmes with management review and corrective action records - 1 credit
- e. For Industrial Park to implement the Pollution Control Plan



### DOCUMENTARY EVIDENCES

For 4-9(a)

- Environmental site analysis and assessment for the purpose of planning, design and management integration to adopt an environmentally friendly management system and practice during development.

For 4-9(b)

- A certified true copy of the ISO 14000 certificate of developer, master planner and major contractor where applicable.

For 4-9(c)

- A certified true copy of the certificate of GreenRE Accredited Professional (GreenREAP) where applicable and a confirmation of their involvement performance.

For 4-9(d)

- Provision of intent, measures and implementation strategies of environmental policy with measurable targets & programmes with management review and corrective action records.

For 4-9(e)

- Pollution Control Plan consist of on measurable target and corrective action records.



## REFERENCES

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1. ISO 14001 standards and Scope
2. Sustainable Development Goal (SDG) 2015-2030- Goal 11 *Sustainable Cities and Communities*

## TS 4-10 FUTURE PROVISION AND CONNECTIONS



### OBJECTIVES

To actively encourage the future adaptability and flexibility of the site, including expansion



### APPLICABILITY

Generally applicable to all plots



### REQUIREMENTS

Up to 2 credits for the implementation suitable design features to allow for future installation including:

- a. Utilities expansion and distribution upgrades (Gas, electricity, water, cooling)
- b. Transport and infrastructure expansion plans
- c. Others

1 credit for showing potential of expansion for utilities expansion and distribution.

1 credit for demonstration that other elements have been considered.



### DOCUMENTARY EVIDENCES

- Report on design features for the purpose of future utilities expansion and distribution upgrades. Includes drawings & design brief.
- Report on design features for the purpose of future transport and infrastructure expansion plans. Includes drawings & design brief.
- Report on design features for the purpose of other expansion plans. Includes drawings & design brief.

# Other Green Requirements

Part 5 – Green Building and Green Transport



**TS 5-1 Green Building within Township**

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**TS 5-2 Green Urban Design Guidelines**

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**TS 5-3 Green Transport Within Township**

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## TS 5-1 GREEN BUILDING WITHIN TOWNSHIP



### OBJECTIVES

Encourage the adoption of green building practices in building design, construction and retrofitting within the township (includes buildings assessed under GreenRE for New Developments and GreenRE for Existing Buildings)



### APPLICABILITY

Applicable to the Phase 1 of the township



### BASELINE STANDARD

GreenRE NRB, RES, ENRB



### REQUIREMENTS

GreenRE Building Credits (GRBc)

GRB Award Level	Weightage	GRBC = Weightage*GFA percentage %
Platinum	0.20	C1 = 0.20* % GFA of GreenRE Platinum buildings
Gold	0.15	C2 = 0.15* % GFA of GreenRE Gold buildings
Silver	0.10	C3 = 0.10* % GFA of GreenRE Silver buildings
Total	GRBP = C1 + C2 + C3	

GFA certified building (m<sup>2</sup>) / Total building GFA in the township (m<sup>2</sup>)



## PREREQUISITE REQUIREMENTS

At least 10% of the GFA or 5,000 sqm (whichever is higher) at Phase 1 to achieve the corresponding GreenRE rating.

GreenRE Township Rating	At least 10% of the GFA or 5,000 sqm (whichever is higher) at <u>Phase 1</u>
GreenRE Bronze	Bronze
GreenRE Silver	GreenRE Silver
GreenRE Gold	GreenRE Gold
GreenRE Platinum	GreenRE Platinum



## DOCUMENTARY EVIDENCES

- A copy of Certificate of GreenRE 's Provisional Certification on targeted building
- Site plan showing the certified building located on the Phase 1 of township development.
- Document showing the GFA of certified building & total GFA of all the building in township.
- Calculation of credit scoring based on weightage & GFA of certified GreenRE building over total GFA.



## WORK EXAMPLE

Township: Gold

GFA of certified building: 10,458 m<sup>2</sup>

Total Building GFA for the whole township: 653,647 m<sup>2</sup>

$$10,458/653,647 \times 100\% = 1.599\%$$

$$\begin{aligned} \text{Credit scored: } & 0.15 \times 1.599 \\ & = 0.24 \text{ credit} \end{aligned}$$



## TS 5-2 GREEN URBAN DESIGN GUIDELINES



### OBJECTIVES

To ensure key green features at the township level are carried through to development at the individual parcels.



### APPLICABILITY

Applicable to the whole township including lease land parcel or developed by developer.



### BASELINE STANDARD

- Local plan
- GreenRE Guidelines



### REQUIREMENTS

Provision of green urban design guidelines for all land parcels in the township (4 credits)

Provision of green urban design guidelines for all land parcels to be sold to other sub-developers (2 credits)

Provision of green urban design guidelines for strategic land parcels to be sold to other sub-developers (1 credit)



### DOCUMENTARY EVIDENCES

- A copy of the green urban design guidelines highlighting key green features for all land parcels in the township. Provide drawings, tender specification and/or technical data of product where applicable.
- A copy of green urban design guidelines highlighting key green features for all land parcels to be sold to other sub-developers. Provide drawings, tender specification and/or technical data of product where applicable.

- A copy of green urban design guidelines highlighting key green features for strategic land parcels to be sold to other sub developers. Provide drawings, tender specification and/or technical data of product where applicable.



## REFERENCES

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- Local plan



## TS 5-3 GREEN TRANSPORT WITHIN TOWNSHIP



### OBJECTIVES

- Promote environmentally friendly transportation options and facilities to reduce pollution from individual car use
- Promote cycling as a real alternative to cars for shorter journeys
- To improve the accessibility for the physically challenged



### APPLICABILITY

Generally applicable to overall masterplan of the township development.



### BASELINE STANDARD

- Local Plan
- MS1184:2014
- Panduan Bandar Selamat



### REQUIREMENTS

#### 5-3(a)

2 credits for conducting traffic modelling for the township to assess and make improvements to the township masterplan

#### 5-3(b)

2 credits for compact and walkable township pattern for master plan; major building entrances with good access to nearest LRT or bus stops in accordance to local planning guidelines or within a 500m walking distance, with sheltered and connected linkage.

#### 5-3(c)

1 credit for transit options connecting outwards from the main LRT nodes

5-3(d)

1 credit for providing dedicated shuttle services and facilities to mass transit

5-3(e)

1 credit for network of bicycles lanes and routes that are safe, well-lit and segregated with direct links to key areas and routes

5-3(f)

1 credit for provision of secure and sheltered bicycle facilities to public Amenities.

