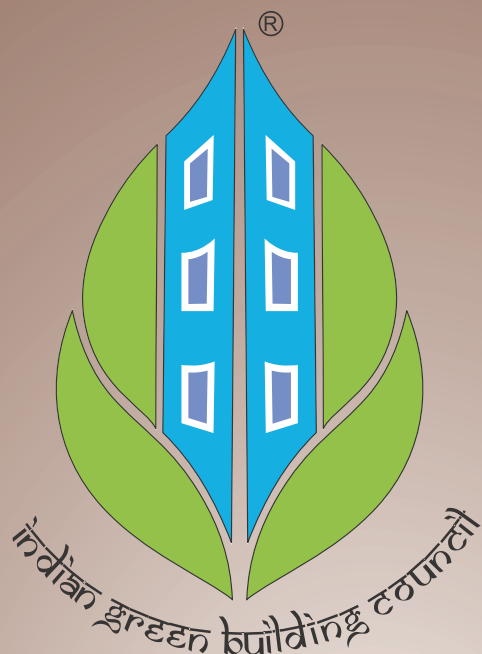




Confederation of Indian Industry



# IGBC



## IGBC Green Homes Rating System - Version 3.0

For Multi-dwelling Residential Units

### Abridged Reference Guide

September 2019



[www.igbc.in](http://www.igbc.in)

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Several champions have led this initiative from the front since 2008 onwards. They have shown tremendous involvement, commitment and leadership in developing this standard from Pilot Version to Version 3.0.

The IGBC Green Homes® Version 3.0 Abridged Reference Guide has been made possible through the efforts of many dedicated volunteers, staff members and others in the IGBC community. The Abridged Reference Guide was developed by the IGBC Green Homes® Technical Committee and many other members. Excellent inputs came in during the 'IGBC Green Homes' Technical Committee Meetings held in September 2018 at Hyderabad and April 2019 at Bengaluru.

IGBC would like to thank the following Technical Committee members for their participation and contribution in developing the rating programme. We also thank members for agreeing to participate in future development of the rating programme. The Green Homes Ver3.0 has included the latest building codes National Building Code 2016 & Eco-Niwas Samhita 2018 (ECBC-R).

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## Contents

## IGBC Green Homes® Rating Ver 3.0

Foreword from Indian Green Building Council	Page 1
Introduction	
Benefits of Green Homes	
National Priorities Addressed	
Rating System Updates and Addenda	
IGBC Certification Process	
Project Checklist	
<b>Sustainable Design</b>	Page 22
SD Mandatory Requirement 1	Local Building Regulations
SD Mandatory Requirement 2	Soil Erosion Control
SD Credit 1	Natural Topography & Vegetation
SD Credit 2	Heat Island Effect, Roof & Non-roof
SD Credit 3	Passive Architecture
SD Credit 4	Universal Design
SD Credit 5	Green Parking Facility
SD Credit 6	Basic House-hold Amenities
SD Credit 7	Basic Facilities for Construction Workforce
SD Credit 8	Green Education & Awareness
<b>Water Conservation</b>	Page 42
WC Mandatory Requirement 1	Water Efficient Plumbing Fixtures
WC Mandatory Requirement 2	Rainwater Harvesting
WC Credit 1	Water Efficient Plumbing Fixtures
WC Credit 2	Landscape Design
WC Credit 3	Management of Irrigation system
WC Credit 4	Recycle & Reuse of waste water
WC Credit 5	Water Quality
WC Credit 6	Enhanced Rainwater Harvesting
WC Credit 7	Water Metering

## **Energy Efficiency**

Page 68

EE Mandatory Requirement 1	HCFC Free Equipment
EE Mandatory Requirement 2	Minimum Energy Performance
EE Credit 1	Enhanced Energy Performance
EE Credit 2	Alternate Water Heating systems
EE Credit 3	On-site Renewable Energy – Common Lighting
EE Credit 4	Energy efficiency in common area equipment
EE Credit 5	Integrated Energy Monitoring System

## **Materials & Resources**

Page 89

MR Mandatory Requirement 1	Separation of House-hold Waste
MR Credit 1	Green Procurement Policy
MR Credit 2	Optimisation on structural Design
MR Credit 3	Certified Green Products
MR Credit 4	Local Materials
MR Credit 5	Eco friendly wood based materials
MR Credit 6	Alternative Construction Material
MR Credit 7	Handling of Construction & Demolition Waste
MR Credit 8	Organic Waste treatment Post Occupancy

## **Resident Health & Wellbeing**

Page 107

RHW Mandatory Requirement 1	Minimum Daylighting
RHW Mandatory Requirement 2	Ventilation Design
RHW Mandatory Requirement 3	No Smoking Policy
RHW Credit 1	Enhanced Daylighting
RHW Credit 2	Enhanced Ventilation Design
RHW Credit 3	Cross Ventilation
RHW Credit 4	Connectivity to Exteriors
RHW Credit 5	Low VOC Materials, Paints & Adhesives
RHW Credit 6	Facility for Physical Wellbeing



## **Innovation & Design**

Page 130

ID Credit 1.1-1.2

Innovation

ID Credit 2.1-2.2

Exemplary Performance

ID Credit 3

IGBC Accredited Professional

## **Annexures**

Annexure - 1

Climatic Zone as per ECBC-R

Page 137

Annexure – 2

RETV Calculations

Page 139

Annexure - 3

Sample Daylighting Simulation

Page 141

Annexure – 4

List of Plants

Page 144

Annexure – 5

Sample Energy Simulation

Page 148

## **Glossary**

Page 161

## **Foreword from the Indian Green Building Council (IGBC)**

India is witnessing tremendous growth in infrastructure and construction development. The construction industry in India is one of the largest economic activities and is growing rapidly. As the sector is growing rapidly, preserving the environment poses a host of challenges. To enable the construction industry environmentally sensitive, CII-Sohrabji Godrej Green Business Centre has established the Indian Green Building Council (IGBC). IGBC is a consensus driven not-for-profit Council representing the building industry, consisting of more than 1,950 committed member organisations. The Council encourages, builders, developers, owners, architects and consultants to design & construct green buildings thereby enhancing the economic and environmental performance of buildings.

The Green Building Movement in India has been spearheaded by IGBC (part of CII) since 2001, by creating National awareness. The Council's activities have enabled a market transformation with regard to green building concepts, materials and technologies.

IGBC continuously works to provide tools that facilitate the adoption of green building practices in India. The development of IGBC Green Homes<sup>®</sup> Rating System is another important step in this direction.

### **IGBC Membership**

IGBC draws its strength from its members who have been partners in facilitating the Green Building Movement in India. The local chapters led by individual champions and committed members have been instrumental in reaching out the vision of the IGBC at the regional levels. IGBC is today seen as a leader in spearheading the Indian Green Building Movement. The Council is member-driven and consensus-based.

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## Introduction

The housing sector in India is growing at a rapid pace and contributing immensely to the growth of the economy. This augurs well for the country and now there is an imminent need to introduce green concepts and techniques in this sector, which can aid growth in a sustainable manner.

Green concepts and techniques in the residential sector can help address national issues like water conservation, energy efficiency, fossil fuel usage reduction in commuting, handling of consumer waste and conserving natural resources. Most importantly, these concepts can enhance occupant health, happiness and well-being.

By 2030, the country is expected to have 68 cities with a population of more than one million, 13 cities with more than 4 million people and 6 megacities with populations of 10 million or more, with Mumbai and Delhi among the biggest cities worldwide. (*Source: Ministry of Urban development*). This implies that the country would see an upsurge in housing requirements for all strata of communities. Alongside this comes the demand for energy and water. The residential sector consumes about 24% of the electrical energy generated, which would continue to rise.

The housing sector in the country needs to make judicious shifts towards sustainable living so as to live a better earth for posterity. As on date, India has almost 15 lakh dwelling units going green under IGBC Green Homes Rating System.

Against this background, the Indian Green Building Council (IGBC) has launched 'IGBC Green Homes Rating System' to address National priorities. By applying IGBC Green Homes criteria, homes which are sustainable over the life cycle of the building can be constructed. This rating programme is a tool which enables the designer to apply green concepts and criteria, so as to reduce environmental impact, that are measurable. The programme covers methodologies to cover diverse climatic zones and changing lifestyles.

IGBC Green Homes is the first rating programme developed in India, exclusively for the residential sector. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts. The system is designed to be comprehensive in scope, yet simple in operation.

IGBC has set up the Green Homes Core Committee to develop the rating programme. This committee comprised of key stakeholders including architects, builders, consultants, developers, home owners, academicians, institutions, manufacturers and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system both in its content and process.

## **I. Benefits of Green Homes**

Green homes can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption right from day one of occupancy. The energy savings could range from 20 - 30 % and water savings around 30 - 50%.

Intangible benefits of green homes include enhanced air quality, excellent daylighting, health & wellbeing of the occupants, lower energy bills and conservation of scarce national resources.

## **II. National Priorities Addressed in the Rating System**

The Green Homes Rating System addresses the most important National priorities which include water conservation, handling of house-hold waste, energy efficiency, reduced use of fossil fuels, lesser dependence on usage of virgin materials and resident health & well-being of occupants.

## **III. IGBC Green Homes®**

IGBC has set up the Green Homes Core Committee to focus on residential sector. The committee includes builders, developers, home owners, architects, consultants, experts on building science, manufacturers and industry representatives. The varied experience and professions of the committee members brings in a holistic perspective in the process of developing the rating programme.

### **A. Evolution of the Rating System**

IGBC, in its endeavor to extend green building concepts to all building types envisioned a rating programme for homes in December 2007. A core committee was formed to draft the pilot version of the programme which was launched in July 2008. After one year of implementation, feedback from pilot projects were reviewed by the core committee and the suggestions have been incorporated in the version 1.0 of the rating system, launched in April 2009.

Based on the feedback and learning from various projects that have implemented the rating programme. Version 2.0 (Abridged Reference Guide) was launched in March 2012. The Abridged Reference Guide is further developed into enhanced version as IGBC Green Homes Detailed Reference Guide and launched in October 2013. With the experiences gained over years from the implemented projects and suggestions from stake holders Version 3.0 is now launched. The rating system is designed to suit Indian climatic conditions and residential construction practices.

**As on Sep 2019 more than 5,409 Green Buildings projects with a footprint of over 7 Billion sq.ft. The Green Homes contribute to 1,963 green home projects which is over 1,879 million sq.ft. of built-up area is registered under the rating programme.**

This growth has been possible with the participation of all stakeholders in the green building movement. About 220 members representing 120 organisations have participated in the development of the rating programme.

The rating system will be subject to review by the core committee, every two years, to ensure that it is updated and contemporary.

## **B. Features of IGBC Green Homes®**

IGBC Green Homes® Rating System is a voluntary and consensus based programme. The objective of IGBC Green Homes® is to facilitate the effective use of site resources, water conservation, energy efficiency, handling of house-hold waste, optimum material utilisation and design for healthy, comfortable & environmentally friendly homes.

The rating system evaluates certain mandatory requirements & credit points using a prescriptive approach and others on a performance-based approach. The rating system is evolved so as to be comprehensive and at the same time user-friendly. The programme is fundamentally designed to address national priorities and the quality of life for occupants.

The rating programme uses well accepted National standards and wherever local or National standards are not available, appropriate international benchmarks have been considered.

## **A. Scope of IGBC Green Homes®**

IGBC Green Homes® Rating System is a measurement system designed for rating new and major renovation of residential buildings. In general, all dwelling spaces which can meet the mandatory requirements and minimum points can apply. Various levels of green building certification are awarded based on the total points earned.

## **B. The Future of IGBC Green Homes®**

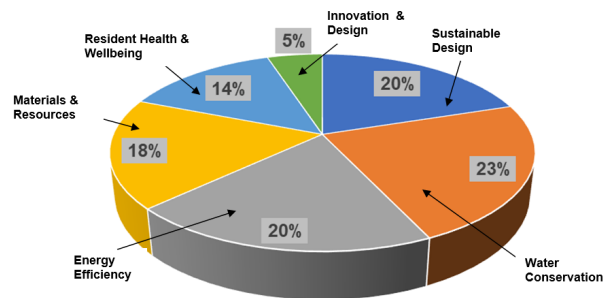
Many new green building materials, equipment and technologies are being introduced in the market. With continuous up-gradation and introduction of new green technologies and certified green products, it is important that the rating programme also keeps pace with current standards and technologies. Therefore, the rating programme will also undergo periodic revisions to incorporate the latest advances and changes. It is important to note that project teams applying for IGBC Green Homes® should register their projects with the latest version of the rating system. During the course of implementation, projects have an option to transit to the latest version of the rating system.

\*IGBC will highlight new developments on its website on a continuous basis at [www.igbc.in](http://www.igbc.in)

## IGBC Green Homes® Rating System

IGBC Green Homes® rating system addresses green features under the following categories:

- ❖ Sustainable Sites
- ❖ Water Conservation
- ❖ Energy Efficiency
- ❖ Materials & Resources
- ❖ Resident Health & well-being
- ❖ Innovation & Design



The guidelines detailed under each mandatory requirement & credit enables the design and construction of green homes of all sizes and types. Different levels of green building certification are awarded based on the total credits earned. Every Green Home should meet all the mandatory requirements, which are non-negotiable.

### a. When to use IGBC Green Homes®

IGBC Green Homes® is designed primarily for new residential projects viz., Multi-dwelling units, Apartment complexes, residential communities, guest houses, hostels etc.,

The project team can evaluate all the possible points to apply under the rating system using a suitable checklist. The project can apply for IGBC Green Homes® certification if it can meet all mandatory requirements and achieve the minimum required points.

### b. IGBC Green Homes® Registration

Project teams interested in IGBC Green Homes® Certification for their project must first register with IGBC. Projects can be registered on IGBC website ([www.igbc.in](http://www.igbc.in)) under 'IGBC Green Homes®'. The website includes information on registration fee for IGBC member companies as well as non-members. Registration is the initial step which helps establish contact with IGBC and provides access to the required documents, templates, important communications and other necessary information.

IGBC web site will have all important details on IGBC Green Homes® registration & certification - process, schedule and fee.

### c. IGBC Green Homes® Certification

The rating system caters to projects like gated communities, high-rise residential apartments, residential buildings with major renovation, hostels, service apartments, resorts, motels, guest houses, etc.,

## d. Documentation

To earn the IGBC Green Homes<sup>®</sup> Rating, the project must satisfy all the mandatory requirements and the minimum number of credit points.

The project team is expected to provide supporting documents at two stages viz., preliminary and final stage of submission for all the mandatory requirements and the credits attempted.

The project needs to submit the following:

1. General information of project including
  - a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
  - b. General drawings (in PDF format only):
    - Master/ Site plan
    - Parking plans
    - Floor plans
    - Elevations
    - Sections
    - Photographs/ Rendered views
2. Filled-in Master Template (in excel format)
3. Narratives and supporting documentation such as drawings, calculations (in excel sheets), declarations/ contract documents, purchase invoices, manufacturer cut sheets/ letters/ material test reports, etc., for each mandatory requirement/ credit
4. **In addition, project teams can refer the ‘Documentation Required for Certification’ section provided under each mandatory requirement/ credit.**

The necessary details are mentioned in this abridged version, under each mandatory requirement and credit.

Documentation is submitted in two phases – preliminary submittal and final submittal:

It is important to note that the mandatory requirements/ credits earned at the preliminary review are only considered as anticipated. These mandatory requirements/ credits are not awarded until the final documents are submitted, along with additional documents showing implementation of design features. If there are changes in any ‘credit expected’ after preliminary review, these changes need to be documented and resubmitted during the final review.

IGBC will recognise homes that achieve one of the rating levels with a formal letter of certification and a mountable plaque.

**e. Physical Verification & Monitoring**

Before the award of rating, the residential project would be physically audited to verify implementation of the design measures.

**f. Validity of Rating:**

The rating for the final certified projects is valid for 3 years from the date of Award. Thereafter, projects need to apply Re-Certification.

**g. Pre-certification**

Projects by developers can register for Pre-certification. This is an option provided for projects aspiring to get pre-certified at the design stage. The documentation submitted for pre-certification must detail the project design features which will be implemented. The rating awarded under pre-certification is based on the project's intention to conform to the requirements of IGBC Green Homes<sup>®</sup> Rating system. It is important to note that the pre-certification rating awarded need not necessarily correspond to the final certification.

Pre-certification gives the owner/ developer a unique advantage to market the project to potential buyers. For documentation required is mentioned under each credit.

**Precertified projects need to adhere to the following:**

Pre-certification is awarded to a project based on the green measures considered during design. IGBC is NOT responsible for the promises / declarations made by developer / owner to their end users / buyers

Please note the following:

- 1) The IGBC pre-certification project needs to submit for final Certification after actual implementation of the envisaged measures. The IGBC precertification is valid only for 3 years. It is mandatory to submit six monthly project updates till final certification. The Final award is based on the site verification by IGBC Team and actual implementation of envisaged green measures.
- 2) The IGBC Final Certification is valid for 3 years. Thereafter, the project needs to submit for renewal.
- 3) Registered projects without IGBC rating level should not use IGBC logos (or) IGBC Precertification level (or) IGBC Certification levels in their promotions/ marketing.



## **h. Credit Interpretation Ruling**

In some instances, the design team can face certain challenges in applying or interpreting a mandatory requirement or a credit. Project Teams may face site specific conditions which require an alternative compliance path to meet the intent behind the credit. To resolve this, IGBC uses the process of 'Credit Interpretation Ruling' (CIR) to ensure that rulings are consistent and applicable to other projects as well.

The following are the steps to be followed if a project team faces an issue not addressed in the IGBC Green Homes (Version 3.0) Abridged Reference Guide:

- ❖ Consult the Abridged Reference Guide for description of the credit intent, compliance options, documentation required, related credits, case studies, definitions and annexures.
- ❖ Review the intent of the mandatory requirement/ credit and self-evaluate whether the project satisfies the intent.
- ❖ Review the Credit Interpretation web page for previous CIR on the relevant mandatory requirement or credit. All projects registered under IGBC Green Homes will have access to this page.
- ❖ If a similar CIR has not been addressed or does not address the issue sufficiently, submit a credit interpretation request (A CIR shall not exceed 600 words or 5,000 characters including spaces). Only registered projects are eligible to post CIRs. Two CIRs are answered without levying any fee and for additional CIRs beyond the first two CIRs, a fee is levied.

The CIR Rulings for the earlier CIR raised by project terms is available in [www.igbc.in](http://www.igbc.in)

## **i. Appeal Process**

In rare cases, mandatory requirements or credits may be denied due to misinterpretation of the intent. On receipt of the final review, if a Project Team feels that sufficient grounds exist to appeal a credit denied in the final review, the project has an option to appeal to IGBC for reassessment of denied mandatory requirements or credits. The documentation for the mandatory requirements or credits seeking appeal may be resubmitted to IGBC along with necessary fee. IGBC will take 30 days to review such documentation. If an appeal is pursued, please note that a different review team will assess the Appeal Documentation.

The following documentation should be submitted:

- I. Filled-in template + revised checklist
- II. Original, re-submittal, and appeal submittal documentation for only those mandatory requirement/ credits that the project is appealing for. Also include a narrative for each appealed mandatory requirement/ credit to describe how the documents address the reviewers` comments and concerns.

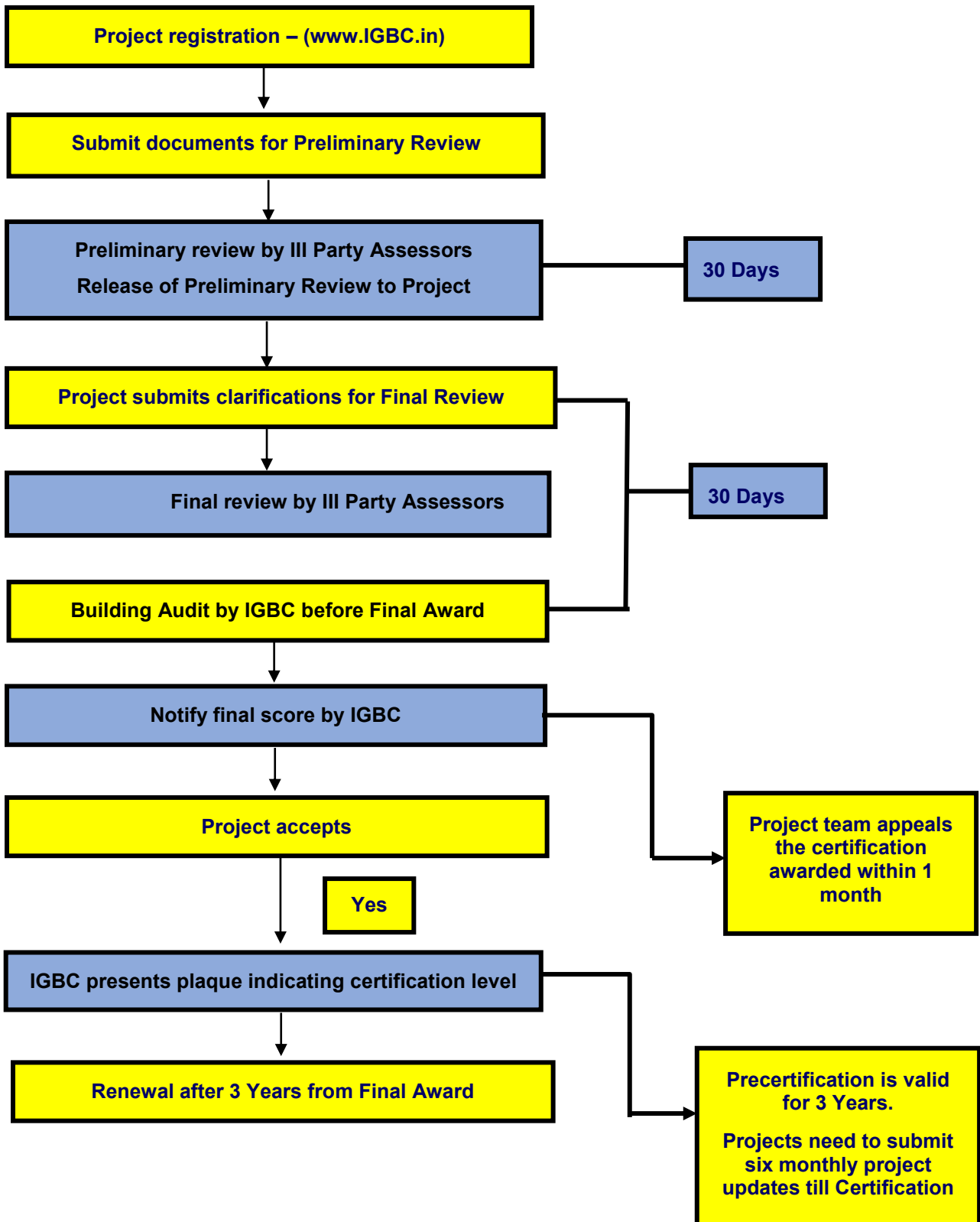
**j. Fee**

Registration, Certification, Appeal and CIR fee details are available on IGBC website ([www.igbc.in](http://www.igbc.in)) or projects can write to IGBC ([igbc@cii.in](mailto:igbc@cii.in)).

**k. Updates and Addenda**

This is the first version of IGBC Green Homes<sup>®</sup> Version 3.0 Abridged Reference Guide. As the rating system continues to improve and evolve, updates, addenda and errata to the Abridged Reference Guide will be made available through the IGBC website. These additions will be incorporated in the next version of the rating system.

## A. IGBC Certification Process

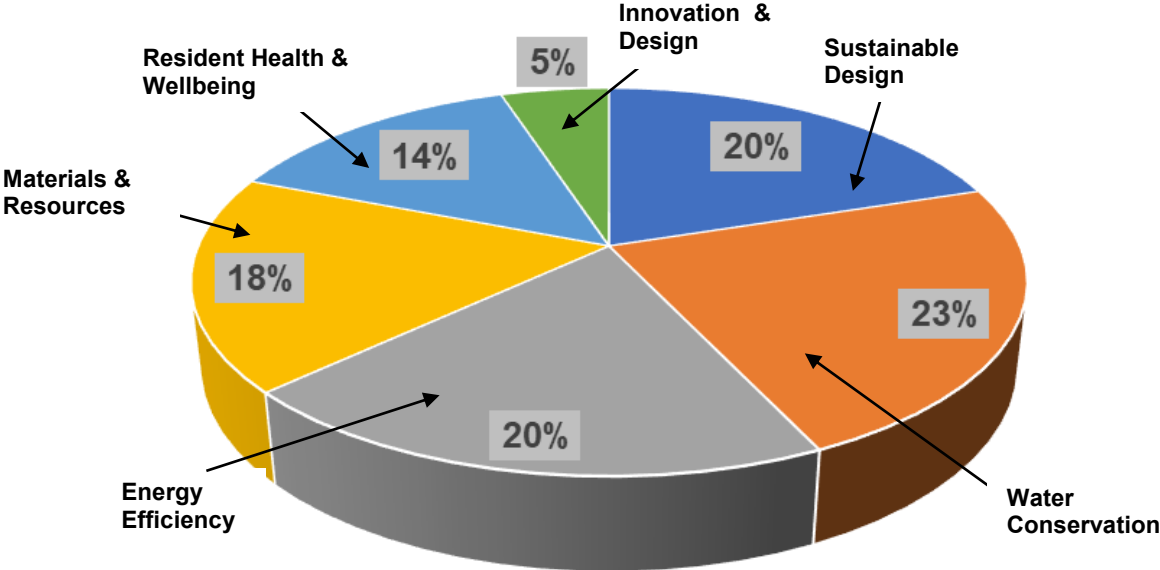


## Check List Green Homes Ver3.0

<b>Sustainable Design</b>		<b>Possible Points:</b>	<b>20</b>
SD Mandatory Requirement 1	Local Building Regulations		Required
SD Mandatory Requirement 2	Soil Erosion Control		Required
SD Credit 1	Natural Topography & Vegetation		4
SD Credit 2	Heat Island Effect, Roof & Non-roof		4
SD Credit 3	Passive Architecture		2
SD Credit 4	Universal Design		2
SD Credit 5	Green Parking Facility		4
SD Credit 6	Access to Amenities		2
SD Credit 7	Basic Facilities for Construction Workforce		1
SD Credit 8	Green Education & Awareness		1
<b>Water Conservation</b>		<b>Possible Points:</b>	<b>23</b>
WC Mandatory Requirement 1	Water Efficient Plumbing Fixtures		Required
WC Mandatory Requirement 2	Rainwater Harvesting		Required
WC Credit 1	Water Efficient Plumbing Fixtures		6
WC Credit 2	Landscape Design		3
WC Credit 3	Management of Irrigation System		2
WC Credit 4	Recycle & Reuse of Waste water		4
WC Credit 5	Water Quality		1
WC Credit 6	Enhanced Rainwater Harvesting		4
WC Credit 7	Water Metering		3
<b>Energy Efficiency</b>		<b>Possible Points:</b>	<b>20</b>
EE Mandatory Requirement 1	HCFC Free Equipment		Required
EE Mandatory Requirement 2	Minimum Energy Performance		Required
EE Credit 1	Enhanced Energy Performance		10
EE Credit 2	Alternate Water Heating system		3
EE Credit 3	On-site Renewable Energy - Common area Lighting		4
EE Credit 4	Energy efficiency in common area equipment		1
EE Credit 5	Integrated Energy Monitoring System		2

<b>Materials and Resources</b>		<b>Possible Points:</b>	<b>18</b>
MR Mandatory Requirement 1	Separation of House-hold Waste		Required
MR Credit 1	Green Procurement Policy		1
MR Credit 2	Optimisation on Structural Design		1
MR Credit 3	Certified Green Products		5
MR Credit 4	Local Materials		2
MR Credit 5	Eco friendly wood based materials		2
MR Credit 6	Alternative Construction Material		2
MR Credit 7	Handling of Construction & Demolition Waste		2
MR Credit 8	Organic Waste treatment Post Occupancy		3
<b>Resident Health &amp; Wellbeing</b>		<b>Possible Points:</b>	<b>14</b>
RHW Mandatory Requirement 1	Minimum Daylighting, 50%		Required
RHW Mandatory Requirement 2	Ventilation Design		Required
RHW Mandatory Requirement 3	No Smoking Policy		Required
RHW Credit 1	Enhanced Daylighting		2
RHW Credit 2	Enhanced Ventilation Design		2
RHW Credit 3	Cross Ventilation		4
RHW Credit 4	Connectivity to Exteriors		2
RHW Credit 5	Low VOC Materials, Paints & Adhesives		2
RHW Credit 6	Facility for Physical Wellbeing		2
<b>Innovation &amp; Design</b>		<b>Possible Points:</b>	<b>5</b>
ID Credit 1.1-1.2	Innovation		2
ID Credit 2.1-2.2	Exemplary Performance		2
ID Credit 3	IGBC Accredited Professional		1
<b>Total Available Points</b>			<b>100</b>

**Green Homes Ver 3.0 - Points Distribution**



**Threshold criteria for certification levels:**

Certification Level	Points	Recognition
Certified	50 – 59	Best Practices
Silver	60 – 69	Outstanding Performance
Gold	70 – 79	National Excellence
Platinum	80 – 100	Global Leadership



# Sustainable Design





## Introduction

The Sustainable Design section addresses the ecology and environment concerns related to residential construction & site development activities. Construction and development activities often have a negative impact on the ecology of the site. These activities impact the natural vegetation of the site, stormwater runoff patterns, perviousness of the site and also affect the existing migratory corridors of the site fauna.

When considering site alternatives, it is important to consider environmental criteria throughout the site selection process. The major ecological features of the site should be identified, including the site topography, existing trees, vegetation, wildlife and prior site history.

The erosion and sedimentation control plan can be implemented during construction to ensure that the existing vegetation on site is protected and the nutrient rich top soil is not washed away with the site water run-off. Flooding in urban areas during monsoons is largely caused by the debris clogging up the municipal stormwater ways. Projects shall consider implementing post occupancy strategies such as rainwater harvesting pits, storm water drain with filtering media, swales, retaining vegetation to mitigate the soil erosion and sedimentation control.

Increase in constructed areas leads to urban heat island effect where the local temperature increase due to heat retention. The urban heat island effect results in increased cooling energy requirement and affects the site flora and fauna.

Green homes are recommended to have easy access to basic amenities in order to take advantage of the existing infrastructure and enhance the quality of life of the occupants.

It is also important to minimise the negative impacts on surrounding areas after construction is complete. While it is known that many a time, the site selection may not be fully under the control of the occupant or developer, all possible measures can be explored.

Construction workers must be provided with safety and basic facilities such as sanitation facilities, drinking water, first aid, personal protection, etc., A green home design must be user friendly to differently abled and senior citizens.



**Local Building Regulations****SD Mandatory Requirement 1****Intent:**

Ensure that the building(s) complies with necessary statutory regulatory codes.

**Compliance Options:**

Design and execute the project as per the local building bye-laws.

**Documentation Required:*****Precertification***

- Site plan approved by local Government authority.  
(OR)
- Approved building plan/ site plan from regulatory body  
(OR)  
Attested copies of all drawings from Principal Architect
- Declaration from developer to build as per local regulations.
- Project attempting MoEF Clearance, need to submit the application submitted copy

***Certification***

- Fit-for-occupancy certificate issued by local Government authority (OR) In case project has submitted the application for Fit-for-occupancy, a letter from Principal Architect stating that the project is Fit for Occupancy to be submitted;
- As-built drawings (floor plans, elevations, sections, etc.,) approved by local Government authority.
- Photographs at site level and building level - all orientations taken after completion of the project.

**Soil Erosion Control****SD Mandatory Requirement 2****Intent:**

Control soil erosion and sedimentation thereby, reducing negative impacts to the site and surroundings.

**Compliance Options:**

Adopt the following measures:

Soil erosion control measures for pre-construction and during construction must conform to the best management practices highlighted in the National Building Code 2016 (NBC\*) of India

- ❖ Fertile topsoil to be stockpiled prior to construction, for reuse later either on site or sold/donated for use off-site.
- ❖ Develop a storm-water management plan during construction to ensure that the storm-water run-offs during construction are filtered to remove the TSS\* prior to conveying into the municipal storm-water drain.
- ❖ Develop appropriate measures to address soil erosion, post occupancy.



**Photographs showing best practices during construction**

*Notes: Please refer best landscape practices in National Building Code 2016 (NBC\*) of India, Chapter 11 – Approach to Sustainability, No. 7 – External Development & Landscape and Chapter 10, Part 10, Section 1 – Landscape Site Planning. No. 4- Protection of Landscape during Construction and No. 5. General landscape development.*

*\*TSS – Total Suspended Solids*

### **Documentation Required:**

#### **Precertification**

- Narrative describing the proposed Erosion and Sedimentation Control (ESC) measures to be implemented on-site, during construction and post occupancy.
- Conceptual site drawing highlighting proposed ESC measures to be implemented on-site in two stages – During construction & Post occupancy
- Photographs showing current status of project i.e. pre and during construction ESC measures implemented on-site before and during construction.

#### **Certification**

Submit the same documents as mentioned in precertification level. Additionally, submit photographs showing site conditions before and during construction of the project and post occupancy.

**Natural Topography or Vegetation**

**SD Credit 1**

**Points: 4**

**Intent:**

Minimise disturbances to the natural topography of the site, promote local habitat and bio-diversity thereby reduce the related long-term environmental impacts.

**Compliance Options:**

**Case A: Vegetation on Ground surface**

Retain Natural topography\* or Vegetation or Develop Vegetated green spaces **only on ground** for atleast 15% of the site area.

Points are awarded as below:

Percentage of Natural Topography and /or Vegetated area on Ground	Points
15 %	1
25 %	2



**Case B: Vegetation on Ground & Built structures**

Projects have option to include vegetation / greenery on **ground and built-structures** such as podium, roof surfaces, vertical greenery to meet atleast 30% of the site area as compliance.

Points are awarded as below:

Percentage of Natural Topography and /or Vegetated area on Ground + Built-structures	Points
30 %	3
40 %	4



*Notes:*

1. *\*Retaining 'Natural Topography' in its broad sense means preserving natural features of the terrain such as natural vegetation, rocks, water body;*
2. *The project has to meet the local bye-laws if there is requirement for maintaining minimum vegetation on ground. Credit points shall not be awarded incase the local bye-law requirement is not met.*
3. *In Case B, projects with less vegetation on ground, can still meet this credit intent by having 30% vegetation over built-structures which include landscape over roofs, basement, podium and vertical landscaping can be considered.*
4. *Grass pavers, potted plants, jogging track, open-air theatre, parking areas, playground, swimming pool, tot-lots, walkways etc., shall not be considered as natural topography credit*
5. *The total site area must be consistent across all the credits.*
6. *Inc case of trees, area of the tree canopy can be considered (estimate over 5 years)*

**Exemplary Performance:**

The project is eligible for exemplary performance under Innovation & Exemplary Performance, if more than 50 % of the site area is vegetated which includes vegetation over Ground & built-structures

**Documentation Required:*****Precertification***

Submit the following:

1. Copy of local bye-law highlighting the requirement of landscaping
2. Conceptual drawings highlighting the vegetation area on ground and built-structures clearly with area breakup.
3. Area break up calculations (approximate) indicating the total site area, area with natural topography / vegetation on ground + built-structures.

***Certification***

Submit the same documents as pre-certification level. Additionally, submit on-site photographs supporting the same.

**Heat Island Effect, Non-roof & Roof**

SD Credit 2

Points: 4

**Intent:**

Reduce heat islands to minimise negative impacts on microclimate and local bio-diversity.

**Compliance Options:**

**1. Heat Island Effect - Non-Roof areas: ( 2 points)**

Provide atleast 50% of exposed non-roof impervious areas with a combination of the below:

- ❖ Shade from tree cover within 5 years of project completion
- ❖ Open grid pavers or Grass pavers
- ❖ Hardscape materials (including pavers) with SRI of atleast 29 (and not higher than 64)

Points are awarded as below:

Percentage of the area covered with trees/ low SRI materials/ grass pavers to the total of total non-roof area	Points
50 %	1
75 %	2

*Notes:*

- *The non-roof impervious areas include footpaths, pathways, roads, uncovered surface parking and other impervious areas.*
- *Trees/ Saplings should be planted before occupancy.*
- *Incase of trees, area of the tree canopy can be considered (estimate over 5 years)*

**2. Heat Island Effect - Roof Areas: ( 2 points)**

Provide atleast 75% of exposed roof areas with a combination of the below:

- ❖ High SRI materials
- ❖ High albedo materials
- ❖ Roof garden/ Vegetation



Minimum Solar Reflective Index (SRI\*) values for different roof types are provided below:

Solar Reflective Index (SRI) values for different roof types

Roof Type	Slope	SRI
Low-sloped roof	≤ 1:6	78
Steep-sloped roof	> 1:6	29

Points are awarded as below:

Percentage area covered with high SRI materials/ vegetation to the exposed roof area	Points
75 %	1
95 %	2

Notes:

- For this credit, all roof areas, including podium, covered surface parking and utility blocks, which are exposed to the sky (at and above ground level) should be considered for calculations.
- Exposed roof area need not include equipment platforms, areas with solar photovoltaic &, solar water heaters, skylights, swimming pool, driveways, pathways, roads, play areas etc.,
- The other materials which can be used to show compliance include white/ light coloured china mosaic tiles, high reflective coatings and other high reflective materials/ surfaces.
- Use ‘Green Pro’ or any other Ecolabel mentioning high SRI values.
- The solar reflective index (SRI) is a measure of the constructed surface’s ability to reflect solar heat, as shown by a small temperature rise.

\*SRI - Solar Reflective Index

**Solar Reflective Index (SRI) for some of the standard roofing materials**

Materials	Typical Solar Reflective Index (SRI)
Gray Asphalt Shingle	22
Unpainted Cement tile	25
Light Gravel on Built – Up roof	37
White – Coated gravel on Built-up roof	79
White Cement Tile	90
White Coating – 2 coats, 20 mm	107

**Exemplary Performance:**

The project is eligible for exemplary performance under Innovation & Exemplary Performance, if Tree cover is provided or 100 % of the Non-Roof area (or) 100 % Roof area is covered with Vegetation.

**Documentation Required:*****Precertification*****Heat Island Effect : Non-Roof**

1. Narrative describing the proposed strategies to reduce heat island effect from Non-roof areas.
2. Site drawing highlighting non-roof impervious (hardscape) areas and areas covered with shade from tree cover within 5 years (and/or) open grid pavers, including grass pavers.
3. Calculations showing the percentage of area shaded by trees (or) covered by low SRI materials.
4. List of existing trees/planted species which are likely to be grown in 5 years for shading.
5. Details of proposed Green Pro Eco labelled SRI materials in the project (product name & manufacture details).

**Heat Island Effect: Roof**

1. Narrative describing the proposed strategies to reduce heat island effect from roof areas.
2. Roof plans highlighting location and the extent of high reflective roof materials/vegetation.
3. Calculations highlighting the percentage of area that would be covered with high SRI materials/ Vegetation.
4. Details of proposed 'Green Pro' Eco labelled high SRI materials used in the project.

***Certification***

Submit the same documents as mentioned in precertification level. Additionally, submit the following:

1. Purchase invoice/ payment receipts of the Green Pro Eco labelled high reflective roof materials sourced for the project.
2. Photographs of the Roof & Non-roof areas.



## Passive Architecture

SD Credit 3

Points: 2

### Intent:

Adopt passive architectural measures to design an efficient building envelope, reduce energy consumption and the related negative environmental impacts.

### Compliance Options:

Demonstrate that the project has implemented atleast one of the following passive measures that result in energy savings: *(1 point for each measure; maximum 2 points)*

#### ❖ Exterior Openings:

Atleast 80% of the exterior openings (fenestration) have a Projection Factor\* of 0.5 or more

*\*Projection Factor is a ratio of the length of overhang projection divided by height from window sill to the bottom end of the overhang (must be permanent). For more details, please refer Energy Conservation Building Code for Residential Buildings (ECBC-R\* or ECBC)*

#### ❖ Skylights:

Open courtyards, skylights open to sky; To meet these criteria, the percentage of skylight area should be minimum 10% of the building roof area.

#### ❖ Daylighting:

50% of the common areas (lobbies, corridors, staircase) with daylight illuminance levels of minimum 110 Lux in a clear sky condition on 21st September at 12 noon, at working plane. *(Lux level can be measured during lighting instrument or simulation approach)*

#### ❖ Passive Cooling / Heating Technologies:

Wind tower, Earth tunnel, Geothermal technologies and any other passive measures, as applicable.

*Notes : Skylights provided on the basement/ podium areas can also be considered for credit calculations.*

*\* ECBC-R - Energy Conservation Building Code for Residential Buildings*

**Exemplary Performance:** Not Applicable

**Documentation Required:**

***Precertification***

1. Narrative on the passive measures to be implemented in the project
2. Submit relevant sketches / drawings for each envisaged passive architectural concept

***Certification***

Submit documents same as mentioned in precertification level. Additionally, submit photographs of the implemented passive measures.

## Universal Design

SD Credit 4

Points: 2

### Intent:

Ensure that the building/ campus design is differently abled and elderly people friendly.