Extent of Coverage:

Bicycles parking lot: Minimum 10 number and maximum 50 numbers of bicycle parking lot.

5-3(g)

1 credit for reducing carpark footprint by employing underground or multi storey carpark, etc.

5-3(h)

1 credit for provision of >10% open air parking spaces can be designated for flexible use when not being used for parking, e.g., market stalls, play areas

5-3(i)

1 credit for provision of hybrid/electric vehicles refuelling/charging Stations.

Extent of coverage:

Minimum 1 number priority parking bays for every 100 public carpark lots. EV chargers – 1 for every 200 parking bays. (Cap at 3)

5-3(j)

1 credit for provision of universal design features (barrier-free accessibility)

5-3(k)

1 credit for way finding strategies

5-3(l)

1 credit for accessible from major highway outlets and /or within proximity to major cargo services (i.e airport, seaport, railway station). Project to be within 10km of these facilities



## DOCUMENTARY EVIDENCES

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### For 5-3(a)

- A copy of traffic modelling report summarising the analysis and modelling results for purpose of assessing and improving township master plan.
- Improvement plan responding on the traffic assessment

### For 5-3(b)

- Masterplan of the overall township highlighting on the major building entrance to the nearest LRT or bus stops within 500m walking distance
- Detail drawings of sheltered walkway and connected linkage between the major building entrance to the nearest LRT or bus stops

### For 5-3(c)

- Layout plan drawings and design brief showing location, routes of green transport features.

### For 5-3(d)

- Provision of shuttle service connecting the township to mass transit (LRT/MRT/bus/integrated station)
- Provision of facilities (transportation hub/station) for the shuttle service

### For 5-3(e)

- Bicycle route masterplan highlighting on the key area and route throughout the township
- Road cross section showing the segregation of bicycle route from main road
- Detail drawing of bicycle lane with sufficient lightings

### For 5-3(f)

- Plan showing the location of shelter and secured bicycle facilities
- Detail drawing of the shelter and rack with lock designated for the bicycles

### For 5-3(g)

- Plan showing the location of underground or multi storey carpark
- The carpark must be located and accessible for public usage

### For 5-3(h)

- Plan showing the location of open-air carpark can be used for other purpose

- To show percentage over total open-air carpark in the township
- To provide the plan of flexible usage or activity for that area

For 5-3(i)

- Extract tender specification showing provision for charging station
- Plan showing the location of charging station

For 5-3(j)

- Universal design plan showing the strategies consists of carpark space, kerb ramp, tactile walking surface indicator (TWSI), flush threshold drainage grating etc. as per MS 1184:2014

For 5-3(k)

- Extract tender specification showing the requirement to provide way finding strategies/features throughout the township for all type of users.
- Plan on way finding strategies to cater for all level of users (pedestrian, vehicles, physically challenged)
- Detail drawing for the strategies and location

For 5-3(l)

- Site / Layout plan drawings and design brief showing location, cargo delivery routes and major highway



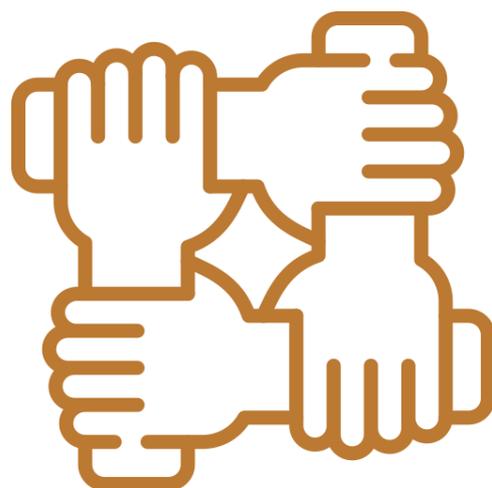
## REFERENCES

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- MS 1184:2014
- Garis Panduan Perancangan Reka Bentuk Sejagat (GP015-A)
- Panduan Pelaksanaan Pengasingan Laluan Bermotor: Pemasangan Tonggak Laluan dan Rel Penghadang
- Panduan Pelaksanaan Inisiatif Pembangunan Kejiranan Hijau – Penyediaan Laluan Basikal

# Other Green Requirements

## Part 6 – Community and Innovations



**TS 6-1 Stakeholder Engagement, Feedback and Evaluation**

**TS 6-2 Public Awareness, Education and Community Involvement**

**TS 6-3 Green Lease**

**TS 6-4 Intelligent Infrastructure**

**TS 6-5 Safe Environment**

**TS 6-6 Light Pollution Reduction**

**TS 6-7 Other Green Features and Innovation**



## TS 6-1 STAKEHOLDER ENGAGEMENT, FEEDBACK AND EVALUATION



### OBJECTIVES

- To solicit feedback to enhance the quality of the living environment in common facilities/public amenities
- To provide effective feedback channels (e.g., hotlines, emails, etc) for residents to take ownership of the township



### APPLICABILITY

Applicable during Design Phase and Construction Phase/Post Completion



### REQUIREMENTS

#### For 6-1(a)

- 1 credit for consultation with stakeholders during construction / post completion (based in extent of consultation and community involvement)

#### For 6-1(b)

- 1 credit for consultation of at least two key stakeholder group

#### For 6-1(c)

- 1 credit for providing proper evaluation of feedback/survey findings

#### For 6-1(d)

- 1 credit for release of findings and feedback received.
- Additional 2 credits for addressing follow-up actions.



## DOCUMENTARY EVIDENCES

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### For 6-1(a)

- Copy of final draft of development report/planning permission/master plan
- Copy of survey for post completion
- Minutes of meeting, attendance list and photographic evidence on public consultation/feedback sessions on stipulated key stakeholders.

### For 6-1(b)

- Minutes of meeting, attendance list and photographic evidence on public consultation/feedback sessions on stipulated key stakeholders:
  - » Public Sector/Government agencies
  - » Community/residents committee
  - » NGOs
  - » Professional Bodies
  - » Trade Unions

### For 6-1(c)

- Evaluation of feedback from item TS 6-1 (b).
- Raw data of the survey analysis
- Survey report

### For 6-1(d)

- Relevant documents and photographic evidence on the released findings and feedback from item TS 6-1 (a) and/or (b) including list of follow-up actions taken.

## TS 6-2 PUBLIC AWARENESS, EDUCATION AND COMMUNITY INVOLVEMENT



### OBJECTIVES

To encourage and promote sustainable lifestyle and integration within the township through the production of a dedicated outreach or education programme to increase public awareness on environmental sustainability and green features of the township



### APPLICABILITY

Generally applicable to overall masterplan of the township development.



### REQUIREMENTS

For 6-2(a)

- Up to 2 credits based on extent of outreach or education programmes and contents.

Extent of outreach or education programmes and contents	Weightage for Credits Allocation
Low Impact	0.5
Medium Impact	1
High Impact	2

*Table 6-2.1: Weightage for Credits Allocation*

User guide brochures, information portals and facilities (such as visitor centres and exhibits) should be provided where appropriate to facilitate public awareness and education.

These areas may include:

- Online energy efficiency and energy tracker
- Refuse collection
- Recycling facilities
- Water conservation and usage
- Environmental technologies and info



- Local transport information
- Local amenities and local information
- Community groups and activities
- Religious building locations
- Biodiversity of the area

Strategies that covered any two areas specified will be considered as low impact (0.5 credits).

Strategies that covered any five areas specified will be considered as medium impact (1 credit).

Strategies that covered more than five areas will be considered as high impact (2 credits).

The credits awarded on condition that all strategies are applicable to all users of the township including residents, visitors & managements.

#### For 6-2(b)

- 2 credits for at least 1 activity per year
- Additional 1 credit for each additional green activity organised per year (up to 3 credits)



## **DOCUMENTARY EVIDENCES**

#### For 6-2(a)

- User guide brochures and/or documentation on information portals, facilities used.
- Provide drawings, tender specification and/or photograph where applicable.
- Report showing proposed responsible parties, type of activities, budgeting and controls on green activities.
- Provide details on extent of outreach or education programmes and contents.

#### For 6-2(b)

- Provide drawings, tender specification and/or photograph where applicable.
- Report showing proposed responsible parties, type of activities, budgeting and controls on green activities.



## WORKED EXAMPLE

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For 6-2(a)

Provision of township apps where the people who live or work there able to monitor their house/premise energy & water consumption, apply for visitor permit, view latest announcement by management regarding refuse schedule, recycling schedule, bus routes map and daily schedule, location of bicycle parking & electric car charging, events and program, emergency hotline & maintenance fee payment with notification function are considered **high impact, 2 credits**.

Provision of one stop centre for management and residents/users as centralised information centre, community centre where all the educational activity conducted including recycling points, e-waste, composting, etc. are considered **medium impact, 1 credit**.

The management provide brochure with content of township info, green features, sustainable initiative and any printed educational material are considered **low impact, 0.5 credit**.

## TS 6-3 GREEN LEASE



### OBJECTIVES

---

To encourage green lease as an alternative to regular economic rental models within the township.



### APPLICABILITY

---

Applicable to all leased parcel within the township



### REQUIREMENTS

---

2 credits for provision of green lease contract documents



### DOCUMENTARY EVIDENCES

---

- Extract of tender specification showing the provision of green lease agreement.
- Proposed green lease agreement contents.



### WORKED EXAMPLE

---

The green lease contract documents should specify, but not limited to:

- The township GreenRE rating
- Minimum specification requirement for energy efficiency
- Water management plan
- Green design, practices and selection of material and resources
- IAQ management plan to enhance air quality, thermal comfort, acoustic control & daylighting.
- Building capacity supporting green commute
- Building users involvement and innovative features for the benefit of overall community



## TS 6-4 INTELLIGENT INFRASTRUCTURE



### OBJECTIVES

To allow for future growth and maintenance and to utilise the current technology such as IoT (Internet of Things) for public access in decision making an automated transport information



### APPLICABILITY

Generally applicable to public-accessed communication infrastructures and transport information in the township development.



### REQUIREMENTS

For 6-4(a)

- 2 credits for provision of infrastructure supporting high speed communication (digital, fibre optic, etc) and allowing for future growth and maintenance.

For 6-4(b)

- 1 credit for provision of public access to intelligent transport information, to reduce the transport demand.



### DOCUMENTARY EVIDENCES

For 6-4(a)

- Technical information on communications infrastructure, including information on its speed and etc.
- Layout plan drawing showing future ready communication infrastructure.

For 6-4(b)

- Technical information on intelligent transport information, including the content and features/usage.
- Related drawing showing provision of public access to the intelligent transport information.

- Report on intelligent infrastructure including transit routes, schedules, carpark lot availability, amenities nearby and etc.



## REFERENCES

---

- Smart Cities Initiative
- MS ISO 37122:2019 Sustainable Cities and Communities – Indicators for Smart Cities



## WORKED EXAMPLE

---

Intelligent infrastructure is a digital transformation focused on improving communication and transportation management.

- Apps that turn data into intelligence, helping in decision making to avoid delays and speed restrictions when using public transportation, public facilities and amenities.
- Easy to use apps with interactive maps and aerial survey imagery to support evidence-based decision making and help out the community worked and move smarter.



## TS 6-5 SAFE ENVIRONMENT



### OBJECTIVES

To provide good natural surveillance of public spaces



### APPLICABILITY

Applicable to all public area within the township



### REQUIREMENTS

1 credit for designing good natural surveillance of public spaces.

One of universal principal of CPTED is natural surveillance. The main purpose of this principle is to increase the level of public surveillance through 'eyes on the street' approach for potential crimes and subsequently be able to raises the uncertainty of the criminals to commit crime.

Natural surveillance means that environmental capacity creates clear opportunities and extensive surveillance from various angles either from outside or inside the building by residents or security guards through design approach.

The strategies should, but not limited to:

- Security signage
- Education, public awareness and publicity
- Safety mirror
- Pedestrian walkway and railings
- Lighting
- Unobstructed route or path from public view
- Police bit



### DOCUMENTARY EVIDENCES

- Report detailing natural surveillance of public spaces in project site and drawings showing distance and range of sight.

- Internal road lighting drawing
- Landscape design masterplan (if applicable)



## REFERENCES

---

- Crime Prevention Through Environmental Design (CPTED)
- Panduan Bandar Selamat



## TS 6-6 LIGHT POLLUTION REDUCTION



### OBJECTIVES

To minimise light trespass from site, only light areas as required for safety and comfort



### APPLICABILITY

Applicable to all public area within the township



### REQUIREMENTS

2 credits for minimizing light trespass from site for 80% of township.