### Compliance Options:

Design the building/ campus to provide the following, as applicable, for differently abled people and elderly people in accordance with the guidelines of National Building Code (NBC 2016) of India

#### A. Project shall provide the following: (1 point for all 3 measures)

- Preferred car park space(s) having an easy access to the main entrance or closer to the lift lobby - one car park space for every 250 dwelling units. *Min. dimensions for differently abled parking shall be 3.6 m(width) x 6.0 m(length)*
- Rest rooms (toilets) in common areas designed for differently abled people (minimum one rest room for every 250 dwelling units. Minimum width of toilet for differently abled as per NBC\* guidelines
- Wheelchair and stretcher board provision near security area.

#### B. Any four measures to meet the compliance : ( 1 point)

- Uniformity in floor level for hindrance-free movement in common areas & exterior areas with ramps and hand rails on atleast one side of ramp.
- Walkways/ pathways with adequate width in exterior areas
- Braille and audio assistance in lifts for visually impaired people. Elevator call buttons designed to be within reach of wheelchair occupants
- Atleast one lift with minimum dimensions to allow a stretcher for residential towers above 15m.
- Visual warning signages in common areas & exterior areas

\* NBC – National Building Code, 2016

*Notes:*

- *Toilets provided in the common area can be designed to cater both differently abled people and service staff & visitors*
- *Differently abled toilet opening should be minimum 1000mm, door swing opening outside.*
- *Toilets provided in the clubhouse cannot be considered to show credit compliance*

**Exemplary Performance:** Not Applicable

**Documentation Required:**

***Precertification***

1. A narrative describing all the measures proposed in building design for differently abled .
2. Drawings highlighting provisions for differently abled.
3. Detailed drawing of differently abled toilets & proposed ramps.

***Certification***

Submit the same documents as mentioned in precertification level. Additionally, submit the photographs of measures implemented for differently abled.

## Green Parking Facility

SD Credit 5

Points: 4

### Intent:

Minimize the negative environment & health impacts due to the emissions from the fossil fuel-based automobiles.

### Compliance Options:

Provide adequate ventilation in basements, encourage use of hybrid vehicles and bicycles.

#### 1. Ventilation for Basements (1 point)

Provide axial fans, CO sensors and meet minimum air changes per hour (ACH\*) requirements as per NBC 2016 in the basement parking spaces.

*Note: Parking planned in stilt or ground floor would deem to meet the ventilation compliance.*

*\*ACH – Air changes per hour*

#### 2. Electric charging facility (2 points)

Provide common charging facility to cater to minimum 20% of the four wheelers & two wheelers in the campus.

*Notes: Charging facilities for 20% of the vehicles has been suggested as per the guidelines of Ministry of Housing and Urban Affairs (MoHUA)*

Points are awarded as below:

Percentage of vehicles to be catered by the common charging facility	Points
20 %	1
30 %	2

#### 3. Dedicated Bicycle parking (1 point)

Provide dedicated bicycle parking facility catering to atleast 5% of the dwelling units. The location of bicycle parking to be clearly marked with signages.

**Exemplary Performance:** Not Applicable

**Documentation Required:**

***Precertification***

1. Narrative describing the strategy to this credit to show compliance.
2. Conceptual parking plans showing the CO sensors, axial fans, electric charging stations/rapid charging systems, bicycle parking spaces.
3. Tentative calculations showing the percentage of parking area with electrical charging points and bicycle parking facilities with layout clearing highlighting the same.

***Certification***

Submit the same documents mentioned in precertification level. Additionally, submit photographs and purchase invoices of the CO sensors, axial fans, electric charging stations/rapid charging systems.

**Access to Amenities****SD Credit 6****Points: 2****Intent:**

Reduce negative environmental impact due to emissions from automobiles by providing basic house-hold amenities, thereby, enhancing the quality of life.

**Compliance Options:**

Select a site with access to at least six basic house-hold amenities, within a walking distance of 1 km from the building entrance. (*For list of basic house-hold amenities, refer Exhibit – A*)  
– (1 point)

**(AND)**

Provide the following within the campus premises: (1 point)

- ❖ Play area for children to include tot-lot play equipment which is permanently installed.
- ❖ Seating area in common spaces
- ❖ Common toilet facilities for visitors & service staff as per local regulation or as below:
  - Projects with 250 dwelling units or less: one common toilet for service staff & visitors.
  - Projects with more than 250 dwelling units: 1 toilet for every 250 additional dwelling units or 1 toilet per block/ tower, as applicable.

*Notes:*

- *Toilets provided in the common area can be designed to cater both differently abled people and service staff & visitors. For designing differently abled toilets the project must adhere to the local regulations or NBC 2016.*
- *Toilets provided in the clubhouse cannot be considered towards credit compliance calculations.*
- *This point can be earned only if the basic amenities are available before or at the time of project completion.*
- *Basic amenities within the campus can also be considered to show compliance.*
- *All basic house-hold amenities are to be considered only once.*
- *The amenities should be accessible to building/ campus visitors also.*

***Exhibit A - List of Basic Amenities***

- Bank/ ATM
- Beauty saloon
- Bus stop / Railway station/ Metro station/ Auto stand
- Clubhouse
- Educational institutions (Pre-school, School, etc.,)
- Grocery store / Super market
- Stores such as clothes, electrical, stationary, milk booth, pharmacy, etc.,
- Laundry services
- Medical clinic/ Hospital
- Park / Garden
- Place of Worship
- Playground / Jogging track/ walking
- Restaurant
- Refueling station for automobiles
- Sports club / Fitness center / Gym
- Theater

**Exemplary Performance:** Not Applicable

**Documentation Required:*****Precertification***

1. Site vicinity map with a graphical scale, highlighting location of existing/ proposed basic house-hold amenities from the project indicating the pedestrian access.
2. Drawings highlighting the proposed toilets in the common area.

***Certification***

Submit documents same as mentioned in precertification level. Additionally, submit the documents mentioned below:

1. Photographs showing the basic house-hold amenities.
2. Drawings and photographs showing the facilities within the campus complying to the credit requirements.



## Basic Facilities for Construction Workforce

SD Credit 7

Points: 1

### Intent:

Promote welfare of construction workforce by providing safe and healthy work conditions.

### Compliance Options:

Provide the following on-site basic facilities for construction workforce:

- ❖ Adequate housing to meet or exceed local/ labour bye-law requirement.
- ❖ Sanitary measures to meet or exceed local/ labour bye-law requirement

(OR)

Provide atleast one toilet seat/ urinal for every 50 workers in any shift, whichever is more stringent. The sanitary measures should be provided separately for men and women.

- ❖ First-aid and emergency facilities.
- ❖ Adequate drinking water facilities.
- ❖ Personal protective equipment (by owner/ contractor).
- ❖ Dust suppression measures.
- ❖ Adequate illumination levels in construction work areas.
- ❖ Day care/ crèche facility for workers' children

**Exemplary Performance:** Not Applicable

### Documentation Required:

#### *Precertification Level*

- A narrative describing the basic facilities proposed in the project for construction workforce.
- Conceptual drawings highlighting the basic facilities proposed in the project for construction workforce, as applicable.
- Copy of the construction contract agreement highlighting facilities proposed, as applicable.

#### *Certification Level*

- Same as Precertification. Additionally, submit photographs showing the measures implemented.

## Green Education & Awareness

**SD Credit 8**

**Points: 1**

**Intent:**

Educate the workforce during construction phase and occupants post construction to sustain the green features through the life of the building, thereby reducing the negative impacts associated on environment

**Compliance Options:**

**1. During construction**

- a. Awareness sessions for construction workforce on green & safety measures
- b. Display signages indicating envisaged green features

**2. Post construction:**

- a. Project brochure highlighting the green features proposed
- b. Awareness sessions to prospective occupants
- c. Circulate green home guidelines
- d. Permanent signages highlighting the implemented green features

**Exemplary Performance:** Not Applicable

**Documentation Required:**

***Precertification***

1. Declaration from owner stating the schedule of awareness sessions planned
2. Photographs of the signages displayed in construction site, as applicable
3. Project brochure

***Certification***

1. Submit documents addressing each aspect highlighted above during construction and post construction phases with photographs and copy of green home guidelines circulated to occupants.
2. Additionally, share the snapshot of the acknowledgment of receipt of green home guidelines by occupants

# Water Conservation

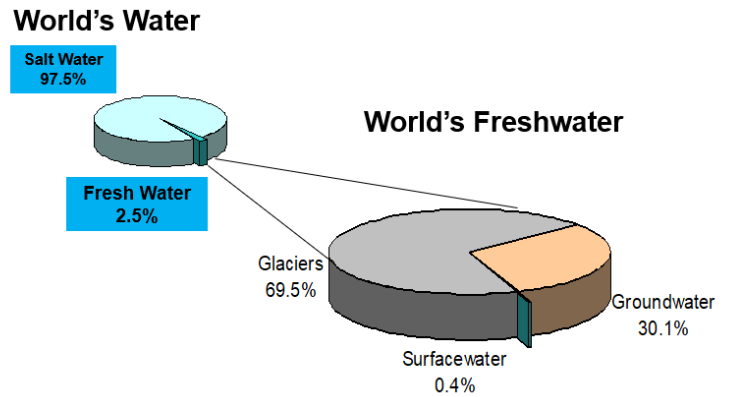


# WATER CONSERVATION

## Introduction

Water is a National priority for India. Most of the Asian countries are water stressed and the water table has reduced drastically over the last decade. With the present scenario, if water is not used diligently, water would become scarce for the future generations. The residential sector is one of the significant water consumer, after agriculture. There are tremendous opportunities to conserve water in homes.

The earth’s surface is covered with 70% water, of which 97.5 % is salt water & 2.5 % is fresh water. Of the 2.5% of the fresh water, 69.5% is locked away in glaciers and 30.1% is in the form of ground water. Only about 0.4% is surface water, which is available for human consumption. Hence, every drop of water is precious and to be used diligently.



Green Homes encourages water usage in a self-sustainable manner through 3 R’s - *Reduce-Recycle-Reuse*.

The broad approach for water reduction in homes is through the use of efficient plumbing fixtures, water recycling by installing the on-site Sewage Treatment Plant and reusing treated water for applications such as flushing, landscaping etc.,

Landscape is a visual delight. By striking a balance between the aesthetic value & water usage, alternate strategies such as capturing free rainwater through storage tanks, recharging into ground water, using drought tolerant species, native species, efficient irrigation system, segregation of plant species based on watering needs can be adopted.

Monitoring the actual water consumption can play a significant role in optimising the water usage.

Case studies indicate that there is a potential to save more than 40% of potable water by incorporating strategies that reduce, reuse and recycle water.

# WATER CONSERVATION

## Water Efficient Plumbing Fixtures

## Mandatory Requirement 1

### Intent:

Minimise dependence on municipal and bore water, by reducing water consumption.

### Compliance Options:

#### Option 1:

1. Install GreenPro Ecolabelled water efficient plumbing fixtures (or) plumbing fixtures having flow rates **5 % lower than the baseline flow rates** specified by Uniform Plumbing Code.
2. In case plumbing fixtures which are not Ecolabelled are proposed for use, provide details of flow rates along with test certificates for the manufacturer.

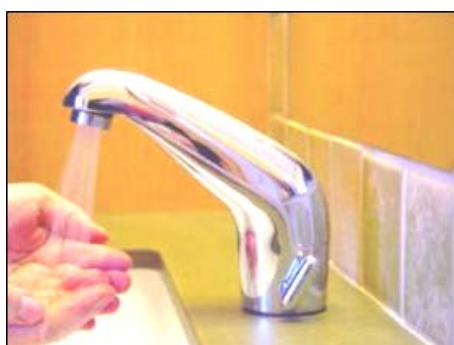
*Note: Treated water from STP should not be considered to show this compliance*

### Baseline Flow Rates / Capacity as per Uniform Plumbing Code of India (UPCI)

Fixture Type	Maximum Flow Rate / Capacity	Duration	Daily Uses per Person/ Day
Water Closets	6 LPF (High flush)	1 Flush	1
	3 LPF (Low flush)	1 Flush	1
Health Faucet/ Bidet, Hand-held spray*	6 LPM	15 Seconds	1
Faucet/ taps*	6 LPM	15 Seconds	8
Kitchen Sink*	6 LPM	15 Seconds	6
Urinal*	4 LPF	1 flush	2
Showerhead* / Hand-held Spray*	10 LPM	8 Minutes	1

Source: Uniform Plumbing Code – India, 2016

\* At a design pressure of 4 bar



## **Option 2: Core & Shell only**

- For Core & Shell residential structures, the developer shall show compliance for mandatory requirement by mentioning about the installation of water efficient plumbing fixtures in the sale deed.
- Additionally, project shall conform to minimum water baselines mentioned under option 1 in all common area plumbing fixtures to meet this mandatory requirement.

### *Notes:*

- *The number of permanent occupants has to be considered as two persons each for the first two bed rooms, and one additional person for each additional bedroom.*
- *Rain showers (if any) need to be considered in the calculations. Considering that bath tubs may not be used on a daily basis, they may be excluded for the calculations.*

## **Documentation Required:**

### ***Precertification Level***

- Calculations demonstrating savings through proposed plumbing fixtures over baselines.
- Summary sheet of the proposed list of GreenPro Eco labelled plumbing fixtures (flow and flush), with respective make & model.

### ***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit a copy of the purchased order and photographs of the installed water efficient flush & flow fixtures.



## Rainwater Harvesting

## WC Mandatory Requirement 2

### Intent:

Enhance ground water table and reduce municipal water demand by harvesting rain water

### Compliance Options:

❖ **Case A: Rainwater Harvesting, Roof & Non-roof**

Design rainwater harvesting system to capture at least ‘one-day rainfall\*’ run-off volume from roof and non-roof areas.



**Amount of rainfall varies from very heavy to scanty on different parts of India**

\* The quantity of ‘one day rainfall’ that needs to be harvested can be estimated based on the suggested percent of average peak month rainfall in the table 1 given below:

**Table 1 - Criteria to arrive at 'One-day Rainfall'**

Sl.No.	Average Peak Month Rainfall (in mm)	One-day Rainfall (% of Average Peak Month Rainfall)
1.	Upto 250	9%
2.	251 – 350	7.5%
3.	351 – 500	6%
4.	501 – 700	4.5%
5.	701 & above	3%

*Note: To estimate the average peak month rainfall, consider the average of at least last 5 years peak month rainfall of the project location.*

#### ❖ Case B: High Ground Water Table

The project need not implement the rain water harvesting system:

- (i) If the Central/ State Ground Water Board does not recommend artificial rain water recharge
- (ii) If the groundwater table is less than 8 meters

In such cases the project has to provide the notifications issued by the relevant authorities (or) submit hydrological survey report highlighting the water table.

*Notes:*

- For rainfall information, refer Indian Meteorological Department data at <http://www.imd.gov.in>
- Percolation/ Infiltration rate should be as per soil type. (eg., clay soil, the percolation / infiltration rate is 1- 5 mm/ hr ; in case of sand , the percolation/ infiltration rate is 30 mm / hr)
- $Runoff\ volume = Surface\ area \times Runoff\ Coefficient \times One\ day\ Rainfall.$
- Consider Rainwater Harvesting Guidelines (as and when available) from the National Building Code (NBC) of India, Part 11 - Approach to Sustainability, Section 7.2 - Rainwater Harvesting Surface Run-off.



## WATER CONSERVATION

- *In areas where the water percolation is limited, collection tanks / water bodies may be provided to meet the above requirement.*
- *Filtering of suspended solids shall be ensured by providing suitable filtering media before letting the water into the collection tanks, water bodies, municipal storm water drains.*

**Table 2 - Runoff coefficients for Typical Surface Types**

S No	Surface Type	Runoff Coefficient
1	Cemented / Tiled Roof	0.95
2	Roof Garden (<100 mm thickness)	0.95
3	Roof Garden (100 – 200 mm thickness)	0.3
4	Roof Garden (201 – 500 mm thickness)	0.2
5	Roof Garden (> 500 mm thickness)	0.1
6	Turf, Flat (0 - 1% slope)	0.25
7	Turf, Average (1 - 3% slope)	0.35
8	Turf, Hilly (3 - 10% slope)	0.4
9	Turf, Steep (> 10% slope)	0.45
10	Vegetation, Flat (0 - 1% slope)	0.1
11	Vegetation, Average (1 - 3% slope)	0.2
12	Vegetation, Hilly (1 - 3% slope)	0.25
13	Vegetation, Steep (> 10% slope)	0.3
14	Concrete Pavement	0.95
15	Gravel Pavement	0.75
16	Open-grid Concrete Pavement	0.75
17	Open-grid Grass Pavement	0.5
18	Water Bodies (lined) eg., Swimming Pool	0.95
19	Water Bodies (un-lined) eg., Water Pond	0

## Rainwater Harvesting Calculation Sample:

### Step 1: Illustration for arriving at one day rainfall for Mumbai

Customized Rainfall Information System (CRIS)  
Hydromet Division  
India Meteorological Department  
Ministry Of Earth Sciences  
New Delhi-110 003

Choose the States/UTs: MAHARASHTRA Select District: SUBURBAN MUMBAI GO

District : SUBURBAN MUMBAI

Note : (1) The District Rainfall in millimeters (R/F) shown below are the arithmetic averages of Rainfall of Stations under the District.  
(2) % Dep. are the Departures of rainfall from the long period averages of rainfall for the District.  
(3) Blank Spaces show non-availability of Data

YEAR	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEPT		OCT		NOV		DEC	
	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
2010					0.0	-100	0.7	-61	0.0	-100	713.3	30	1241.7	58	1023.3	104	328.9	5	64.0	-3	47.2	195	0.0	-100
2011	0.0	-100	0.0	-100	0.0	-100	0.0	-100	0.0	-100	661.7	23	1362.5	73	855.2	68	254.1	-18	120.1	56	0.0	-100	0.0	-100
2012	0.0	-100	0.0	-100	0.0	-100	0.0	-100	0.0	-100	290.7	-46	627.9	-20	377.4	-26	563.9	82	197.7	156	0.0	-100	0.0	-100
2013	0.0	-100	0.0	-100	0.0	-100	0.0	-100	0.0	-100	1029.8	91	958.1	22	256.3	-50	190.7	-38	85.3	11	0.0	-100	0.0	-100
2014	0.0	-100	0.0	-100	0.0	-100	0.0	-100	0.0	-100	87.3	-84	1468.7	87	458.0	-10	285.8	-8	23.4	-70	5.8	-53	1.5	-65

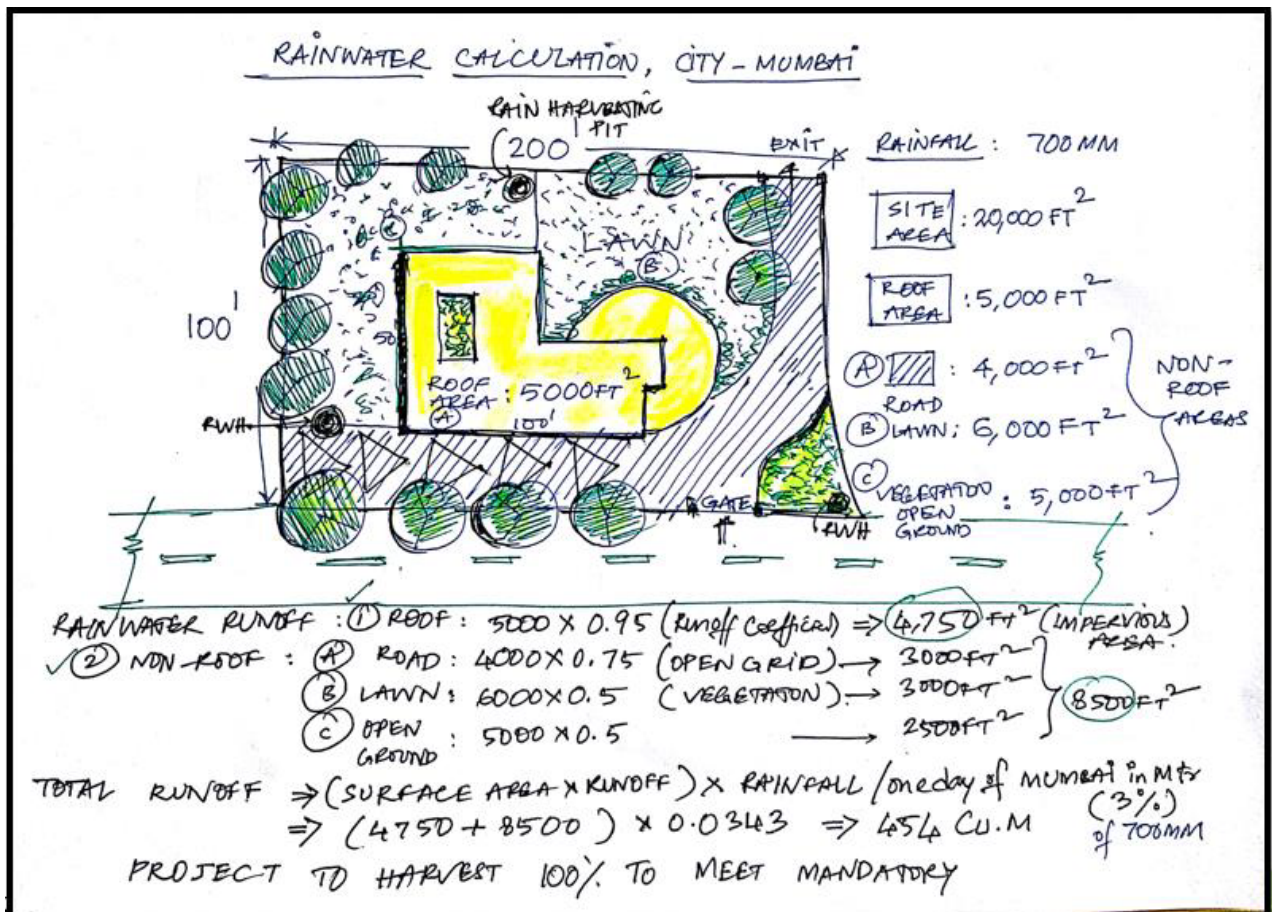
IMD Weather Data File : Mumbai

Average Peak Month Rainfall =  $(1241.7 + 1362.5 + 624.9 + 1029.8 + 1468.7) / 5 = 1145.52 \text{ mm} = 1.1452 \text{ m}$

Criteria for One-day Rainfall for 700 mm and above = 3%

One day rainfall @ 3 % =  $1.145 * (3/100) = 0.0345 \text{ m}$

### Step 2: Illustration for arriving at total runoff volumes – roof & non-roof



## WATER CONSERVATION

Site Area: 20,000 sq.ft;

Roof Area: 5,000 sq.ft

Runoff Calculations: Roof :

5000 x 0.95 (runoff coefficient) : 4,750 sq.ft (Impervious area)

### Runoff Calculations Non-Roof:

A: Road: 4,000x 0.75(open grid): 3,000 sqf.t+

B. Lawn area: 6,000 x 0.5 (vegetation): 3,000 sq.ft +

C. Open ground: 5,000x 0.5 : 2,500sq.ft

( Runoff for non-roof surfaces is 8,500 sq.ft impervious area)

### Total Runoff Calculations:

( Roof + Non-roof impervious area 4,750 sq.ft + 8,500 sq.ft ) x One day rainfall (Mumbai)

0.0345m = 454 Cu.m ( calculated for 3 % which is mandatory requirement)

Project need to 100% harvest 454 Cu.m runoff volumes through rainwater harvesting tank (or) harvesting pits (or) pond



\*\*\*

### Documentation Required:

#### *Precertification Level*

- Narrative describing proposed strategies to capture/ harvest rain water from roof & non-roof areas.
- A document from the Indian Metrological Department or any other reliable source substantiating the rainfall data used in the calculations.
- Calculations highlighting proposed quantity of rain water (run-off volume) for harvesting.
- Site drawing highlighting external rain water drainage system and location of rain water harvesting system (e.g.: ponds, pits, storage tanks, etc.), including cross sectional drawings (as applicable), and capacity details.
- Details of the rainwater harvesting system specifying harvesting pits capacity to capture/ harvest water. Indicate the type of soil. Consider the percolation/ infiltration rate as per soil type. The soil characteristics to be verified through geo-technical survey.

- Submit the third-party report confirming the level of water table, if project's water table is less than 8 meters.

### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, submit photographs of the installed rain water harvesting system.



# WATER CONSERVATION

## Water Efficient Plumbing Fixtures

WC Credit 1

Points: 6

**Intent:**

Minimise dependence on municipal and bore water, by reducing water consumption.

**Compliance Options:**

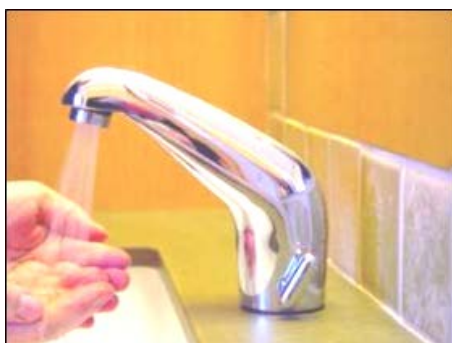
1. Install GreenPro Ecolabelled water efficient plumbing fixtures (or) plumbing fixtures having flow rates atleast **10 % lower than the baseline flow rates** specified by Uniform Plumbing Code.
2. In case plumbing fixtures which are not Ecolabelled are proposed for use, provide details of flow rates along with test certificates for the manufacturer.

**Baseline Flow Rates / Capacity as per Uniform Plumbing Code of India (UPCI)**

Fixture Type	Maximum Flow Rate / Capacity	Duration	Daily Uses per Person/ Day
Water Closets	6 LPF (High flush)	1 Flush	1
	3 LPF (Low flush)	1 Flush	1
Health Faucet/ Bidet, Hand-held spray*	6 LPM	15 Seconds	1
Faucet/ taps*	6 LPM	15 Seconds	8
Kitchen Sink*	6 LPM	15 Seconds	6
Urinal*	4 LPF	1 flush	2
Showerhead* / Hand-held Spray*	10 LPM	8 Minutes	1

Source: Uniform Plumbing Code – India, 2016

\* At a design pressure of 4 bar



**Demonstrate the reduction in water consumption through installation of water efficient plumbing fixtures.**

Points are awarded as below:

Water Savings through Efficient Plumbing Fixtures	Points
≤ 10 % less than baseline criteria	1
≤ 15 % less than baseline criteria	2
≤ 20 % less than baseline criteria	3
≤ 25 % less than baseline criteria	4
≤ 30 % less than baseline criteria	5
≤ 35 % less than baseline criteria	6

*Notes:*

- *Treated water from STP should not be considered to show this compliance*
- *The number of permanent occupants has to be considered as two persons each for the first two bed rooms, and one additional person for each additional bedroom.*
- *Rain showers (if any) need to be considered in the calculations. Considering that bath tubs may not be used on a daily basis, they may be excluded for the calculations.*

**Exemplary Performance:**

This credit is eligible for exemplary performance under Innovation & Exemplary Performance, if water consumption is 40 % lesser than the baseline criteria. *(Treated water from STP should not be considered)*

**Documentation Required:**

***Precertification Level***

Submit documents same as mentioned under WC Mandatory Requirement 1

***Certification Level***

Submit documents same as mentioned under WC Mandatory Requirement 1

## WATER CONSERVATION

### Landscape Design

*Applicable only if 15% of the site area is vegetated*

WC Credit 2

Points: 3

#### Intent:

Design landscape to ensure minimum water consumption

#### Compliance Options:

##### *Case 1 (1 point):*

Limit use of turf on the site so as to conserve water. Ensure that landscaped area is planted with turf less than or equal to 15 % of the total landscaped area.

##### *Case 2 (1 point):*

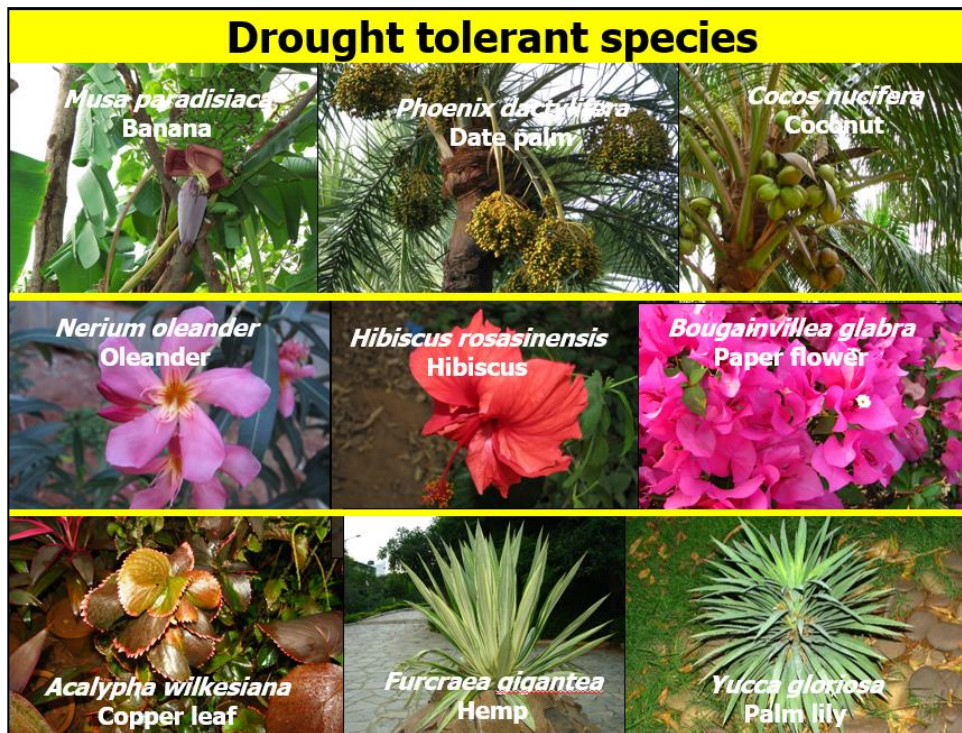
Ensure that landscaped area is planted with native/ adaptive species for atleast 40% of total landscaped area.

##### *Case 3 (1 point):*

Source fruit/ vegetable bearing plants for atleast 5% of the total landscaped area.







**Adaptive species**



**Notes:**

- For this credit, landscape area includes vegetation on Ground & built structures such as basements, podium, roofs, etc., can be considered for landscape area calculations.
- Landscape here refers to soft landscaping which includes only vegetation.



## WATER CONSERVATION

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- *Areas planted with turf should not exceed a slope of 25 percent (i.e., 4 to 1 slope).*
- *For this credit calculation, potted plants should not be considered.*
- *Incase of trees, area of the tree canopy can be considered (estimate over 5 years)*

### **Exemplary Performance:**

This credit is eligible for exemplary performance under Innovation & Exemplary Performance, if more than 85% of the landscaped area is planted with native/ adaptive species

### **Documentation Required:**

#### ***Precertification Level***

- Landscape area calculations and plans indicating total site area; break-up of landscaped area viz., native/ adaptive species, ground covers, fruit & vegetable farming & other plant species on the ground and over built structures.
- List of proposed plant species in the project.

#### ***Certification Level***

Same as precertification level documentation. Additionally, provide photographs showing the landscaped areas.

## Management of Irrigation Systems

WC Credit 3

Points: 2

### Intent:

Reduce water demand for irrigation through water efficient management systems and techniques.

### Compliance Options:

Install efficient irrigation systems to minimize the water requirements for the landscape / vegetation in the campus.

#### A. Project shall provide the following: *(1 point for all 2 measures)*

- Atleast 50% of landscape planting beds must have Drip Irrigation system to reduce evaporation
- Sprinkler system for Turf / lawn areas

#### B. Any three measures to meet the compliance : *(1 point)*

- Central shut-off valve
- Turf and each type of bedding area must be segregated into independent zones based on watering needs
- Pressure regulating device(s) to maintain optimal pressure to prevent water loss
- Moisture based sensor controllers
- Install timer controlled irrigation systems
- Any other innovative methods for watering



**Exemplary Performance: Not Applicable**

## **Documentation Required:**

### ***Precertification level:***

- Narrative describing the proposed water efficient irrigation systems and techniques.
- Conceptual landscape plan highlighting drip irrigation system.
- Manufacturer cut-sheets/ brochures of the proposed water efficient irrigation systems.

### ***Certification Level***

Same as precertification level documentation. Additionally, provide photographs showing the installed irrigation systems and techniques.

## Recycle & Reuse of Waste Water

WC Credit 4

Points: 4

### Intent:

Reduce consumption of potable water and waste water generation to minimise the burden on municipal water supply

### Compliance Options:

#### Waste Water Treatment: (2 points)

- ❖ Provide an on-site treatment system to treat atleast 50% of waste water generated in the building/ campus, to the quality standards suitable for reuse as prescribed by Central (or) State Pollution Control Board, as applicable.

AND

- ❖ Provide separate plumbing lines for reuse of treated waste water available from insitu waste water treatment plant for flushing requirements.

Points are awarded as below:

Percentage of waste water treated	Points
50%	1
95%	2

#### Waste Water Reuse: (2 points)

- ❖ Reuse treated waste water for flushing, landscaping, car washing or any other purposes, as applicable. The treated grey water for reuse must conform to the water quality standards as per the CPCB norms or local Government Authority.

Points are awarded as below:

Percentage of treated waste water used	Points
50%	1
75%	2

## WATER CONSERVATION

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### Notes:

- *Waste water here refers to both grey and black water.*
- *The credit point(s) can be claimed only if the waste water is treated in-situ and reused in-situ.*
- *Treated waste water/ captured rainwater can be reused for flushing. The reused quantity for flushing can be subtracted from the annual water use and compared against the baseline annual quantity.*

### **Exemplary Performance: Not Applicable**

### **Documentation Required:**

#### ***Precertification Level***

- Narrative describing the proposed on-site waste water treatment system, along with quality standards of the waste water to be treated and reused.
- Submit annual water balance for entire project.  
*Note: The water balance shall include calculations (approximate) showing quantity of waste water generated & treated; water demand for landscaping, flushing & other applications, and quantity of waste water reused for such applications.*
- Site plan highlighting the location of proposed on-site waste water treatment system.
- Submit schematic drawing showing proposed dual plumbing lines, if treated waste water is reused for flushing and other requirements.

#### ***Certification Level***

Same as precertification level documentation. Additionally, provide photographs showing the on-site waste water treatment system installed.

## Water Quality

**WC Credit 5**

**Points: 1**

**Intent:**

Improve the quality of water to make it more acceptable for dwelling unit consumption, thereby reducing the impact on environment

**Compliance Options:**

Install a water treatment plant (WTP) to remove sediments, bacteria and other impurities. The system shall be designed to meet 95 % of the total dwelling units (or) total occupancy.

The potable water quality should meet the criteria set by CPCB for water quality.

*Note: As per the CPCB , the water quality should conform to following norms*

- *Total Coliforms Organism MPN/100ml shall be 5000*
- *less pH between 6 to 9*
- *Dissolved Oxygen 4mg/l or more*
- *Biochemical Oxygen Demand 5 days 20 degrees Celsius 3mg/l or less*

**Exemplary Performance: Not Applicable**

**Documentation Required:**

***Precertification Level***

- Narrative describing the process of the treatment plant
- Water balance calculations
- Treatment water characteristics such as COD, BOD values

***Certification Level***

Same as precertification level documentation. Additionally, provide photographs of the water treatment plant.

**Enhanced Rainwater Harvesting**

**WC Credit 6**

**Points: 4**

**Intent:**

Enhance ground water table and reduce municipal water demand through effective rain water management.

**Compliance Options:**

❖ **Case A: Rainwater Harvesting, Roof & Non-roof**

Design rainwater harvesting system to capture at least ‘one-day rainfall\*’ run-off volume from roof and non-roof areas.

\* The quantity of ‘One day rainfall’ that needs to be harvested can be estimated based on the suggested percent of average peak month rainfall in the table 2 given below:

**Table 2 - Criteria to arrive at ‘One-day Rainfall’**

Sl.No.	Average Peak Month Rainfall (in mm)	One-day Rainfall (% of Average Peak Month Rainfall)			
		1 Points	2 Points	3 Points	4 Points
1.	Upto 250	12%	15%	18%	21%
2.	251 – 350	10%	12.5%	15%	17.5%
3.	351 – 500	8%	10%	12%	14%
4.	501 – 700	6%	7.5%	9%	10.5%
5.	701 & above	4%	5%	6%	7%

*Note: To estimate the average peak month rainfall, consider the average of at least last 5 years peak month rainfall of the project location.*



# WATER CONSERVATION



Amount of rainfall varies from very heavy to scanty on different parts of India

**Customized Rainfall Information System (CRIS)**  
Hydromet Division  
India Meteorological Department  
Ministry Of Earth Sciences  
New Delhi-110 003

Choose the States/UTs: MAHARASHTRA | Select District: SUBURBAN MUMBAI | GO

District : SUBURBAN MUMBAI

Note : (1) The District Rainfall in millimeters (R/F) shown below are the arithmetic averages of Rainfall of Stations under the District.  
(2) % Dep. are the Departures of rainfall from the long period averages of rainfall for the District.  
(3) Blank Spaces show non-availability of Data

YEAR	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEPT		OCT		NOV		DEC	
	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
2010	0.0	-100	0.0	-100	0.0	-100	0.7	-61	0.0	-100	719.3	30	1241.7	59	1029.3	104	328.9	5	64.0	-3	47.2	195	0.0	-100
2011	0.0	-100	0.0	-100	0.0	-100	0.0	-100	0.0	-100	661.7	23	1362.5	73	855.2	68	254.1	-18	120.1	56	0.0	-100	0.0	-100
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2014	0.0	-100	0.0	-100	0.0	-100	0.0	-100	0.0	-100	87.3	-84	1468.7	87	458.0	-10	285.8	-8	23.4	-70	5.8	-53	1.5	-65

IMD Weather Data File : Mumbai

Average Peak Month Rainfall =  $(1241.7+1362.5+624.9+1029.8+1468.7) / 5 = 1145.52 \text{ mm} = 1.1452 \text{ m}$

Criteria for One-day Rainfall for 700 mm and above = 3%

One day rainfall @ 3 % =  $1.145 \times (3/100) = 0.0345 \text{ m}$

One day rainfall calculation sample for Mumbai city



## WATER CONSERVATION

### ❖ Case B: High Ground Water Table

Project with ground water table less than 8 meters. Project shall provide Rain water storage systems to capture the runoff volumes as per table -3.

\* One-day rainfall can be derived from ‘percentage of average peak month rainfall’ given in Table – 3.

**Table 3 - Criteria to arrive at ‘One-day Rainfall’**

Sl.No.	Average Peak Month Rainfall (in mm)	One-day Rainfall (% of Average Peak Month Rainfall)			
		1 Points	2 Points	3 Points	4 Points
1.	Upto 250	6%	9%	12%	15%
2.	251 – 350	5%	7.5%	10%	12.5%
3.	351 – 500	4%	6%	8%	10%
4.	501 – 700	3%	4.5%	6%	7.5%
5.	701 & above	2%	3%	4%	5%

#### Notes:

- For rainfall information, refer Indian Meteorological Department data at <http://www.imd.gov.in>
- Run-off volume = Surface area x Run-off Coefficient x Rainfall.
- Percolation/ Infiltration rate should be as per soil type. (eg., clay soil, the percolation / infiltration rate is 1- 5 mm/ hr ; in case of sand , the percolation/ infiltration rate is 30 mm / hr). The soil characteristics to be verified through geo-technical survey.
- Consider Rainwater Harvesting Guidelines from the National Building Code (NBC) of India, Part 11 - Approach to Sustainability, Section 7.2 - Rainwater Harvesting Surface Run-off.
- In areas where the water percolation is limited, collection tanks/ water bodies may be provided to meet the above requirement.
- Filtering of suspended solids shall be ensured by providing suitable filtering media

*before letting the water into the collection tanks, water bodies, municipal storm water drains.*

### Exemplary Performance:

This credit is eligible for exemplary performance under ID Credit 1 - Innovation in Design Process, if rainwater run-off from roof & non-roof areas is captured and/ or recharged, as listed below:

#### Criteria to arrive at ‘One-day Rainfall’ for exemplary performance

Sl.No.	Average Peak Month Rainfall (in mm)	One-day Rainfall (% of Average Peak Month Rainfall)	
		Case A	Case B
1.	Upto 250	24%	18%
2.	251 – 350	20%	15%
3.	351 – 500	16%	12%
4.	501 – 700	12%	9%
5.	701 & above	8%	6%

### Documentation Required:

#### *Precertification Level*

- Narrative describing proposed strategies to capture/ harvest rain water from roof & non-roof areas.
- A document from the Indian Metrological Department or any other reliable source substantiating the rainfall data used in the calculations.
- Calculations highlighting proposed quantity of rain water (run-off volume) for harvesting.
- Site drawing highlighting external rain water drainage system and location of rain water harvesting system (e.g.: ponds, pits, storage tanks, etc.), including cross sectional drawings (as applicable), and capacity details.