Lamp Type and Shielding Standards:

Use Class and Lamp Type	Lighting zones				
	E4	E3	E2	E1	E1A
<b>Class 1 Lighting (Colour Rendition)</b>					
i. Initial output greater than or equal to 2000 lumens	F	F	F	F	F
ii. Initial output below 2000 lumens	A(1)	A(1)	A(1)	F	F
<b>Class 2 Lighting (General Illumination)</b>					
i. Initial output greater than or equal to 2000 lumens	F	F	F	F	F
ii. Initial output below 2000 lumens (2)	A(1)	A(1)	A(1)	F	F
<b>Class 3 Lighting (Decorative) (3):</b>					
Initial output greater than or equal to 2000 lumens	F	F	X	X	X
Initial output below 2000 lumen (2)	A(1)	A(1)	F	F	F
<b>Residential Lighting (all Classes) (4):</b>					
Initial output greater than or equal to 2000 lumens	F	F	F	F	F
Initial output below 2000 lumens (2)	A(1)	A(1)	A(5)	A(5)	F

## IDA lighting Zone

### INTRINSIC DARK SKY ZONE

**E1**

Area with intrinsically dark landscapes. These Zones include all areas within 50km of astronomical observatories and within 10km of local or national park boundaries, as well as the park themselves. In these areas the preservation of a naturally -dark environment, both in the sky and in the viable landscape is considered of paramount concern. These zones may also include rural areas, that have identified preservation of natural darkness as high priority or other areas where the preservation of a naturally dark landscape is of utmost priority.

### LOW AMBIENT LIGHTING ZONES

**E2**

These Zone generally include rural residential and agricultural rea but may also include small outlying neighbourhood commercial and industrial area surrounded by rural residential areas

### MEDIUM AMBIENT LIGHTING ZONES

**E3**

These Zone generally include urban areas with primary land used for commercial, business and industrial activities including highway and downtown district.

### HIGH AMBIENT LIGHTING ZONES

**E4**

These zones generally include urban areas with primary land uses for commercial, business and industrial activities including highway and downtown district.

#### Notes

1. A =all types of lighting fixtures allowed; shielding not required but highly recommended, except any spot or flood light must be aimed no higher than 45 degrees above straight down.  
F =only fully shielded fixtures allowed.  
X =not allowed.
2. Classes of lighting are as define by IDA (International Dark Sky Association) as follows:



#### **Class 1 Lighting**

All outdoor lighting used for, but not limited to, outdoor sales or eating areas, assembly or repair areas, advertising and other signs, recreational facilities and other similar applications where COLOR RENDITION IS IMPORTANT

to preserve the effectiveness of the activity. Recognized Class 1 uses are outdoor eating and retail food or beverage service areas; outdoor maintenance areas; display lots; assembly areas such as concert or theatre amphitheatres.



### **Class 2 Lighting**

All outdoor lighting used for, but not limited to, illumination for walkways, roadways, equipment yards, parking lots and outdoor security where GENERAL ILLUMINATION for safety or security of the grounds is the primary concern.



### **Class 3 Lighting**

Any outdoor lighting used for DECORATIVE effects including, but not limited to, architectural illumination, flag and monument lighting, and illumination of trees, bushes, etc.

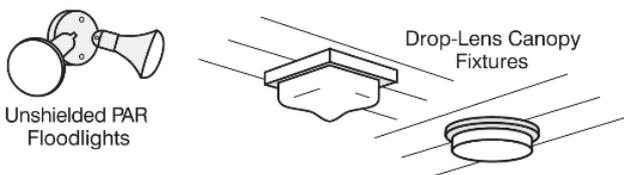
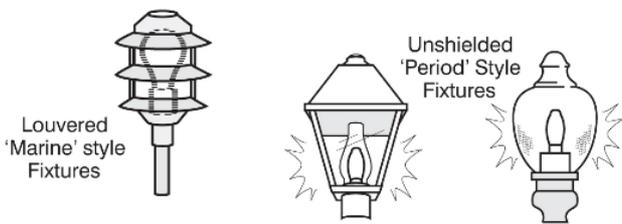
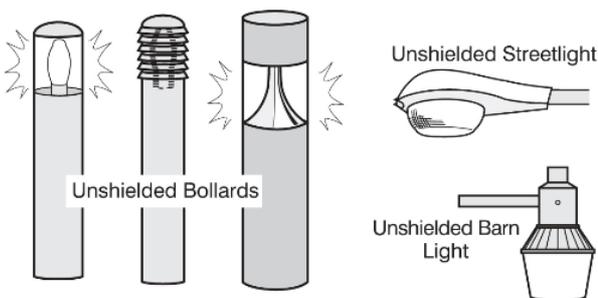
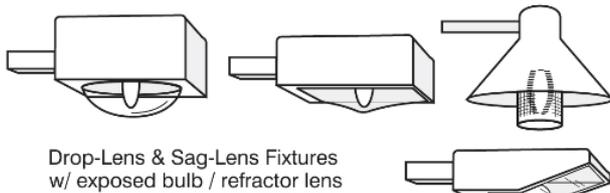
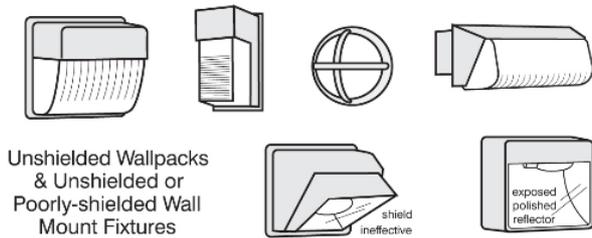
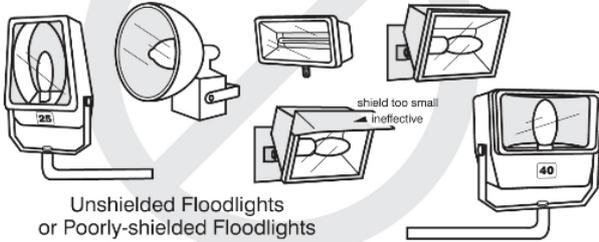
The light pollution, unlike many other forms of pollution, is reversible. To minimize the harmful effects of light pollution, lighting should:

- Be fully shielded (pointing downward)
- Only use when and where it is necessary
- Install motion detector lighting and timers
- Yellow/orange light instead of white light, with more blue content or with ultraviolet content.
- Where white light is preferred, the white light sources must have blue light and ultraviolet filter.

# Examples of Acceptable / Unacceptable Lighting Fixtures

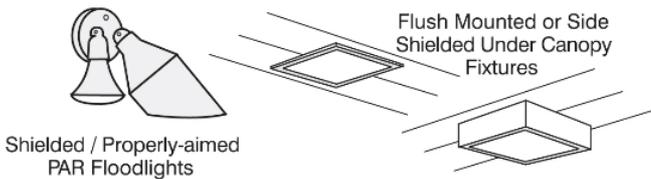
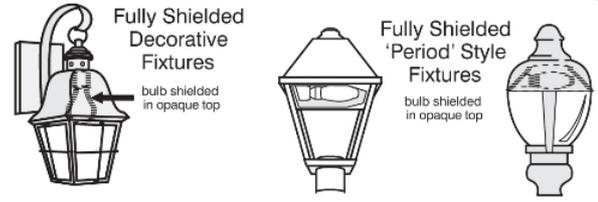
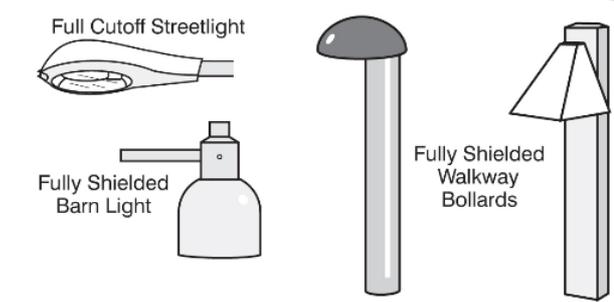
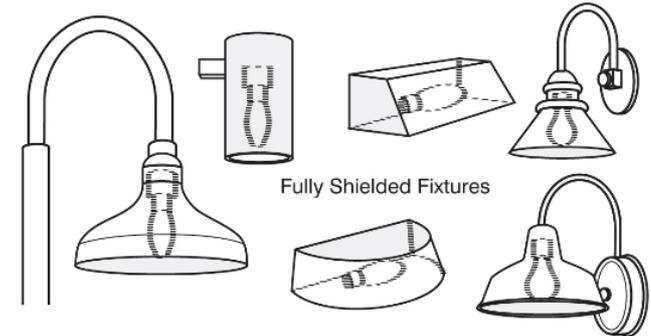
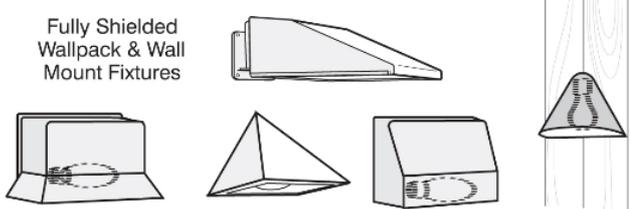
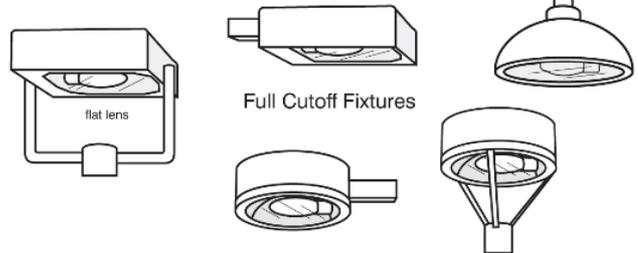
## Unacceptable / Discouraged

Fixtures that produce glare and light trespass



## Acceptable

Fixtures that shield the light source to minimize glare and light trespass and to facilitate better vision at night



Illustrations by Bob Crelin© 2005. Rendered for the Town of Southampton, NY. Used with permission.



## DOCUMENTARY EVIDENCES

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- Extract of tender specification showing the requirement for the shielded outdoor lighting, sensor & timer within the township.
- Technical specification of the outdoor lighting, sensor & timer.
- Related drawing showing the location of all outdoor lighting including pedestrian, landscape and decorative lighting.
- Photographic evidence



## REFERENCES

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- [https://www.darksky.org/wp-content/uploads/bsk-pdf-manager/RASC-GOL\\_2018\\_51.pdf](https://www.darksky.org/wp-content/uploads/bsk-pdf-manager/RASC-GOL_2018_51.pdf)
- [https://www.lightingassociates.org/i/u/2127806/f/tech\\_sheets/Light\\_Trespass\\_and\\_Light\\_Pollution.pdf](https://www.lightingassociates.org/i/u/2127806/f/tech_sheets/Light_Trespass_and_Light_Pollution.pdf)



## TS 6-7 OTHER GREEN FEATURES AND INNOVATION



### OBJECTIVES

To encourage the use of other green features which are innovative and have positive environmental impact



### APPLICABILITY

Generally applicable to overall masterplan of the township development.



### REQUIREMENTS

Up to 5 credits for the use of green features that are innovative and have positive environmental impact

Examples:

- Dedicated bus and tram lanes on public roads
- Car-free township
- Use of pre-cast / pre-fabricated construction materials for infrastructure and public amenities
- Common services tunnel
- Adoption of local labour to ensure economic sustainability

Extent of environmental benefits or environmental impacts	Weightage for Credits Allocation
Low Impact	1
High Impact	2

Table 6-7.1: Weightage for Credits Allocation



## DOCUMENTARY EVIDENCES

---

- Extracts of the tender specification showing the provision of the specific green features used and the extent of implementation where applicable.
- Technical product information (including drawing and supporting documents) of the green features.
- A summary sheet listing the breakdown and the extent of implementation as well as the total requirements for the same intended purpose for the specific green features used.
- Quantified evidences on the potential environmental benefits that the features can bring to the township.



## TS 6-8 OPERATIONAL EMBODIED CARBON CALCULATION



### OBJECTIVES

To calculate the carbon emission resulted from the associated energy used during construction and operational phase of a development.



### APPLICABILITY

Generally applicable to all building development.



### REQUIREMENTS

- a. Recognise the carbon emission based on operational carbon footprint computation of the building comprising energy [B6] and water consumption [B7].
- b. 1 credit for recognise the calculation of product stage embodied carbon based on following building materials [A1-A3]:
  - concrete
  - steel
  - bricks
  - cement
  - steel and metal
- c. 0.5 credit for calculation of construction stage embodied carbon [A4-A5]
- d. Up to 1 credit for reduction from reference embodied carbon (for Ready Mix Concrete, Cement, Steel Reinforcement, Bricks, Steel & Metal) as follow:

>10%	0.5 credit
>30%	1 credit



Baseline as follow:

EC (tCO <sub>2</sub> eq/t)				
Ready Mixed Concrete	Cement	Steel Reinforcement	Bricks	Steel & Metal
0.199 - 0.219	0.965 - 1.0857	1.39 - 2.41	0.249 - 0.279	1.478 - 2.498



## DOCUMENTARY EVIDENCES

For 6-8 (a)

- Detail calculation for the estimated energy load for each component in the building e.g.: lighting, air-conditioning system, pump, receptacle load.
- Details calculation for estimated water consumption of the building e.g.: water fittings, landscape, water features.
- Technical product information on the energy efficient features and water efficient features used.
- Summary tabulation of estimated total energy savings and total water savings of the development for the year.
- Carbon emission calculation.