- Details of the rainwater harvesting system specifying harvesting pits capacity to capture/ harvest water. Indicate the type of soil. Consider the percolation/ infiltration rate as per soil type.
- Submit the third party report confirming the level of water table, if project's water table is less than 8 meters.

### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, submit photographs of the installed rain water harvesting system.

## Water Metering

WC Credit 7

Points: 3

### Intent:

Encourage continuous monitoring to enhance the water efficiency.

### Compliance Options:

Quantify water used in each of the dwelling units and common area applications.

(1) **Install Water meters** at dwelling unit level (Kitchen, Toilets) : (max 2 points)

- 75 % of the Dwelling unit consumption: 1 point
- 100% of the Dwelling unit consumption: 2 points

( And/or)

(2) **Other Area Water meters** (any 3 measures) for the following applications: (max 1 point)

- STP treated water
- Landscape water consumption
- Water consumption in club house
- Captured rain water reuse
- Any other major source of water consumption such as, swimming pools, water fountain, common car wash facilities, etc.,



**Exemplary Performance: Not Applicable**

### Documentation Required:

#### *Precertification Level*

- A declaration from developer for installation of water meters for all dwelling units and other applications.
- A narrative describing the proposed list of water metering system/ equipment in the project.
- Single line diagram showing the proposed water metering system/ equipment.

#### *Certification Level*

Same as precertification documents, additionally provide Purchase invoices + photographs

# Energy Efficiency



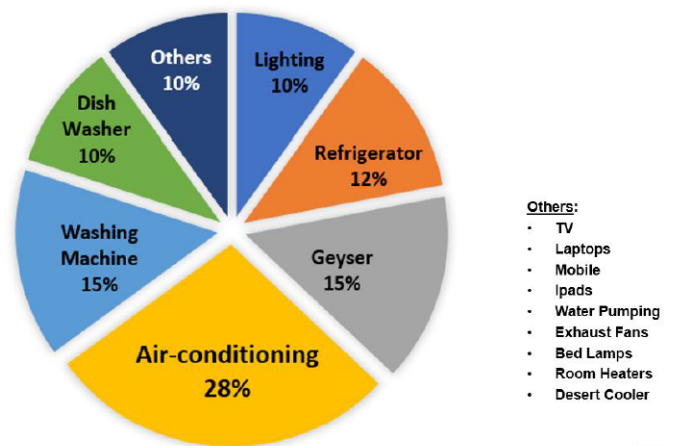
## Introduction

India is a rapidly growing economy where the energy demand far outstrips the generation. Also, almost 68%\* of the energy generated in India is from fossil fuel based thermal power plants, which are amongst the biggest sources of atmospheric pollution. Energy conservation has been identified as a national priority by the Government of India and several measures have been initiated towards promoting energy efficiency. (\*Source: Ministry of Power, Govt. Of India website - <http://www.powermin.nic.in>)

The broad approach to energy efficiency is to optimise the energy use by reducing energy demand in apartments and homes.

Energy consumption can be substantially reduced by incorporating strategies that are economically viable with an attractive return on investment. Simple measures like orientation, harvesting daylight, providing for abundant ventilation, adopting passive measures and selecting energy efficient appliances can go a long way in enhancing the energy efficiency. The beneficiaries are the end users who can reap the benefits through the life of the building.

**Energy Distribution in a Typical Home**



This can result in National benefits like reducing the dependence on fossil fuels and the associated pollution impacts

In India, Sun is the source of abundant untapped energy. Roof tops may be used for generating hot water and also for generating renewable power with solar photovoltaic cells. Other sources of renewable on-site energy such as bio-gas digesters, small wind systems using organic waste may also be explored.

Incorporating energy efficiency reduces the monthly bills and also result in environmental benefits

**HCFC-Free Equipment****EE Mandatory Requirement 1****Intent:**

Avoid use of refrigerants and ozone depleting gases which has negative impact to the environment.

**Compliance Options:**

- ❖ Zero use of Hydro-chlorofluorocarbon (HCFC) refrigerants in Heating, Ventilation & Air-conditioning (HVAC) equipment and Unitary Air-Conditioners installed in the building(s).
- ❖ Use halon free fire suppression equipment.

**Documentation Required:*****Precertification Level***

- Declaration letter signed by owner/ developer stating the proposed HVAC system(s) & fire suppression equipment, under owner's /developer's scope, if any, and type of refrigerant used.
- A copy of draft tenant guidelines stating the use of HCFC-free refrigerants in the HVAC system(s) and fire suppression equipment.
- List of proposed HVAC systems, with make and model.
- Manufacturer cut-sheet/ brochure indicating the type of refrigerant to be used in the proposed HVAC system(s).

***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit a copy of tenant guidelines stating the use of HCFC-free refrigerants installed in the HVAC systems & fire suppression equipment.

**Minimum Energy Performance****EE Mandatory Requirement 2****Intent:**

Improve energy efficiency of the proposed building(s) and system(s) to reduce environmental impacts from excessive energy use.

**Compliance Options:**

Prescriptive Approach: Project need to demonstrate the compliance for minimum energy performance.

*Note:*

- *Projects having multiple building types must independently (i.e. each residential typology; e.g.: apartments, villas, club house, etc.,) meet the minimum energy performance criteria.*

**Prescriptive Approach**

The prescriptive approach allows the project to comply with applicable criteria for all the parameters as outlined below:

**1. Building Envelope:**

The project must ensure that the following building envelope measures meet the baseline criteria as outlined below:

## ❖ Glazing

- i. Equivalent Solar Heat Gain Coefficient ( $SHGC_{eqi}$ )\*: 0.5
- ii. U value : 5.7 W/m<sup>2</sup>K

❖ Roof Assembly: U value : 1.5 W/m<sup>2</sup>K❖ Wall Assembly: U value : 2.5 W/m<sup>2</sup>K*Notes:*

- *\*  $SHGC_{eqi}$  : equivalent solar heat gain coefficient value can be achieved through chajjas or other shading devices or efficient fenestration or a combination of both*
- *Envelope optimization measures can be referred under National Building Code 2016- Chapter 11, No. 8- Envelope Optimisation*



## 2. Efficient Lighting systems:

The project must ensure that the interior, exterior, common and parking area lighting power densities to be designed to meet baseline values through ‘building area method’ or ‘space by space method’ as outlined below:

Space Description	Applicable Spaces	Baseline Lighting Power Density (LPD)
Interior Lighting (Developer scope)	Dwelling unit level, Apartments, Villas, Gated communities	5 W/sq.m (or) 0.46 W/sq.ft
Interior Lighting (for Non-residential)	Guest House, Hostels, Service Apartments	5 W/sq.m (or) 0.46 W/sq.ft
External Lighting	Landscaping, Facades, Street lighting, Pathways, Signages	2.5 W/sq.m (or) 0.23 W/sq.ft
Common Area Lighting (excluding parking area)	Corridors, lobbies, staircases, Terrace	4 W/sq.m (or) 0.37 W/sq.ft
Parking Area	Basement Parking/ Stilt Parking	2.5 W/sq.m (or) 0.23W/sq.ft

Notes:

- *Projects should show compliance for all the areas which are in developer’s/ owner’s scope only.*
- *Compliance for interior, exterior, common and parking area lighting must be shown separately.*
- *Decorative lighting in respective areas should be considered for lighting power density calculations.*
- *Exterior areas illuminated by lighting only should be considered for lighting power density calculations*

## 3. Air-conditioning Systems:

The project must ensure that the air-conditioning systems meet the baseline criteria as outlined below:

- ❖ Unitary air-conditioner(s) must be BEE 3-star as per latest notification or equivalent  
(Or)
- ❖ Centralised air-conditioning system(s) must meet the baseline values as per ECBC 2017

*Notes:*

- *Applicable for project only if 25% of the total regularly occupied spaces are air-conditioned, excluding kitchen & bathroom*
- *Projects should show compliance for all the air-conditioning system(s) installed, within the owner's/ developer's scope*
- *For latest list of air-conditioners rated by BEE, please refer BEE website <https://www.beestarlabel.com/>*

**Documentation Required:*****Precertification Level*****Prescriptive Approach**

- Narrative stating the climate zone and the list of proposed Energy Conservation Measures (ECMs) to be implemented.
- Comparison of the baseline building parameters and the proposed building parameters
- Details of proposed glazing along with the list of identified manufacturers and respective specifications of glazing (SHGC value, U-value and VLT). Also, specify window-to-wall ratio (WWR) for each building.
- Construction details of proposed roof (including roof insulation material, etc.) along with the U-value of the overall roof assembly.
  - Sectional drawings of roof assembly.
- Details of the proposed lighting system including list of interior and exterior lighting fixtures, with make and model.
  - Proposed LPD calculations for interior, exterior, common and parking areas, in owner's/ developer's scope, separately.
  - Conceptual lighting layout of interior and common areas for each typical floor, as applicable
  - Conceptual exterior lighting layout
- Details of the proposed air-conditioning system indicating the COP/ EER values or BEE star rating along with make and model.

- Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), roof insulation materials, lighting fixtures and air-conditioning system, as applicable.

### *Certification Level*

#### Prescriptive Approach

Submit documents same as mentioned in precertification level.

## Enhanced Energy Performance

### EE Credit 1

Points: 10

#### Intent:

Enhance energy efficiency of the building(s) to reduce environmental impacts from excessive energy use.

#### Compliance Options:

The project can choose any one of the following options:

- ❖ Option 1 – Prescriptive Approach (Maximum 10 points)
- ❖ Option 2 – Simulation Approach (Maximum 10 points)

#### Note:

*Projects having multiple building types must independently (i.e. each typology e.g.: apartments, villas, club house, etc.) meet the minimum energy performance criteria to be eligible for Enhanced Energy Performance.*

### Option 1 - Prescriptive Approach

The prescriptive approach allows the project to comply with applicable criteria for the parameters as outlined below:

#### 1. Building Envelope: (7 points)

- The project should design the building envelope measures as per **Eco-Niwas Samhita 2018 (ECBC-R)**. The criteria for attaining the points shall be as follows:

Residential envelope transmittance value (RETV\*) for building envelope (except roof) shall comply with the following:

- i. RETV value of 15.0 W/m<sup>2</sup> (1 point)
  - ii. RETV value of 14.5 W/m<sup>2</sup> (2 points)
  - iii. RETV value of 14.0 W/m<sup>2</sup> (3 points)
  - iv. RETV value of 13.5 W/m<sup>2</sup> (4 points)
  - v. RETV value of 13.0 W/m<sup>2</sup> (5 points)
- **Roof Assembly:**
    - i. U value of Roof assembly of 1.2 W/m<sup>2</sup>K (1 point)
    - ii. U value of Roof assembly of 1.0 W/m<sup>2</sup>K; (2 points)

**2. Efficient Lighting systems: ( 2 points)**

The project must ensure that the interior, exterior, common and parking area lighting power densities are reduced by atleast 25% over the baseline values through ‘building area method’ as outlined below:

Points are awarded as below for Lighting Power Density (LPD):

Reduction in Interior, Exterior Common & Parking Area LPDs from Baseline Values	Points
≥ 25 %	1
≥ 30 %	2

*Notes:*

- *Projects should show compliance for all the areas which are in developer’s/ owner’s scope only.*
- *Compliance for interior, exterior, common and parking area lighting must be shown separately.*
- *Decorative lighting in respective areas should be considered for lighting power density calculations.*

**3. Air-conditioning Systems: ( 2 points)**

The project must ensure that the air-conditioning systems meet the enhanced criteria as outlined below:

- ❖ *Unitary air-conditioner(s) must be BEE 4-star rated as per the latest notification or equivalent (1point) & BEE 5 star / Inverter based (2 points)*

**(Or)**

- ❖ *Centralised air-conditioning system(s) must be efficient by atleast 10% over the baselines of ECBC- R / ECBC 2017*

Points are awarded as below for Centralised Air-conditioning Systems:

Efficiency in Centralised Air-conditioning Systems from Baseline Values	Points
≥ 10 %	1
≥ 20 %	2

*Notes:*

- *Applicable for project only if 25% of the total regularly occupied spaces are air-conditioned, excluding kitchen*
- *For latest list of air-conditioners rated by BEE, please refer BEE website <https://www.beestarlabel.com/>*
- *Minimum Efficiency Requirements for VRF Systems can be referred from ASHRAE Standard 90.1-2016*
- *BEE Star rating to be considered as per the latest notifications.*

**4. Lighting Controls: (1 point)**

All non-emergency exterior & common area lighting such as façade, pathways, landscaping, surface and covered parking, street lighting, staircases should have at least one of the following in common areas & common toilets:

- Day light sensor
- Occupancy/ Motion sensor
- Timer based controls

**5. Space Heating Systems (1 point)**

*(Applicable for project only if HDD\*\* 18 is greater than 150)*

- ❖ Unitary heat pumps must meet the baseline criteria of ECBC-R/ ECBC 2017
- ❖ Non-electricity based heating system should have a minimum thermal efficiency of 70%

*Notes:*

- *\*\*Degree day: The difference in temperature between the outdoor mean temperature over 24 hour period and a given base temperature*
- *\*\*Heating degree day base 18°C, HDD 18: for any one day, when the mean temperature is less than 18°C, there are as many degree-days as degree Centigrade temperature difference between the mean temperature for the day and 18°C. Annual heating degree-days (HDDs) are the sum of the degree-days over the calendar year*

## Option 2 – Simulation Approach

The simulation (performance) based approach involves a building energy simulation and modeling. This approach allows the project to demonstrate improvements over the mandatory requirements specified in the EE MR 2.0

Points are awarded based on energy cost percentage savings as detailed below:

Points for % improvement over mandatory requirements	Points
2.5%	1
5 %	2
7.5 %	3
10 %	4
12.5 %	5
15 %	6
17.5 %	7
20 %	8
22.5 %	9
25 %	10

The following comfort conditions should be considered for energy simulation:

- ❖ Indoor temperature set point for simulation should be 24°C+/- 2° C for cooling systems & 20°C for Space heating systems all through the year.
- ❖ Comfort conditions should be considered both for summer and winter.

*Notes:*

- *Projects having multiple building types must independently (i.e. each typology e.g.: apartments, villas, club house, etc.) meet the minimum energy performance criteria to be eligible for Enhanced Energy Performance.*
- *Trade-offs among different building parameters (such as lighting, air-conditioning, etc.) are permissible.*

- *Projects which use on-site renewable energy sources (such as solar photovoltaics, wind turbines, etc.) can subtract the renewable energy generated from the total energy of the proposed case.*
- *Alternate hot water heating systems (Solar Hot water, LPG, Heat Pumps) should not be modeled in either the base case or the proposed case, to show energy savings. Such systems are separately recognised*

**Exemplary Performance:**

## 1. Prescriptive Approach:

- Building Envelope: RETV value of 12.0 W/m<sup>2</sup>
- Roof Assembly: U value of Roof assembly of 0.8 W/m<sup>2</sup>K
- 40% Savings in LPD over baselines

## 2. Performance Approach:

- 30 % improvement over Energy Mandatory Requirements

**Documentation Required:*****Precertification Level*****Prescriptive Approach**

- Narrative stating the climate zone and the list of proposed Energy Conservation Measures (ECMs) to be implemented.
- Comparison of the baseline building parameters as per ECBC-R for Envelope, Roof Assembly, LPD and Air-conditioning systems as per ECBC 2017 baselines.
- Details of proposed glazing along with the list of identified manufacturers and respective specifications of glazing (SHGC value, U-value and VLT). Also, specify window-to-wall ratio (WWR) for each building.
- Construction details of proposed roof (including roof insulation material, etc.) along with the U-value of the overall roof assembly.
  - Sectional drawings of roof assembly.
- Details of the proposed lighting system including list of interior and exterior lighting fixtures, with make and model.



- Proposed LPD calculations for interior, exterior, common and parking areas, in owner's/ developer's scope, separately.
- Conceptual lighting layout of interior and common areas for each typical floor, as applicable
- Conceptual exterior lighting layout
- Details of the proposed air-conditioning system indicating the COP/ EER values or BEE star rating along with make and model.
- Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), roof insulation materials, lighting fixtures and air-conditioning system, as applicable.

\*\*\*\*

### **Performance Approach:**

- Detailed Energy Simulation Report as per ECBC-R & ECBC 2017 as applicable.
- Narrative stating the climate zone and the list of proposed Energy Conservation Measures (ECMs) to be implemented.
- Comparison of the baseline building parameters as per ECBC-R for Envelope, Roof Assembly, LPD and Air-conditioning systems as per ECBC 2017 baselines.
- Details of proposed glazing along with the list of identified manufacturers and respective specifications of glazing (SHGC value, U-value and VLT). Also, specify window-to-wall ratio (WWR) for each building.
- Construction details of proposed roof (including roof insulation material, etc.) along with the U-value of the overall roof assembly.
  - Sectional drawings of roof assembly.
- Details of the proposed lighting system including list of interior and exterior lighting fixtures, with make and model.
  - Proposed LPD calculations for interior, exterior, common and parking areas, in owner's/ developer's scope, separately.
  - Conceptual lighting layout of interior and common areas for each typical floor, as applicable

- Conceptual exterior lighting layout
- Details of the proposed air-conditioning system indicating the COP/ EER values or BEE star rating along with make and model.
- Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), roof insulation materials, lighting fixtures and air-conditioning system, as applicable.

### ***Certification Level***

#### Prescriptive Approach

Submit documents same as mentioned in precertification level.

#### Performance Approach:

Submit documents same as mentioned in precertification level.

**Alternate Water Heating Systems****EE Credit 2****Points: 3****Intent:**

Encourage use of alternate water heating systems to improve energy efficiency.

**Compliance Options:**

Provide any **one or combination** of the below technologies for atleast 50 % of hot water requirement:

- ❖ Natural Gas (or) LPG based systems
- ❖ Heat pump with minimum of COP 3.2
- ❖ Solar water heating systems

*Note:*

- *The minimum hot water requirement for domestic purposes should be considered as 20 liters per person per day.*
- *The minimum temperature requirement of hot water to be considered for domestic applications can range between 35-40 deg C.*

Points are awarded as below:

Hot water through alternative heating systems as a percentage of total hot water requirement of the building(s)	Points
50 %	1
75%	2
95 %	3

**Exemplary Performance:** Not Applicable

**Documentation required:*****Precertification Level***

- Narrative describing the proposed alternative heating systems.
- Proposed list of alternative heating systems with make and model.

- Tentative calculations indicating the total hot water requirement in the project (liters/ day) and capacity of the proposed alternative heating systems (liters/ day).
- Conceptual drawings showing the location(s) of proposed alternative heating systems.
- Technical details of the proposed alternative heating systems.

### ***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit the documents mentioned below:

- Purchase invoice/ payment receipts of the installed alternative heating systems.
- Photographs of the installed alternative heating systems.
- Schematic of plumbing design showing the hot water line.

**On-site Renewable Energy - Common area Lighting**

EE Credit 3

Points: 4

**Intent:**

Promote self-sufficiency in energy through renewable technologies for on-site power generation and use within the project.

**Compliance Options:**

Install renewable energy systems for atleast 25% of annual common area lighting requirements.

Points are awarded as below:

Renewable energy as a percentage of total annual common lighting energy consumption	Points
25 %	1
50%	2
75%	3
95%	4

*Note:*

- *Solar hot water systems cannot be considered as power generation source and cannot be subtracted from the total energy of the proposed case.*
- *Common area lighting requirements include lighting used in corridors, basements, parking, club house, landscaping and any other common areas under developer scope.*

**Exemplary Performance:** Not Applicable

**Documentation required:**

***Precertification Level***

- Narrative describing the proposed renewable energy systems.
- Proposed list of renewable energy systems with manufacturer details (make).
- Tentative calculations indicating total annual energy consumption of the project (kWh), capacity of the renewable energy system (kW) and energy generation from the renewable energy systems (kWh).

- Drawing showing the location of proposed renewable energy systems with roof area details.
- Feasibility study report with technical details of the proposed renewable energy systems.

### ***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit the documents mentioned below:

- Technical details of the installed renewable energy systems.
- Purchase invoice/ payment receipts of the installed renewable energy systems.

**Energy Efficiency in Common Area Equipment****EE Credit 4****Points: 1****Intent:**

Conserve energy in the use of house-hold appliances and other equipment, thereby reducing environmental impacts.