For 6-8 (b)

- Embodied carbon footprint calculation

For 6-8 (c)

- Calculation of construction stage embodied carbon [A4-A5]

For 6-8 (d)

- Calculation showing the reduction from reference embodied carbon (for Ready Mix Concrete, Cement, Steel Reinforcement, Bricks, Steel & Metal)



## WORKED EXAMPLES

### 6-8 (a) Operational Carbon Calculation

**Table 6-1: Energy Consumption**

Type of usage	Design	Baseline
	(kWh/yr)	(kWh/yr)
Lighting	819,498	1,151,575
Air-Conditioning	860,589	1,406,899
M/V System	25,550	25,550
Total Energy Usage	1,705,637	2,584,024

**Table 6-8.2: Water Consumption**

*(Please refer GreenRE Water Calculator)*

Type of fixtures	Design	Baseline
	(m <sup>3</sup> /yr)	(m <sup>3</sup> /yr)
Flow Fixtures	2,402	6,899
Flush Fixtures	5,366	5,161
Total Water Usage	7,768	12,060

**Table 6-8.3: Operational Carbon Footprint**

Type of usage	Design	Baseline
	kgCO <sub>2</sub> e/yr	kgCO <sub>2</sub> e/yr
Energy	1,226,619	1,860,497
Water	155,344	241,192
Total Annual Carbon Footprint	1,381,963	2,101,689

Energy CO2 Emission Reduction (ktCO<sub>2</sub>e/annum, based on electricity energy reduction only @ 1kWh =

- 0.639 kg CO<sub>2</sub>- Peninsular
- 0.512 kg CO<sub>2</sub>- Sarawak
- 0.512 kg CO<sub>2</sub>- Sabah

Water CO2 Emission Reduction = 0.419 kg CO<sub>2</sub>e/m<sup>3</sup>

Percentage savings = (2,101,689 - 1,381,963) / 2,101,689 = 34.25%

Credits scored for 6-1 (a) = 1 credit

#### 6-8 (b) Product Stage Embodied Carbon Calculation (A1-A3)

No	Material	Description	Embodied Carbon Factor (kgCO <sub>2</sub> e/kg)	Quantity		Quantity (kg)	Total Embodied Carbon (tCO <sub>2</sub> e)
				Value	Unit		
1	Concrete (G30)	Slab	0.13	5,047	m <sup>3</sup>	12,112,800	1,574.66
2	Glass	10mm of Glass (Single Glass excluding Frame)	1.44	12,415	kg	12,415	17.88
3	Steel Reinforcement	Rebar	0.73	247,945	kg	247,945	181.00
4	Brick	Red brick – internal wall	0.21	9,574	m <sup>3</sup>	16,850,240	3,538.55
5	Cement	Portland cement	0.91	6,217	m <sup>3</sup>	9,748,256	8,870.91
6	Aluminium	Window & door frame	0.93	3,972	kg	3,972	3.69
	<b>Total</b>						<b>14,186.69</b>

Table 6-1.4: Tabulation of total embodied carbon of material for product stage (A1-A3)

Source: CIDB- Embodied Carbon Inventory Data For Construction Materials

Credits scored for 6-8 (b) = 1 credit

### 6-8 (c) Construction Stage Embodied Carbon Calculation (A4 Transport + A5 Material Waste)

No	Mode	TEF <sub>mode</sub> (gCO <sub>2</sub> e/kg/km)	Description
1	Road transport emissions	0.1065	For HGV (all diesel)
2	Sea transport emissions	0.01614	For cargo ship, container ship
3	Freight flight emission	0.59943	International
4	Rail flight emissions	0.02556	Freight train

Table 6-1.5: Transport emissions factors for different modes of transport  
Source: CIDB- Embodied Carbon Inventory Data For Construction Materials

No	Transport Detail	Emissions Coefficient Factors (ECF) (kgCO <sub>2</sub> e/kg)
1	Transport for locally manufactured with average distance travelled by road 50km	0.005
2	Transport for national with average distance travelled by road 300km	0.0032

Table 6-1.6: Transport emissions factors for different modes of transport  
Source: CIDB- Embodied Carbon Inventory Data For Construction Materials

#### A4: Quantity × TEF<sub>mode</sub> × ECF

where:

- Quantity of material in kg
- TEF<sub>mode</sub> based on mode of transport as in Table 6-1.5
- ECF based on distance for material transported to site (locally sourced or imported material) as in Table 6-1.6

No	Type of Waste	Waste Rate	Waste Factor (tCO <sub>e</sub> /t)
1	Concrete in situ	5%	0.053
2	Precast concrete	1%	0.01

3	Steel reinforcement	5%	0.053
4	Brick	20%	0.25
5	Cement	5%	0.053
6	Glass	5%	0.053
7	Aluminium	1%	0.01

Table 6-8.7: Waste rate (WR) and waste factor (WF)

Source: *istrukture.org*

$$A5 : WF \times (A13 + A4 + C2 + C34)$$

where:

- WF is the waste factor, based on expected % waste rate (Table 6-1.7)
- A13 is A1–A3 emissions for production of the wasted material, (6-1 (b))
- A4 for transporting the wasted material to site (Table 6-1.6)
- C2 for transporting the wasted material away from site (in the absence of better data, assume 50km by road to the nearest reuse/recycling location = 0.005kgCO<sub>2</sub>e/kg)
- C34 is C3–C4 emissions for processing and disposal of the waste material (in the absence of better data, assume 1.77kgCO<sub>2</sub>e/kg for timber products and 0.013kgCO<sub>2</sub>e/kg for all other materials).

#### Concrete (A4 + A5)

$$A4: \text{Quantity (kg)} \times \text{TEFmode} \times \text{ECF}$$

$$= 12,112,800 \times 0.1065 \times 0.005$$

$$= 6,450 \text{ kgCO}_2\text{e}$$

$$A5: WF \times (A13 + A4 + C2 + C34)$$

$$\text{Step 1: } A13 = 1,574,664 \text{ kgCO}_2\text{e}$$

$$A4 = 6,450 \text{ kgCO}_2\text{e}$$

$$C2 = 12,112,800 \times 0.005 = 60,564 \text{ kgCO}_2\text{e}$$

$$C34 = 12,112,800 \times 0.013 = 157,467 \text{ kgCO}_2\text{e}$$

Step 2: Sum all components

$$(A13 + A4 + C2 + C34)$$

$$1,574,664 + 6,450 + 60,564 + 157,467$$

$$= 1,799,145 \text{ kgCO}_2\text{e}$$

Step 3: Apply waste factor

$$A5 = 0.053 \times 1,799,145 = 95,354.68 \text{ kg CO}_2\text{e}$$

$$\begin{aligned} \text{Concrete (A4 + A5)} &= 6,450 + 95,354.68 \\ &= 101,804.68 \text{ kgCO}_2\text{e} \end{aligned}$$

-----  
Glass (A4 + A5)

$$\begin{aligned} A4: \text{Quantity (kg)} \times \text{TEFmode} \times \text{ECF} \\ &= 12,415 \times 0.1065 \times 0.005 \\ &= 6.61 \text{ kgCO}_2\text{e} \end{aligned}$$

$$A5: \text{WF} \times (A13 + A4 + C2 + C34)$$

$$\begin{aligned} \text{Step 1: } A13 &= 17,877.60 \text{ kgCO}_2\text{e} \\ A4 &= 6.61 \text{ kgCO}_2\text{e} \\ C2 &= 12,415 \times 0.005 = 62.08 \text{ kgCO}_2\text{e} \\ C34 &= 12,415 \times 0.013 = 161.39 \text{ kgCO}_2\text{e} \end{aligned}$$

Step 2: Sum all components

$$(A13 + A4 + C2 + C34)$$

$$\begin{aligned} 17,877.60 + 6.61 + 62.08 + 161.39 \\ &= 18,107.68 \text{ kgCO}_2\text{e} \end{aligned}$$

Step 3: Apply waste factor

$$A5 = 0.053 \times 18,107.68 = 959.71 \text{ kg CO}_2\text{e}$$

$$\begin{aligned} \text{Glass (A4 + A5)} &= 6.61 + 959.71 \\ &= 996.32 \text{ kgCO}_2\text{e} \end{aligned}$$

-----  
Steel Reinforcement (A4 + A5)

$$\begin{aligned} A4: \text{Quantity (kg)} \times \text{TEFmode} \times \text{ECF} \\ &= 247,945 \times 0.1065 \times 0.005 \\ &= 132.03 \text{ kgCO}_2\text{e} \end{aligned}$$

$$A5: \text{WF} \times (A13 + A4 + C2 + C34)$$

$$\begin{aligned} \text{Step 1: } A13 &= 180,999.85 \text{ kgCO}_2\text{e} \\ A4 &= 132.03 \text{ kgCO}_2\text{e} \\ C2 &= 247,945 \times 0.005 = 1,239.73 \text{ kgCO}_2\text{e} \\ C34 &= 247,945 \times 0.013 = 3,223.28 \text{ kgCO}_2\text{e} \end{aligned}$$

Step 2: Sum all components

$$(A13 + A4 + C2 + C34)$$

$$180,999.85 + 132.03 + 1,239.73 + 3,223.28$$

$$= 185,594.89 \text{ kgCO}_2\text{e}$$

Step 3: Apply waste factor

$$A5 = 0.053 \times 185,594.89$$

$$= 9,836.53 \text{ kgCO}_2\text{e}$$

$$\underline{\text{Steel Reinforcement (A4 + A5)}} = 132.03 + 9,836.53$$

$$= 9,968.56 \text{ kgCO}_2\text{e}$$

-----

Brick (A4 + A5)

$$A4: \text{Quantity (kg)} \times \text{TEFmode} \times \text{ECF}$$

$$= 16,850,240 \times 0.1065 \times 0.005$$

$$= 8,972.75 \text{ kgCO}_2\text{e}$$

$$A5: \text{WF} \times (A13 + A4 + C2 + C34)$$

$$\text{Step 1: } A13 = 3,538,550.40 \text{ kgCO}_2\text{e}$$

$$A4 = 8,972.75 \text{ kgCO}_2\text{e}$$

$$C2 = 16,850,240 \times 0.005 = 84,251.2 \text{ kgCO}_2\text{e}$$

$$C34 = 16,850,240 \times 0.013 = 219,053.31 \text{ kgCO}_2\text{e}$$

Step 2: Sum all components

$$(A13 + A4 + C2 + C34)$$

$$3,538,550.40 + 8,972.75 + 84,251.2 + 219,053.31$$

$$= 3,850,827.66 \text{ kgCO}_2\text{e}$$

Step 3: Apply waste factor

$$A5 = 0.25 \times 3,850,827.66$$

$$= 962,706,915 \text{ kgCO}_2\text{e}$$

$$\underline{\text{Brick (A4 + A5)}} = 8,972.75 + 962,706,915$$

$$= 971,679.67 \text{ kgCO}_2\text{e}$$

-----

Cement (A4 + A5)

$$A4: \text{Quantity (kg)} \times \text{TEFmode} \times \text{ECF}$$

$$= 9,748,256 \times 0.1065 \times 0.005$$

$$= 5,190.95 \text{ kgCO}_2\text{e}$$

$$A5: WF \times (A13 + A4 + C2 + C34)$$

$$\text{Step 1: } A13 = 8,870,912.96 \text{ kgCO}_2\text{e}$$

$$A4 = 9,748,256 \text{ kgCO}_2\text{e}$$

$$C2 = 9,748,256 \times 0.005 = 48,741.28 \text{ kgCO}_2\text{e}$$

$$C34 = 9,748,256 \times 0.013 = 126,727.33 \text{ kgCO}_2\text{e}$$

Step 2: Sum all components

$$(A13 + A4 + C2 + C34)$$

$$8,870,912.96 + 9,748,256 + 48,741.28 + 126,727.33$$

$$= 18,794,637.57 \text{ kgCO}_2\text{e}$$

Step 3: Apply waste factor

$$A5 = 0.053 \times 18,794,637.57$$

$$= 996,115.79 \text{ kgCO}_2\text{e}$$

$$\text{Cement } (A4 + A5) = 9,748,256 + 996,115.79$$

$$= 10,744,371.79 \text{ kgCO}_2\text{e}$$

Aluminium (A4 + A5)