**Compliance Options:**

Provide any two of the following measures:

1. Pumps: BEE 4-star rated Pumps (or) Minimum 70% efficiency for Pumps of capacity greater than 3 HP and ISI certified pumps for others
2. Motors: BEE 4-star rated Motors (or) Minimum 85% efficiency for Motors of capacity greater than 3 HP and ISI certified motors for others
3. Efficient Lifts & Escalators: Select one of the below efficient vertical systems:
  - Regenerative lifts
  - Double-deck elevators
  - Gearless traction elevators
  - Machine-room less traction elevators

**Exemplary Performance:** Not Applicable

**Documentation Required:*****Precertification Level***

- List of the proposed energy efficient appliances & other equipment in the project, with the energy efficiency parameters.
- Manufacturer cut-sheet/ brochure of the proposed appliances & other equipment.
- Narrative on the proposed efficient vertical systems.
- Manufacture brochures of the proposed efficient vertical systems.

***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit purchase invoice/ payment receipts and photographs of the installed appliances & other equipment.



**Integrated Energy Monitoring System****EE Credit 5****Points: 2****Intent:**

Encourage continuous monitoring to enhance the energy performance of residential dwelling unit(s).

**Compliance Options:**

Project can choose either Case A or Case B to meet the compliance.

**Case A: Energy Metering**

Provide energy meters for any four of the following, as applicable (*any 4 measures 1 point; maximum 2 points*):

- ❖ Common area lighting
- ❖ Exterior area lighting
- ❖ Energy meter for lifts
- ❖ STP
- ❖ Pumps & motors
- ❖ Club house
- ❖ DG set
- ❖ RE generation
- ❖ Air-conditioning
- ❖ Treated waste water pumping
- ❖ Power backup systems (Generators sets, Gas turbines, etc.,)
- ❖ Any other energy consuming equipment and systems

**(Or)**

**Case B: Building Management System (2 points)**

Provide over all building management system to monitor the following, as applicable.

*(Every 2 measures integrated with BMS - 1 point; maximum 2 points):*

- ❖ Air-conditioning management system
- ❖ Lighting management system
- ❖ Elevator management system
- ❖ Renewable energy management system
- ❖ CCTV
- ❖ Overhead water level indicators
- ❖ Water Metering (dwelling unit level)

**Exemplary Performance:** Not Applicable

**Documentation Required:*****Precertification Level***

- Narrative describing the proposed energy metering system/ equipment (or) building management system in the project.
- Single line drawing showing the proposed energy metering system/ equipment (or) building management system.

***Certification Level***

Submit documents same as mentioned in Precertification level. Additionally, submit purchase invoice/ payment receipts and manufacturer cut-sheets/ brochures of the installed energy meters (or) building management system.

# Materials & Resources



## Introduction

Building materials consume a significant amount of energy right from the process of extraction of raw materials to transportation to the construction site. Optimizing the embodied energy in materials plays a significant role in sustainability as activities related to raw material extraction often result in habitat loss and degradation of land & pollution.

Materials and Resources section addresses the environmental concerns relating to materials selection, waste disposal and construction waste reduction. Homes generate a large amount of house-hold waste on daily basis. Disposing such waste properly is critical as otherwise it would arise hygiene and disposal issues

The Materials & Resources section encourages segregation of waste at house hold level and diversion of construction waste from landfills at site level while improving the building environment through responsible waste management and material selection.

One of the most effective strategies to reduce the negative impact to the environment is to reduce the consumption of virgin raw materials, by reusing and recycling materials. It is important to consider various alternative materials in order to reduce dependency on virgin materials.

Other interventions could be to design with local materials, materials with recycled content, extending the life of the salvaged materials. Selection of salvaged materials can substitute new materials which reduce emissions due to extraction of raw materials. The use of materials extracted and manufactured locally help reduce the energy required for transportation and also may add a vernacular identity to the home. Eco-labelled materials and products are promoted to reduce the dependency on virgin resources.

The green home also encourages to promote rapidly renewable materials such as bamboo, eucalyptus, bagasse and certified wood for all wood applications in the home. The advantage of rapidly renewable materials is that they can be harvested in a cycle of ten years, which would significantly add to the sustainability quotient of a home.

## MATERIALS & RESOURCES

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### Separation of House-hold Waste

### MR Mandatory Requirement 1

#### **Intent:**

Facilitate segregation of house-hold waste at source so as to prevent such waste being sent to land-fills.

#### **Compliance Options**

Provide separate bins in every dwelling unit to collect dry waste (paper, plastics, metals, glass, etc.,) and wet waste (organic) at each dwelling unit and common areas (as applicable) in the building(s)/ campus. Also, provide a common facility at community level with separate bins to collect waste which covers the following:

- ❖ Dry Waste
- ❖ Wet waste
- ❖ Batteries
- ❖ ‘e’ waste
- ❖ Lamps

#### **Documentation Required:**

##### *Precertification Level*

- Narrative describing how the segregated waste (dry & wet) will be collected at individual house-hold and common area. Also, provide strategies to be implemented to dispose other waste such as batteries, e-waste and lamps from the common facility.
- Conceptual plan showing the location of proposed waste bins at individual level.
- Conceptual plan showing location of the easily accessible common facility.
- Submit e-waste contract with hauler, as applicable.

##### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, submit on-site photographs of the common facility and bins.

**Green Procurement Policy****MR Credit 1****Points : 1****Intent:**

Demonstrate the commitment to purchase products or services with lowest environmental impact.

**Compliance Options:**

Have a policy and procurement guidelines in place to purchase building products & materials which are eco-labelled and have lower impact on the environment. The following aspects to be addressed while purchasing the products & materials, as applicable:

- ❖ High recycled content
- ❖ Greater energy efficiency
- ❖ Reduced water consumption
- ❖ Material emitting fewer toxic substances during installation or use and upon disposal
- ❖ Certified Green Products

**Exemplary Performance:** Not Applicable**Documentation Required:*****Precertification Level***

- A policy document signed by the managing director or head of the organisation

***Certification Level***

- Same as above

## MATERIALS & RESOURCES

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### Optimisation on Structural Design

MR Credit 2

Points: 1

#### Intent:

Encourage optimum use of construction materials to reduce dependence on natural resources.

#### Compliance Options:

Implement a comprehensive structural design philosophy to conserve steel, concrete, water & cement, as compared to national and international practices, for the building type being designed, while maintaining structural integrity. Demonstrate a saving of at least 2.5% by weight of steel and cement.

#### Notes:

- *The baseline steel and cement requirements for construction activities shall be defined by the project team with supporting calculations.*

**Exemplary Performance:** Not Applicable

#### Documentation Required:

##### *Precertification Level*

- A letter from structural engineer stating the resources optimized in the structural design.
- Proposed list of the building materials used to build the structure.
- Manufacturer brochure of the materials to be procured.

##### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, provide photographs (long & close shot images) of the materials/ products sourced.



# MATERIALS & RESOURCES

## Certified Green Products

**MR Credit 3**

**Points: 5**

**Intent:**

Use certified green building materials, products, and equipment, so as to reduce dependence on materials that have associated negative environmental impacts.

**Compliance Options:**

Ensure that the project source GreenPro eco-labelled (or) any other Eco-labelled products & materials for building construction. The purchased quantity of eco-labelled products to be atleast 10% of the total cost of products & materials used for construction.

*For GreenPro eco-labelled products & categories, please refer the GreenPro directory.*

Points are awarded as below:

% of Green products & materials used for construction	Points
5 %	1
10 %	2
15 %	3
20 %	4
25 %	5

*Notes:*

- *\*Material Cost = Total Cost – (Labour cost + Installation cost)*
- *If Labour and Installation cost is not known, the default material cost can be considered as 60% of the total cost of the component*
- *Cost of electrical, mechanical & plumbing - equipment, systems & appliances and movable materials & furniture should not be considered in the total material cost*

**Exemplary Performance:**

This credit is eligible for exemplary performance under Innovation & Exemplary Performance, if green certified products meet 30 % of the total material cost.

## MATERIALS & RESOURCES

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### **Documentation Required:**

#### ***Precertification Level***

- Narrative on green certified building materials, products & equipment available.
- Proposed list of green certified building materials, products & equipment.
- Manufacturer brochure of the materials, products & equipment to be procured.
- Supporting document indicating the green product certification.

#### ***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, provide invoices indicating green products procured.

## MATERIALS & RESOURCES

### Local Materials

MR Credit 4

Points: 2

#### Intent:

Encourage use of building materials available locally thereby minimising the associated environmental impacts resulting from transportation.

#### Compliance Options:

Ensure atleast 50% of the total building materials (by cost), used in the building(s)/ campus, are manufactured within a distance of 400 km.

Points are awarded as below:

Percentage of Local Materials	Points
$\geq 50\%$	1
$\geq 75\%$	2

Notes:

- *Material Cost = Total Cost – (Labour Cost + Installation Cost)*
- *If Labour and Installation cost is not known, the default material cost can be considered as 60% of the total cost of the component*
- *Cost of electrical, mechanical & plumbing - equipment, systems & appliances and movable materials & furniture should not be considered in the total material cost*
- *Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesmen.*
- *Local materials are those which are assembled as a finished product within 400 km distance of the project site. Assembly, here does not include on-site assembly, erection or installation of finished components, as in structural steel, miscellaneous iron or systems furniture.*
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*

#### Exemplary Performance:

## MATERIALS & RESOURCES

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This credit is eligible for exemplary performance under Innovation & Exemplary Performance, if more than 95% of the total building materials (by cost), used in the building(s)/ campus, are sourced locally.

### **Documentation Required:**

#### *Precertification Level*

- Narrative describing the proposed strategies implemented to source local materials. The strategies shall include the following:
  - List of the proposed local materials and respective manufacturers specifying approximate distance from the project site to the place of manufacturing units.
- Tentative calculations indicating the percentage of local materials sourced (in terms of cost) with respect to the total materials cost of the project.

#### **Certification Level**

Submit documents same as mentioned in precertification level. Additionally, submit supplier/ vendor letters indicating the distance from the project site to the place of manufacturing unit.

## MATERIALS & RESOURCES

### Eco friendly Wood based materials

MR Credit 5

Points: 2

**Intent:**

Minimise use of new wood-based products, thereby reducing impacts of deforestation.

**Compliance Options:**

Ensure new wood-based products (by cost) used in the building are:

- ❖ Rapidly renewable\*  
(AND/ OR)
- ❖ Composite / Agri based wood\*\* / Recycled waste wood  
(AND/OR)
- ❖ Wood certified by Forest Stewardship Council (FSC) or Programme for the Endorsement for Forest Certification (PEFC) or equivalent

Points are awarded as below:

<u>Cost of alternate wood products/ Certified Timber</u> Total cost of wood-based products	Points
≥ 50%	1
≥ 75%	2

Notes:

- *\*Rapidly renewable materials are those that can be harvested and used within a ten year cycle. Example: Bamboo, Eucalyptus, Baggase based materials, Jute based materials, cotton blinds, rubber wood etc.,*
- *\*\* Composite / Agri based wood / recycled waste wood examples include (but not limited to) MDF boards, particle boards, linoleum boardsetc.,*

**Exemplary Performance:**

This credit is eligible for exemplary performance under Innovation & Exemplary Performance, if more than 95% of all wood based products (by cost), used in the building(s)/ campus, are certified or rapidly renewable.

## MATERIALS & RESOURCES

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### Documentation Required:

#### *Precertification Level*

- Narrative describing the proposed strategies to source rapidly renewable materials (and/ or) Composite /Agri based wood (and/or) certified timber. The strategies shall include the following:
  - List applications where rapidly renewable material (and/ or) certified wood by FSC/ (PEFC) (and/or) Composite / Agri based wood are used
  - List of proposed manufacturers to source rapidly renewable material (and/ or) certified wood by FSC/ (PEFC)/ equivalent.
- Tentative calculations indicating the percentage of rapidly renewable material (and/ or) certified wood by FSC/ (PEFC)(and/ or) Composite / Agri based wood, to the total cost of new wood used in the project. If certified wood is sourced, provide manufacturer CoC number/ certificate and details of type of certified wood e.g. pure, mixed, etc.,

#### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, submit purchase invoices and payment receipts of the sourced rapidly renewable material (and/ or) certified wood by FSC/ (PEFC)/ equivalent (and / or) Composite / Agri based/ Recycled waste wood

## MATERIALS & RESOURCES

### Alternative Construction Materials

MR Credit 6

Points: 2

**Intent:**

Encourage use of alternative construction materials to conserve natural resources and thereby reduce environmental impacts

**Compliance Options:**

Source atleast 5% of the building construction using alternative materials.

<u>Percentage of Cost of alternative Construction materials</u> Total Cost of the Construction (Civil & Interiors)	Points
$\geq 5\%$	1
$\geq 10\%$	2

Project can consider using the following alternative building construction materials:

- ❖ Innovative curing materials
- ❖ Use Ground-granulated blast-furnace slag (GGBS or GGBFS) to minimise cement usage
- ❖ Replace natural sand with slag sand/artificial sand
- ❖ Other alternative construction materials
- ❖ Curing compounds, readymix concrete, GGBS, Flyash, readymix plasters, artificial aggregates, etc.,

*Notes:*

*Provide tentative calculations for alternate construction materials with respect to industry benchmarks*

**Exemplary Performance:**

The project team may earn an Innovation and Exemplary Performance credit point (for innovative practices) by using atleast 15% of the alternative materials in the building construction.



## MATERIALS & RESOURCES

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### **Documentation Required:**

#### *Precertification Level*

- Narrative describing the proposed strategies for use of alternate construction materials to replace the natural resources in construction.
- Provide tentative calculations for alternate construction materials with respect to industry benchmarks
- Proposed list of identified vendors as applicable.
- Cut-sheets/ brochures from manufacturers.

#### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, submit purchase invoices indicating quantities of materials purchased.

## MATERIALS & RESOURCES

### Handling of Construction & Demolition Waste

MR Credit 7

Points: 2

**Intent:**

Encourage practices to manage construction waste, thereby, avoiding waste being sent to land-fills.

**Compliance Options:**

Avoid atleast 50% of the waste generated (by either weight or volume) during construction from being sent to landfills.

Points are awarded as below:

Percentage of Construction Waste Materials Handled	Points
≥ 50%	1
≥ 95%	2

*Notes:*

- *Excavated earth & stones should not be considered under this credit, as these are natural resources.*
- *Temporary materials such as materials used for form-work, scaffolding etc., shall not be considered for credit calculations.*
- *Declaration letter from scrap vendors / haulers cannot be considered. Project need to submit gate pass / challans / receipts related to waste disposed;*

**Documentation Required:**

***Precertification Level***

- Narrative describing the strategies to be implemented to handle construction waste. The strategies shall include the following:
  - List of construction waste materials likely to be generated and diverted for reuse, recycle & land-fill.
  - Proposed applications of construction waste materials diverted for reuse, within or outside the project.
  - List of haulers identified for any disposal of waste

## MATERIALS & RESOURCES

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- Site plan highlighting the proposed construction waste management yard.
- Tentative calculations indicating the amount of waste generated, reused, recycled and sent to landfill, either by weight or volume.

### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, submit photographs showing the construction waste management on-site. Also, submit gate pass/*challans / receipts* supported with photographs during different phases of construction indicating the diversion of waste generated on-site.

## MATERIALS & RESOURCES

### Organic Waste Management, Post-occupancy

MR Credit 8

Points: 3

#### Intent:

Ensure effective organic waste management, post-occupancy, so as to prevent waste being sent to land-fills.

#### Compliance Options:

Install on-site waste treatment system for treating atleast 50% organic waste generated from the building(s). The output from such systems like manure, power, etc., should be reused *in-situ*. Bio-gas can be considered to show credit compliance.

Points are awarded as below:

Percentage of Treated Organic Waste	Points
$\geq 50\%$	1
$\geq 75\%$	2
$\geq 95\%$	3

Notes:

- *Organic waste includes household kitchen and garden waste.*
- *The number of permanent occupants has to be considered as two persons each for first two bed rooms, and one additional person for each additional bedroom.*
- *Default organic waste quantity per person per day can be considered as 0.25 kgs or as prescribed by the local bye-law, whichever is more stringent.*
- *Projects could consider manure from treated organic waste for on-site consumption or donate or sell*

#### Documentation Required:

##### *Precertification Level*

- Narrative describing the proposed organic waste treatment system.
- Site plan highlighting the location of proposed on-site organic waste treatment system.

## MATERIALS & RESOURCES

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- Tentative calculations indicating the amount of organic waste (kitchen waste) generated and treated.
- Narrative describing the proposed strategies to handle garden waste, as applicable.
- Manufacturer brochure of the proposed organic waste treatment system, as applicable.

### *Certification Level*

Submit documents same as mentioned in precertification level. Additionally, provide purchase invoice/ payment receipts of the installed organic waste treatment system. Also, submit photographs showing the installed organic waste treatment system.

# Resident Health & Wellbeing



## Introduction

People spend about 2/3<sup>rd</sup> of their lives at home, where the quality of indoor environment has a significant impact on the health and well-being of the occupants. Historically, typical Indian homes are constructed to bring in natural sunlight and ventilation into the interior spaces.

The Sun is worshipped by many cultures throughout history because of its vast healing and therapeutic powers. Daylight is vital for body functions, gives a sense of time and place and connects the occupants to the environment. A green home should be designed such that the regularly occupied areas have access to sunlight, natural ventilation, cross ventilation. Daylighting, views to the exterior environment and fresh air are measures for enhancing the quality of life to occupants.

A good ventilation system removes the exhaled carbon dioxide and also helps remove unwanted moisture and other contaminants from the interior spaces. Homes require a continuous flow of outside air to maintain a habitable quality of indoor air.

We often see how, due to insufficient exhaust, carbon is deposited around the exhaust system, perhaps due to cooking oil. Kitchens require to be designed with adequate exhaust and fresh air provisions.

Many materials used in the residential construction and interior fit-outs contain Volatile Organic Compounds (VOC) which poses serious health risks to building occupants. VOC's are also found in many common construction materials. However, many alternative low / zero VOC products are available in the market. Such materials include paints, polish coatings, wood & glass sealants, adhesives for plywood, laminate, and veneer applications. It is also important to run a flush out after the interior fit-out is complete and before occupying the home

**Minimum Daylighting****RHW Mandatory Requirement 1****Intent:**

Design habitable spaces to have access to natural daylight, thereby enhancing the quality of life of the occupants

**Compliance Options:**

The project can choose any one of the following options:

- ❖ Option 1 – Prescriptive Approach
- ❖ Option 2 – Simulation Approach

Option 1: Prescriptive Approach

1. Achieve minimum glazing factors as below in atleast 50% of the regularly occupied spaces in each dwelling unit.

**Table 4 - Glazing factors for Regularly Occupied Spaces**

Type of Regularly Occupied Spaces	Glazing Factor (GF)*
Living/ Bedroom	1
Study room	1
Kitchen	2

**Note:**

*For other regularly occupied spaces\* which are not listed in the above table, a minimum glazing factor of 1 should be achieved.*

**Glazing Factor Calculation**

Glazing factor can be calculated using the formula given below:

$$\text{Glazing Factor} = \frac{\text{Window Area [sq.m]} \times \text{Actual Visible Transmittance of Glazing} \times \text{Constant}}{\text{Floor Area [sq.m]} \times 100}$$

**Constant Values:**

*Windows on wall* : 0.2

*Window on roof (skylight)* : 1.0

*\* Regularly occupied spaces include living room, bed rooms, dining room, study room & kitchen*



Regularly Occupied Space	Type of Regularly Occupied Space <i>(Please choose from dropdown below)</i>	Floor Area (sq.m)	Window Area (sq.m)	Window Glazing VLT (%)	Skylight Area (sq.m)	Skylight Glazing VLT (%)	Glazing Factor Achieved	Glazing Factor to be Achieved	Regularly Occupied Spaces Meet or Exceed the Criteria (Yes/ No)	Area of Regularly Occupied Spaces Meeting the Criteria
Living & Dining Room	Living/ Bedroom	45	8.0	50.0%			1.8	1	Yes	45.0
Bedroom 1	Living/ Bedroom	20	3.0	35.0%			1.1	1	Yes	20.0
Kitchen	Other spaces	15	3.0	35.0%			1.4	1	Yes	15.0
Study	Study room	10	2.0	75.0%			3.0	2	Yes	10.0
Guest room	Living/ Bedroom	20	3.0	35.0%	0.5	50.0%	2.8	1	Yes	20.0
<b>Total</b>		<b>110.0</b>								<b>110.0</b>
<b>Percentage</b>										<b>100.0%</b>

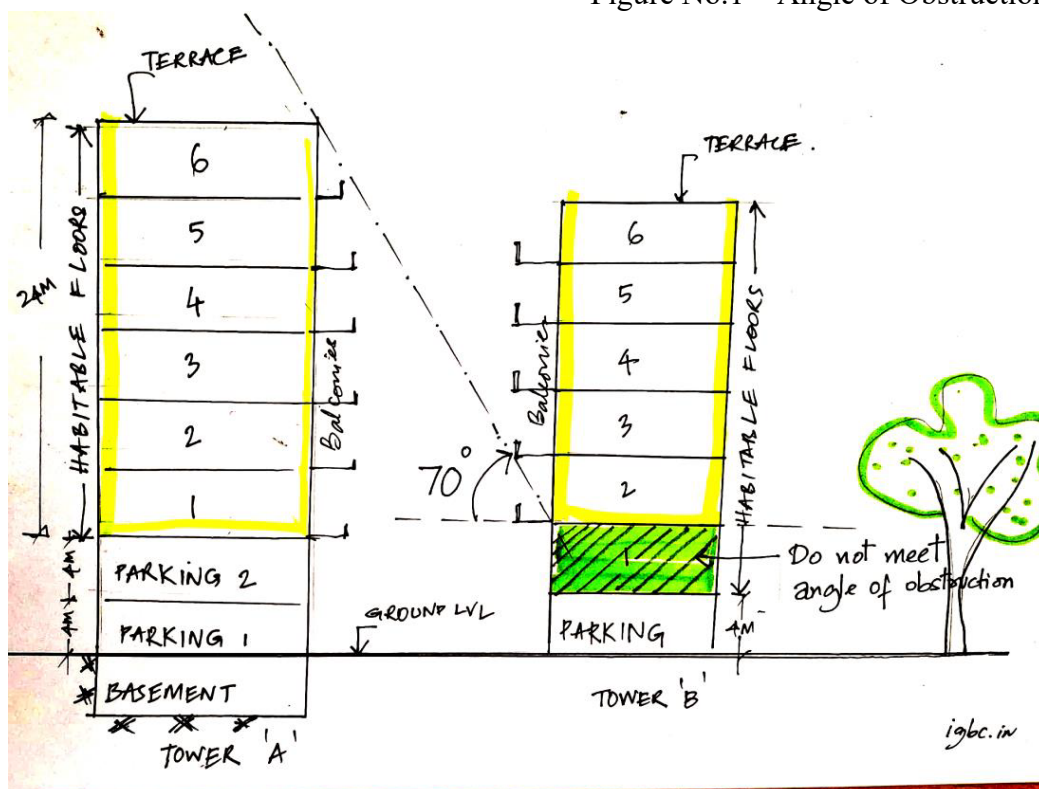
# Constant value considered for glazing factor calculation:  
 Windows on wall : 0.2  
 Window on roof (skylight) : 1.0

## 2. Angle Obstruction Compliance:

In tall buildings, the lowest floors gets inadequate daylighting due to obstruction from the neighboring towers and less distance between the towers. This would result in poor daylight in interior spaces hence it is mandatory to meet this compliance.