$$A4: \text{Quantity (kg)} \times \text{TEFmode} \times \text{ECF}$$

$$= 3,972 \times 0.1065 \times 0.005$$

$$= 2.16 \text{ kgCO}_2\text{e}$$

$$A5: WF \times (A13 + A4 + C2 + C34)$$

$$\text{Step 1: } A13 = 3,693.96 \text{ kgCO}_2\text{e}$$

$$A4 = 2.16 \text{ kgCO}_2\text{e}$$

$$C2 = 2.16 \times 0.005 = 0.108 \text{ kgCO}_2\text{e}$$

$$C34 = 2.16 \times 0.013 = 0.028 \text{ kgCO}_2\text{e}$$

Step 2: Sum all components

$$(A13 + A4 + C2 + C34)$$

$$3,693.96 + 2.16 + 0.108 + 0.028$$

$$= 3,696.26 \text{ kgCO}_2\text{e}$$

Step 3: Apply waste factor

$$A5 = 0.01 \times 3,696.26$$

$$= 36.96 \text{ kgCO}_2\text{e}$$

$$\text{Aluminium } (A4 + A5) = 2.16 + 36.96$$

$$= 39.12 \text{ kgCO}_2\text{e}$$

No	Material	Embodied Carbon Factor (kgCO <sub>2</sub> e/kg)	Quantity (kg)	Material Embodied Carbon A1-A3 (kgCO <sub>2</sub> e)	Transport Embodied Carbon A4 (kgCO <sub>2</sub> e)	Waste Embodied Carbon A5 (kgCO <sub>2</sub> e)	Total Embodied Carbon (kgCO <sub>2</sub> e)	Total Embodied Carbon (tCO <sub>2</sub> e)
1	Concrete (G30)	0.13	12,112,800	1,574,664	6,450	95,354.68	1,676,468.68	1,676.47
2	Glass	1.44	12,415	17,877.60	6.61	959.71	18,843.92	18.84
3	Steel Reinforcement	0.73	247,945	180,999.85	132.03	9,836.53	190,968.41	190.97
4	Brick	0.21	16,850,240	3,538,550.40	8,972.75	962,706,915	966,254,438.15	966,254.44
5	Cement	0.91	9,748,256	8,870,912.96	5,190.95	996,115.79	10,386,123.75	10,386.12
6	Aluminium	0.93	3,972	3,693.96	2.16	36.96	3,733.08	3.73
	<b>Total</b>							<b>978,530.57</b>

Table 6-8.8: Calculation tabulation of materials (A1-A3 + A4 + A5)

Credits scored for 6-8 (c) = 1 credit

For 6-1 (d) Reduction from reference embodied carbon [A1-A5]

Embodied Carbon of Material (Baseline)

EC (tCO <sub>2</sub> eq/t)				
Ready Mixed Concrete	Cement	Steel Reinforcement	Bricks	Others
0.219	1.0857	2.41	0.279	Aluminium 2.498 Glass 1.44 Timber 0.266

Table 6-8.9: Embodied carbon factor for each material (baseline)

Source: CIDB Technical Report No 207-GHG Emission for Construction Industry in Malaysia

## Sample Bill of Quantities

No	Description of Work/Material	Quantity		Quantity (kg)	RM
		Value	Unit		
1	Concrete (G30, in structural elements, 30% GGBS)	5,047	m <sup>3</sup>	12,112,800	xxx
2	Glass (6mm, green tinted low-e glass)	12,415	kg	12,415	xxx
3	Steel Reinforcement (high yield bars, 16mm, >90% scrap content)	247,945	kg	247,945	xxx
4	Brick (fly-ash, hollow bricks)	9,574	m <sup>3</sup>	16,850,240	xxx
5	Cement (Green cement – fly ash content)	6,217	m <sup>3</sup>	9,748,256	xxx
6	Aluminium (secondary aluminium with >50% recycled content)	3,972	kg	3,972	xxx

Table 6-8.10: Sample of Bill of Quantity

No	Material	Baseline Embodied Carbon Factor (kgCO <sub>2</sub> e/kg)	Reduced Embodied Carbon Factor (kgCO <sub>2</sub> e/kg)	Quantity (kg)	Baseline Total Embodied Carbon A1-A3 (kgCO <sub>2</sub> e)	Reduced Total Embodied Carbon (kgCO <sub>2</sub> e)
1	Concrete (G30)	0.219	0.13	12,112,800	2,652,703.20	1,574,664
2	Glass	1.44	1.44	12,415	17,877.60	17,877.6
3	Steel Reinforcement	2.41	0.73	247,945	597,547.45	180,999.85
4	Brick	0.279	0.21	16,850,240	4,701,216.96	3,538,550.40
5	Cement	1.0857	0.91	9,748,256	10,583,681.54	8,870,912.96
6	Aluminium	2.498	0.93	3,972	9,922.056	3,693.96
	<b>Total</b>					<b>14,186.69</b>

Table 6-8.10: Calculation of total embodied carbon in compare to baseline specified

Material	Baseline Embodied Carbon				Reduced Embodied Carbon			
	Material A1-A3 (kgCO <sub>2</sub> e)	Transport A4 (kgCO <sub>2</sub> e)	Waste A5 (kgCO <sub>2</sub> e)	Total (kgCO <sub>2</sub> e)	Material A1-A3 (kgCO <sub>2</sub> e)	Transport A4 (kgCO <sub>2</sub> e)	Waste A5 (kgCO <sub>2</sub> e)	Total (kgCO <sub>2</sub> e)
Concrete (G30)	2,652,703.20	6,450.00	152,490.73	2,811,644.00	1,574,664.00	6,450.00	95,354.66	1,676,468.72
Glass	17,877.60	6.61	959.71	18,843.92	17,877.60	6.61	959.71	18,843.92
Steel Reinforcement	597,547.45	132.03	31,913.55	629,593.03	180,999.85	132.03	9,836.53	190,968.41
Brick	4,177,174.50	8,972.75	1,122,362.89	5,308,510.14	3,538,550.40	8,972.75	962,706.87	4,510,230.02
Cement	8,870,912.96	5,190.95	479,733.34	9,355,837.25	8,870,912.96	5,190.95	479,733.34	9,355,837.25
Aluminium	9,922.06	2.12	99.96	10,024.13	3,693.96	2.12	37.68	3,733.75
<b>Total</b>				<b>18,134,452.47</b>				<b>15,756,082.07</b>

\*A4 - Assuming both quantity (kg) is the same for both cases

$$\begin{aligned}
 & (\text{Baseline} - \text{Reduced}) / \text{Baseline} \times 100\% \\
 & = (18,134,452.47 - 15,756,082.07) / 18,134,452.47 \\
 & = 13.2\%
 \end{aligned}$$

### GreenRE Requirement

>10% 0.5 credit

>30% 1 credit

Credits scored for 6- 8(d) = 0.5 credit