The project shall comply with 70° angle of obstruction compliance. The angle of obstruction shall be measured at the lowest habitable floor window sill to the highest point of adjacent building to ensure minimum glazing factor in every dwelling unit.

Figure No.1 – Angle of Obstruction



*Notes:*

- *Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70° from the horizontal shall not be considered for daylight calculations (refer figure no.1)*
- *Regularly occupied spaces which are used for multi-purposes, such as living-cum-dining room, can be considered as separate spaces based on the function. The room boundary need not be a physical boundary.*

**Option 2: Simulation Approach**

Demonstrate through computer simulation that 50% of the regularly occupied spaces, in each dwelling unit, achieve daylight illuminance levels of a minimum of 10 foot-candles (fc) (110 lux) in a clear sky condition on 21<sup>st</sup> September at 12 noon, at working plane.

**Documentation Required:*****Precertification Level*****Prescriptive Approach**

- Glazing factor calculations for each typical dwelling unit with room dimensions.
- Conceptual site/ master plan showing all the buildings.
- Drawing(s) showing the angle of obstruction between the buildings within the project and the adjacent neighbouring buildings.
- For clubhouse and other common amenities, submit daylight calculations & plans separately.
- Conceptual floor plans with door & window schedules.
- Cut-sheets of the glass showing the visual light transmittance (VLT).

**Simulation Approach**

- Conceptual site/ master plan showing all the buildings.
- Conceptual floor plans with window and skylight schedule.

## RESIDENT HEALTH & WELLBEING

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- For clubhouse and other common amenities, submit daylight calculations & plans separately.
- Daylighting simulation report stating the sky conditions (such as date & month; time; ambient lux levels; wall, floor & roof reflectance properties; etc.) and showing the daylight analysis for each typical dwelling unit in the project. During simulation, consider shading devices and ‘shadow effect’ of adjacent neighbouring buildings.
- Cut-sheets of the glass showing the visual light transmittance (VLT).

Note:

*Compliance for this mandatory requirement can also be shown with combination of both prescriptive and simulation approach.*

### ***Certification Level***

#### **Prescriptive Approach**

Submit documents same as mentioned in precertification level. Additionally, submit photographs showing the building elevations (all sides).

#### **Simulation Approach**

Submit documents same as mentioned in precertification level. Additionally, submit photographs showing the building elevations (all sides).

**Ventilation Design****RHW Mandatory Requirement 2****Intent:**

Avoid indoor pollutants affecting indoor air quality by providing adequate outdoor air ventilation.

**Compliance Options:****Naturally Ventilated Spaces:**

Provide openable windows or doors to the exteriors in all regularly occupied spaces of each dwelling unit such that the openable area is designed to meet the criteria as outlined in the table below:

**Case 1: Less than 5 floors****Design Criteria for Openable Windows and Doors to the Exteriors**

Space type	Openable area as a percentage of total carpet area
Living Spaces	10%
Kitchen	8%
Bathrooms*	4%

**Case 2: More than 5 floors****Design Criteria for Openable Windows and Doors to the Exteriors**

Space type	Openable area as a percentage of total carpet area
Living Spaces	8%
Kitchen	6%
Bathrooms*	4%

*Notes:*

- *Regularly occupied spaces include living room, bed rooms, dining room, study room & kitchen*
- *For sliding windows / doors, only openable area to the exteriors shall be considered in calculations*

## RESIDENT HEALTH & WELLBEING

- *\*Compliance for bathrooms can also be shown through exhaust system and/ or louvers.*

*The exhaust system in toilets shall meet 50 cfm in 50 sq.ft (4.6 sq.m) of area.*

Type of room - 1.5 BHK TYPE 2	Length (M)	Width (M)	Carpet Area (Sq.M)	Type of window	Window Dimensions		Openable type.	Window Area (Sq.M)	Openable window area (Sq.M)	% of Openable Area to Carpet Area - Required	% of Openable Area to Carpet Area - Achieved
					Length (m)	Height (m)					
Living	4.35	2.70	11.75	W3	1.2	1.8	Sliding - 2nos	2.16	1.08	10%	9%
Kitchen	2.05	2.30	4.72	KW1	1.2	0.9	Openable type.	1.08	1.08	8%	23%
Bed Room	3.55	3.00	10.65	W1	1.8	1.35	Sliding - 2nos	2.43	1.22	10%	11%
Study	2.70	2.70	7.29	W2	1.2	1.35	Sliding - 2nos	1.62	0.81	10%	11%
Toilet	1.350	1.45	1.96	V	0.6	0.9	Louvres	0.54	0.54	4%	28%

### Alternative option: Approach through CFD Analysis:

If a project intends to apply the mandatory or credit requirement through CFD analysis, the guidelines specified in NBC norms Part 8: Building Services (Section 1: Lighting & Ventilation) with 3-6 ACH\* could be followed for Living spaces. Hence, 6 ACH can be demonstrated for mandatory requirement.

The submittals must however include modelling data wherein all buildings and contours within 200m radius are modelled, weather file specific to the region with wind data is made available and output files from the software be shared to authenticate the work done.

*\*ACH – Air changes per hour*

### For Air-Conditioned Spaces:

Design mechanical ventilation system to supply minimum 5 cfm per person in each of the habitable spaces.

### Note:

- *Projects installing unitary air conditioning system(s) for a limited period in a entire year can show compliance by providing openable windows & doors. Projects installing centralised air-conditioning system(s) should meet the fresh air requirement of 5 cfm per person in each of the conditioned spaces*

**Documentation Required:*****Precertification Level*****Naturally Ventilated Spaces**

- Fresh air ventilation calculations in each living room of each dwelling unit indicating the openable area (i.e. window/ door) as a percentage of carpet area in each of the regularly occupied spaces and bathrooms.
- Floor plans with door and window schedule.
- For clubhouse and other common amenities, submit fresh air ventilation calculations & plans separately.

**Air-conditioned Spaces**

- A narrative stating the proposed building ventilation design and fresh air intake volumes.
- Calculations indicating fresh air intake volumes in all regularly occupied spaces, for each typical dwelling unit.
- For clubhouse and other common amenities, submit fresh air ventilation calculations & plans separately.

**Note:**

*Compliance for this mandatory requirement can also be shown with combination of both natural ventilation and mechanical ventilation.*

***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit photographs of the building.

**No Smoking Policy****RHW Mandatory Requirement 3****Intent:**

Minimise exposure of non-smokers to the adverse health impacts arising due to passive smoking, post occupancy.

**Compliance Options:**

Smoking should be prohibited in the common areas of the building(s) and campus.

**Documentation Required:*****Precertification Level***

- Declaration letter from the owner/ developer stating that ‘smoking’ will be prohibited in the common areas of the project.
- A narrative stating the proposed strategies (eg. signages, brochures, home user guidelines, etc.,) on how ‘no smoking’ policy will be communicated to all the residents and visitors.
- A copy of ‘no smoking policy’.

***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit photographs showing the ‘no smoking’ signages installed in the project.

**Enhanced Daylighting**

RHW Credit 1

Points: 2

**Intent:**

Ensure connectivity between the interior and the exterior environment, by providing adequate daylighting.

**Compliance Options:**

The project can choose any one of the following options:

- ❖ Option 1 – Prescriptive Approach
- ❖ Option 2 – Simulation Approach

**Option 1: Prescriptive Approach**

Achieve minimum glazing factors as below in atleast 75% of the regularly occupied spaces in each dwelling unit.

Points are awarded as below:

Percentage of daylighting in regularly occupied spaces	Points
≥ 75%	1
≥ 95%	2

**Glazing factors for Regularly Occupied Spaces**

Type of Regularly Occupied Spaces	Glazing Factor (GF)*
Living/ Bedroom	1
Study room	1
Kitchen	2

*Note:*

*For other regularly occupied spaces\* which are not listed in the above table, a minimum glazing factor of 1 should be achieved.*



**Glazing Factor Calculation**

Glazing factor can be calculated using the formula given below:

$$\text{Glazing Factor} = \frac{\text{Window area (sq.m)} \times \text{Glass VLT} \times \text{Constant} \times 100}{\text{Floor Area (sq.m)}}$$

**Constant Values:**

Windows on wall : 0.2

Window on roof (skylight) : 1.0

\* Regularly occupied spaces include living room, bed rooms, dining room, study room & kitchen

AND

**Angle of Obstruction Compliance:**

In tall buildings, the lowest floors get inadequate daylighting due to obstruction from the neighbouring towers and less distance between the towers. This would result in poor daylight in interior spaces hence it is mandatory to meet this compliance.

The project shall comply with 70° angle of obstruction compliance. The angle of obstruction shall be measured at the lowest habitable floor window sill to the highest point of adjacent building to ensure minimum glazing factor in every dwelling unit.

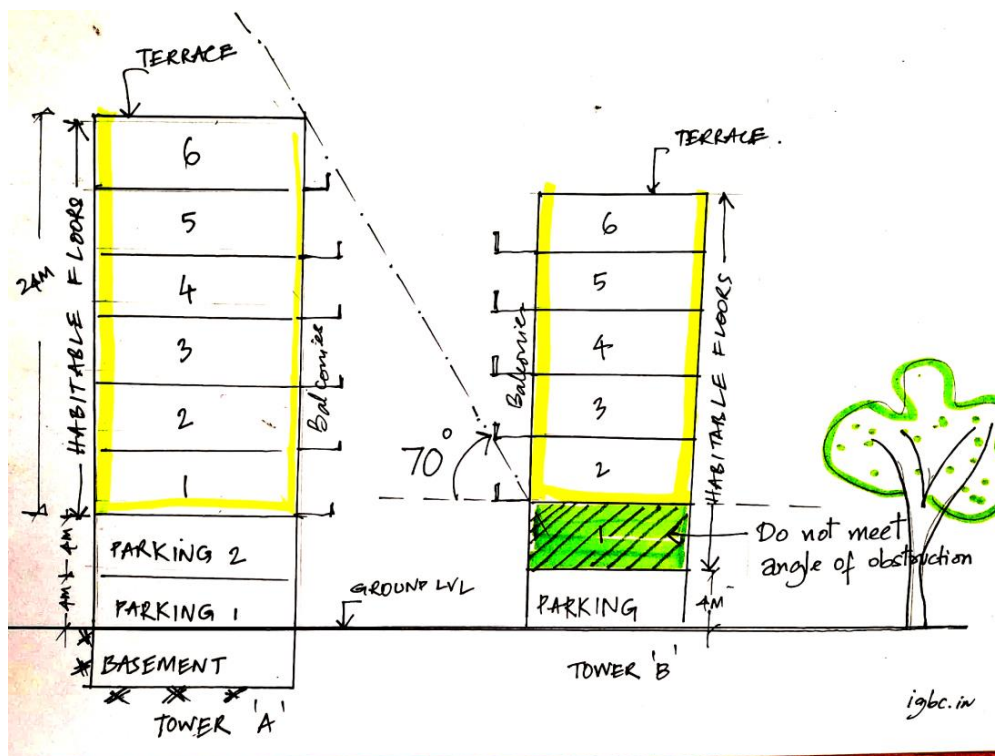


Figure No.1 – Angle of Obstruction

## RESIDENT HEALTH &amp; WELLBEING

Regularly Occupied Space	Type of Regularly Occupied Space <i>(Please choose from dropdown below)</i>	Floor Area (sq.m)	Window Area (sq.m)	Window Glazing VLT (%)	Skylight Area (sq.m)	Skylight Glazing VLT (%)	Glazing Factor Achieved	Glazing Factor to be Achieved	Regularly Occupied Spaces Meet or Exceed the Criteria <i>(Yes/ No)</i>	Area of Regularly Occupied Spaces Meeting the Criteria
Living & Dining Room	Living/ Bedroom	45	8.0	50.0%			1.8	1	Yes	45.0
Bedroom 1	Living/ Bedroom	20	3.0	35.0%			1.1	1	Yes	20.0
Kitchen	Other spaces	15	3.0	35.0%			1.4	1	Yes	15.0
Study	Study room	10	2.0	75.0%			3.0	2	Yes	10.0
Guest room	Living/ Bedroom	20	3.0	35.0%	0.5	50.0%	2.8	1	Yes	20.0
<b>Total</b>		<b>110.0</b>								<b>110.0</b>
<b>Percentage</b>										<b>100.0%</b>
# Constant value considered for glazing factor calculation: Windows on wall : 0.2 Window on roof (skylight) : 1.0										

*Notes:*

- Window openings where the angle of obstruction of objects obscuring the sky dome is greater than 70° from the horizontal shall not be considered for daylight calculations (refer figure no.1)
- Regularly occupied spaces which are used for multi-purposes, such as living-cum-dining room, can be considered as separate spaces based on the function. The room boundary need not be a physical boundary.

**Option 2: Simulation Approach**

Demonstrate through computer simulation that 75% of the regularly occupied spaces, in each dwelling unit, achieve daylight illuminance levels of a minimum of 10 footcandles (fc) (110 lux) in a clear sky condition on 21<sup>st</sup> September at 12 noon, at working plane.

**Exemplary Performance:** Not Applicable

**Documentation Required:*****Precertification Level*****Prescriptive Approach**

- Glazing factor calculations for each typical dwelling unit with room dimensions.
- Conceptual site/ master plan showing all the buildings.
- Drawing(s) showing the angle of obstruction between the buildings within the project and the adjacent neighbouring buildings.

## RESIDENT HEALTH & WELLBEING

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- For clubhouse and other common amenities, submit daylight calculations & plans separately.
- Conceptual floor plans with door & window schedules.
- Cut-sheets of the glass showing the visual light transmittance (VLT).

### **Simulation Approach**

- Conceptual site/ master plan showing all the buildings.
- Conceptual floor plans with window and skylight schedule.
- For clubhouse and other common amenities, submit daylight calculations & plans separately.
- Daylighting simulation report stating the sky conditions (such as date & month; time; ambient lux levels; wall, floor & roof reflectance properties; etc.,) and showing the daylight analysis for each typical dwelling unit in the project. During simulation, consider shading devices and ‘shadow effect’ of adjacent neighbouring buildings.
- Cut-sheets of the glass showing the visual light transmittance (VLT).

### **Note:**

*Compliance for this mandatory requirement can also be shown with combination of both prescriptive and simulation approach.*

### ***Certification Level***

#### **Prescriptive Approach**

Submit documents same as mentioned in precertification level. Additionally, submit photographs showing the building elevations (all sides).

#### **Simulation Approach**

Submit documents same as mentioned in precertification level. Additionally, submit photographs showing the building elevations (all sides).

**Enhanced Ventilation Design****RHW Credit 2****Points: 2****Intent:**

Avoid indoor pollutants affecting indoor air quality by providing adequate outdoor air ventilation.

**Compliance Options:****Naturally Ventilated Spaces:**Option 1:

Provide openable windows or doors to the exteriors in all regularly occupied spaces of each dwelling unit such that the openable area is designed to meet the criteria as outlined in the table below:

**Case 1: Less than 5 floors**

Design Criteria for Openable Windows and Doors to the Exteriors

Space type	Openable area as a percentage of total carpet area
Living Spaces	12%
Kitchen	10%
Bathrooms*	5%

**Case 2: More than 5 floors**

Design Criteria for Openable Windows and Doors to the Exteriors

Space type	Openable area as a percentage of total carpet area
Living Spaces	10%
Kitchen	8%
Bathrooms*	5%

*Notes:*

- Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen etc.,
- For sliding windows / doors, only openable area to the exteriors shall be considered in calculations

# RESIDENT HEALTH & WELLBEING

- *\*Compliance for bathrooms can also be shown through exhaust system and/ or louvers. The exhaust system in toilets shall meet 50 cfm in 50 sq.ft (4.6 sq.m)of area.*

Type of room - 1.5 BHK TYPE 2	Length (M)	Width (M)	Carpet Area (Sq.M)	Type of window	Window Dimensions		Openable type.	Window Area (Sq.M)	Openable window area (Sq.M)	% of Openable Area to Carpet Area - Required	% of Openable Area to Carpet Area - Achieved
					Length (m)	Height (m)					
Living	4.35	2.70	11.75	W3	1.2	1.8	Sliding - 2nos	2.16	1.08	12%	9%
Kitchen	2.05	2.30	4.72	KW1	1.2	0.9	Openable type.	1.08	1.08	10%	23%
Bed Room	3.55	3.00	10.65	W1	1.8	1.35	Sliding - 2nos	2.43	1.22	12%	11%
Study	2.70	2.70	7.29	W2	1.2	1.35	Sliding - 2nos	1.62	0.81	12%	11%
Toilet	1.350	1.45	1.96	V	0.6	0.9	Louvres	0.54	0.54	5%	28%

*\*Highlighted areas do not qualify the enhanced ventilation requirement*

## **Alternate Option: Approach through CFD Analysis:**

If a project intends to apply the mandatory or credit requirement through CFD analysis, the guidelines specified in NBC norms Part 8: Building Services (Section 1: Lighting & Ventilation) with 3-6 ACH\* could be followed for Living spaces. Hence, 6 ACH can be demonstrated for mandatory requirement and 8-10 ACH to meet the Enhanced Fresh Air Ventilation.

The submittals must however include modelling data wherein all buildings and contours within 200m radius are modelled, weather file specific to the region with wind data is made available and output files from the software be shared to authenticate the work done.

*\*ACH – Air changes per hour*

### **For Air Conditioned Spaces:**

Design mechanical ventilation system to supply minimum 6.5 cfm per person in each of the habitable spaces.

*Note:*

- *Projects installing unitary air conditioning system(s) for a limited period in a entire year can show compliance by providing openable windows & doors. Projects installing centralised air-conditioning system(s) should meet the fresh air requirement of 6.5 cfm per person in each of the conditioned spaces*

**Exemplary Performance: Not Applicable**

**Documentation Required:**

*Precertification Level*

Please refer IEQ Mandatory Requirement 3 – Fresh Air Ventilation.

*Certification Level*

Please refer IEQ Mandatory Requirement 3 – Fresh Air Ventilation.

**Cross Ventilation**

**RHW Credit 3**

**Points: 4**

**Intent:**

Encourage adequate cross ventilation in the dwelling units thereby, providing a healthy environment.

**Compliance Options:**

Ensure that minimum 25% of the regularly occupied spaces (by area) in each dwelling unit shall have an opening (doors/ ventilators/ windows) to the outdoor environment, in atleast two of the orientations.

Points are awarded as below:

Percentage of regularly occupied spaces with cross ventilation	Points
≥ 25%	1
≥ 50%	2
≥ 75%	3
≥ 95%	4

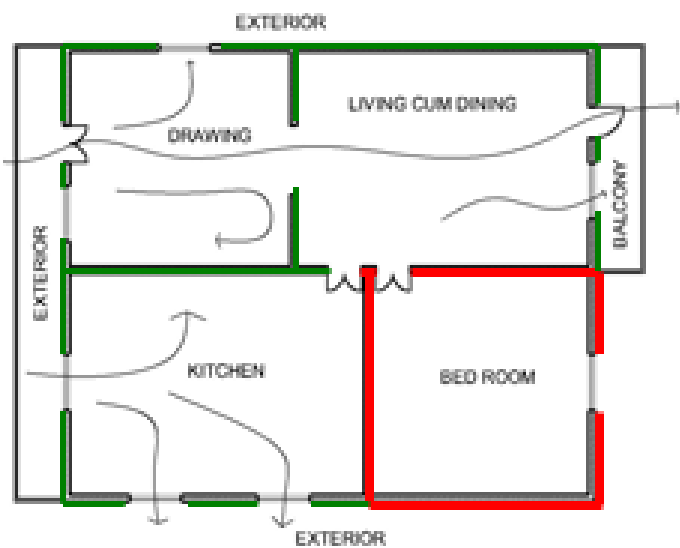


Figure No. 2 – Cross Ventilation

**Notes:**

- Regularly occupied spaces include living room, bed rooms, dining room, study room, kitchen, etc.,
- The doors/ ventilators/ windows should not have any obstruction within 2 m from outside surface.
- The opening considered should meet IEQ Mandatory Requirement 3 - Fresh Air Ventilation criterion.
- Spaces with exterior openings in same wall / plane cannot claim this credit
- Regularly occupied spaces with an opening to the outdoors only in one orientation can also be considered for calculations, if there is a permanent opening to the adjoining room which meets cross ventilation criteria (refer figure no.2).

*(In figure no.2, along with the drawing room and kitchen, the living cum dining room will also have adequate cross ventilation through the permanent opening from drawing room).*

**Exemplary Performance:** Not Applicable

**Documentation Required:*****Precertification Level***

- Conceptual site/ master plan showing all the buildings.
- Conceptual floor plans with door and window schedule, for each typical dwelling unit.
- Tentative calculations indicating the regularly occupied spaces compliant with cross ventilation, for each typical dwelling unit.

***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit long shot photographs showing the door & window sizes.



## RESIDENT HEALTH & WELLBEING

### Connectivity to Exteriors

RHW Credit 4

Points: 2

#### Intent:

Ensure connectivity between the interior and exterior spaces, to achieve visual delight to occupants

#### Compliance Options:

Achieve direct line of sight to vision glazing between 0.9 meters (3 feet) and 2.1 meters (7 feet) above the finished floor level, for building occupants in atleast 50% of all regularly occupied spaces in each dwelling unit. Also, the project shall comply with the following criteria:

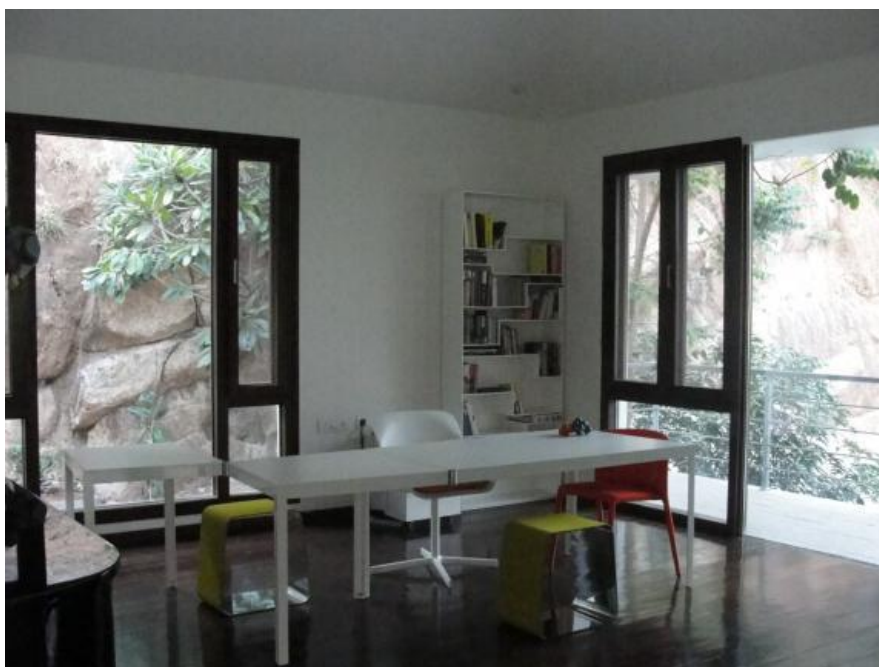
- ❖ The building occupants must not have any obstruction of views atleast 8 meters (26.2 feet) from the exterior vision glazing.

(OR)

- ❖ The building occupants must have access either to sky or flora & fauna or both.

Points are awarded as below:

Percentage of regularly occupied spaces with connectivity to exteriors	Points
$\geq 50\%$	1
$\geq 75\%$	2



*Notes:*

- *Non-regularly occupied areas include toilets, store rooms, etc.,*
- *Internal courtyards with vegetation can be considered for this credit calculation.*
- *Project with multiple buildings (including projects with common basement) must independently meet the Outdoor Views criteria for each building.*

**Exemplary Performance:** Not Applicable

**Documentation Required:**

*Precertification Level*

- Drawing showing the connectivity between the interior and outdoor spaces.

*Certification Level*

- Submit documents same as mentioned in precertification level. Additionally, submit photographs of the exterior views from regularly occupied spaces. Also, submit section of interiors with furniture, ceiling sections & glazing level.

**Low VOC Materials, Paints & Adhesives**

RHW Credit 5

Points: 2

**Intent:**

Encourage use of materials with low emissions so as to reduce adverse health impacts on building occupants.

**Compliance Options:**

- ❖ Source GreenPro or any other Eco-label certified paints, coatings (including primers) for the interior walls and ceilings. *(1 point)*

(And/or)

- ❖ Source GreenPro Eco-label or any other Eco-label certified adhesives and sealants. *(1 point)*

**Note:**

- *If the project has used small quantities of non-complying paints and/or adhesives, a VOC budget can be calculated to demonstrate that the weighted average VOC of all products (based on litres of each applied) is below the allowed limit, by each type.*

**Exemplary Performance:** Not Applicable**Documentation Required:*****Precertification Level***

- List of proposed low or no VOC content materials (make & model) to be used in the building interiors.
- Manufacturer cut-sheets/ brochures/ Materials Safety Data Sheet (MSDS) indicating the VOC content (in g/L, less water) of the paints & adhesives to be sourced.

***Certification Level***

Submit documents same as mentioned in precertification level.

**Facility for Physical Wellbeing****RHW Credit 6****Points: 2****Intent:**

Promote occupant well-being so as to enhance physical, emotional and spiritual well-being of building occupants

**Compliance Options:**

Demonstrate that the project has occupant well-being facilities (such as gymnasium, aerobics, yoga, meditation, swimming pool or any indoor / outdoor games) to cater to at least 2.5% of building occupants at any point during the day

Points are awarded as below:

Percentage of occupants	Points
$\geq 2.5\%$	1
$\geq 5\%$	2

**Exemplary Performance:** Not Applicable

**Documentation Required:*****Precertification Level***

- Narrative describing the outdoor activities proposed.
- Calculations showing the recreational facilities provided based on the number of occupants.
- Conceptual site/ master plan showing all outdoor activities / club house.

***Certification Level***

Submit documents same as mentioned in precertification level. Additionally, submit photographs of outdoor activities.

# Innovation & Design

## Innovation

### ID Credit 1

Points: 2

#### Intent:

Provide design teams and projects an opportunity to be awarded points for innovative performance in green building categories not specifically addressed by the IGBC Green Homes® Rating System.

#### Compliance Options:

##### Credit 1.1: Innovation

Identify the intent of the proposed innovation credit, the proposed requirement for compliance, and the proposed documentation to demonstrate compliance, and the design approach used to meet the required measures.

##### Credit 1.2: Innovation : Same as credit 1.1

**Innovative Performance:** The projects can also identify the innovation strategies those are not addressed by any existing credits in the rating system. These strategies should demonstrate a comprehensive approach and have significant, measurable environmental benefits. For example, only signages in a building would not be considered a significant educational effort by itself. The measurable impacts of such interventions need to be identified and documented

#### Notes:

*The project should also meet the following criteria for achieving an Innovation point:*

- *Quantitative performance improvements (comparing a baseline and design case)*
- *Comprehensive strategy (more than one product or process)*
- *Strategy must be applicable to other projects and significantly better than standard sustainable design practices*
- *Initiatives must be voluntary and should be done both in common areas and tenant areas, as applicable.*

## Documentation Required:

### *Precertification Level*

#### Innovation:

- A narrative describing intent, requirements, proposed potential strategies and technologies to be adopted to achieve the respective innovation credits. Strategies adopted must be significantly better than standard sustainable design practices.
- Tentative quantitative performance improvements, comparing baseline and design case.
- Other supporting documents such as drawings, illustrations, cut-sheets, test-reports, etc., as applicable.

### *Certification Level*

#### Innovation:

- A narrative describing intent, requirements, potential strategies and technologies adopted in the respective innovation credits. Strategies adopted must be significantly better than standard sustainable design practices.
- Quantitative performance improvements, comparing a baseline and design case.
- Other supporting documents such drawings, photographs, illustrations, cut-sheets, test reports, etc., as applicable.

#### *Notes:*

- *Measures must be voluntary. Such measures which are mandated by the local bye-laws and not addressed in the rating system are not eligible for Innovation..*
- *Measures should be done both in common areas and tenant areas, as applicable.*

### **Example for Innovative Performance:**

One of the Projects has implemented a Green Housekeeping Programme for the apartment both in tenant & common areas. The project intended to adopt eco-friendly house keeping practices during maintenance by using bio-degradable / eco-friendly chemicals, to address health, hygiene and well-being of building occupant & maintenance staff.

In order to meet the credit compliance, the following submittal is to be provided:

- Intent
- Requirements
- Statement of Purpose
- Design Approach
- Procedural requirement of Operational Staff and Training

## Exemplary Performance

**ID Credit 2**

**Points: 2**

**Intent:**

Provide design teams and projects an opportunity to be awarded points for exemplary performance in green building categories not specifically addressed by the IGBC Green Homes<sup>®</sup> Rating System.

**Compliance Options:**

Credit 2.1: Exemplary Performance

Identify the intent of the proposed innovation credit, the proposed requirement for compliance, and the proposed documentation to demonstrate compliance, and the design approach used to meet the required measures.

Credit 2.2: Exemplary Performance

Same as credit 1.1

**Exemplary Performance:** Projects should identify appropriate strategies that significantly exceed the requirements of IGBC Green Homes rating system credits. As a general rule, innovation credits for exemplary performance are awarded for doubling the credit requirements and/or achieving the next incremental percentage threshold. Eligibility criteria for different credits are defined in respective credits (refer Exhibit - B).

**Documentation Required:**

***Precertification Level***

- A narrative describing the proposed strategies to be adopted for exemplary performance in the respective base credits.

***Note:***

*There is no need to provide any other supporting documents, if these documents are available in the respective base credit folders.*

For materials related credits, submit calculations supporting the claim.



## *Certification Level*

Same as above, support with photographs.

## **Related mandatory Requirements & credits:**

Refer to the ‘Exemplary Performance’ of each credit in this reference guide.

\*\*\*\*

## **List of Base credits eligible for Exemplary Performance**

### **Sustainable Design**

- |             |  |
|-------------|--|
| SD Credit 1 | Natural Topography & Vegetation : 50% (vegetation over Ground & built-structures)  |
| SD Credit 2 | Heat Island Effect Roof & Non-Roof: <b>Tree cover</b> is provided or 100 % of the Non-Roof area (or) 100 % Roof area is covered with <b>Vegetation</b> . |

### **Water Conservation**

- |             |  |
|-------------|--|
| WC Credit 1 | Water Efficient Plumbing Fixtures: (water consumption is 40 % lesser than the baseline criteria) |
| WC Credit 2 | Landscape Design: 85% of the landscaped area is planted with native/ adaptive species            |
| WC Credit 4 | Rain Water Harvesting  |

## Energy Efficiency

EE Credit1 1

### Prescriptive Approach:

- Building Envelope: RETV value of 12.0 W/m<sup>2</sup>
- Roof Assembly: U value of Roof assembly of 0.8 W/m<sup>2</sup>K
- 40% Savings in LPD over baselines

### Performance Approach:

- 30 % improvement over Energy Mandatory Requirements

## Materials & Resources

MR Credit 3

Certified Products: Green certified products meet 30 % of the total material cost

MR Credit 4

Local Materials: 95% of the total building materials (by cost), used in the building(s)/ campus, are sourced locally.

MR Credit 5

Eco-friendly wood based materials: 95% of all wood based products (by cost), used in the building(s)/ campus, are certified or rapidly renewable.

MR Credit 6

Alternative Materials: 15% of the alternative materials in the building construction

## IGBC Accredited Professional

**ID Credit 3**

**Point: 1**

### Intent:

Support and encourage involvement of IGBC Accredited Professional(s) in the green home project.

### Compliance Options:

Atleast one principal participant of the project team shall be an IGBC Accredited Professional.

### Documentation Required:

#### *Precertification*

Submit copy of the IGBC AP Certificate of the principal participant.

#### *Certification*

Submit documents same as mentioned in precertification level.

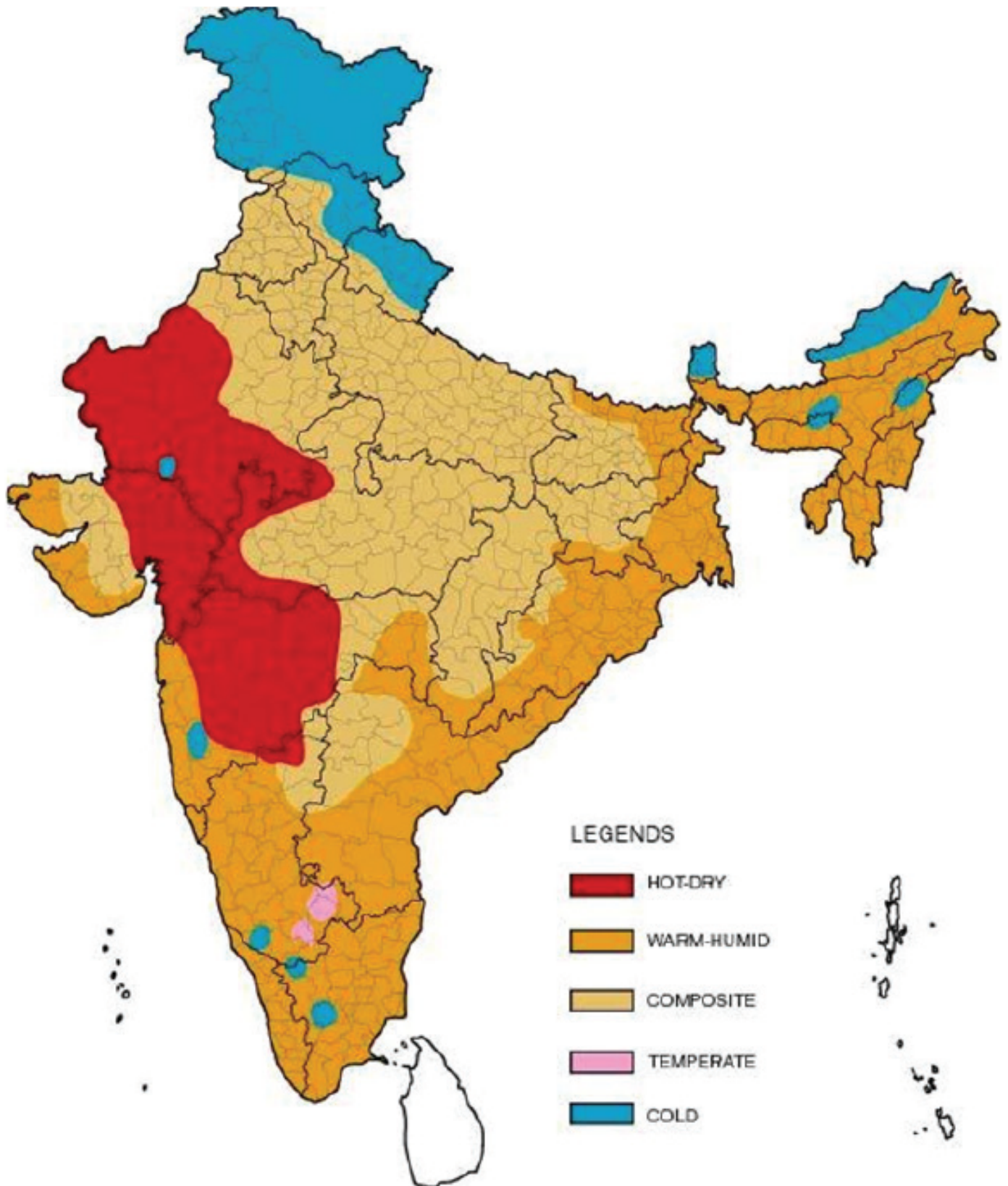




# Annexure- 1

Source: Eco-Niwas Samhita 2018 (ECBC-R)

## Climatic zone and classification of cities



**TABLE 4** Climate zone for major Indian cities

City	Climate Type	City	Climate Type
Ahmedabad	Hot-Dry	Kurnool	Warm-Humid
Allahabad	Composite	Leh	Cold
Amritsar	Composite	Lucknow	Composite
Aurangabad	Hot-Dry	Ludhiana	Composite
Bengaluru	Temperate	Chennai	Warm-Humid
Barmer	Hot-Dry	Manali	Cold
Belgaum	Warm-Humid	Mangaluru	Warm-Humid
Bhagalpur	Warm-Humid	Mumbai	Warm-Humid
Bhopal	Composite	Nagpur	Composite
Bhubaneshwar	Warm-Humid	Nellore	Warm-Humid
Bikaner	Hot-Dry	New Delhi	Composite
Chandigarh	Composite	Panjim	Warm-Humid
Chitradurga	Warm-Humid	Patna	Composite
Dehradun	Composite	Pune	Warm-Humid
Dibrugarh	Warm-Humid	Raipur	Composite
Guwahati	Warm-Humid	Rajkot	Composite
Gorakhpur	Composite	Ramagundam	Warm-Humid
Gwalior	Composite	Ranchi	Composite
Hissar	Composite	Ratnagiri	Warm-Humid
Hyderabad	Composite	Raxaul	Warm-Humid
Imphal	Warm-Humid	Saharanpur	Composite
Indore	Composite	Shillong	Cold
Jabalpur	Composite	Sholapur	Hot-Dry
Jagdelpur	Warm-Humid	Srinagar	Cold
Jaipur	Composite	Sundernagar	Cold
Jaisalmer	Hot-Dry	Surat	Hot-Dry
Jalandhar	Composite	Tezpur	Warm-Humid
Jamnagar	Warm-Humid	Tiruchirappalli	Warm-Humid
Jodhpur	Hot-Dry	Trivandrum	Warm-Humid
Jorhat	Warm-Humid	Tuticorin	Warm-Humid
Kochi	Warm-Humid	Udhagamandalam	Cold
Kolkata	Warm-Humid	Vadodara	Hot-Dry
Kota	Hot-Dry	Veraval	Warm-Humid
Kullu	Cold	Vishakhapatnam	Warm-Humid

## 3.4 Residential envelope transmittance value (RETV) for building envelope (except roof) for four climate zones, namely, Composite Climate, Hot-Dry Climate, Warm-Humid Climate, and Temperate Climate

3.4.1 Residential envelope heat transmittance (*RETV*) is the net heat gain rate (over the cooling period) through the building envelope (excluding roof) of the dwelling units divided by the area of the building envelope (excluding roof) of the dwelling units. Its unit is  $W/m^2$ .

*RETV* characterizes the thermal performance of the building envelope (except roof). Limiting the *RETV* value helps in reducing heat gains from the building envelope, thereby improving the thermal comfort and reducing the electricity required for cooling.

*RETV* formula takes into account the following:

- Heat conduction through opaque building envelope components (wall, opaque panels in doors, windows, ventilators, etc.),
- Heat conduction through non-opaque building envelope components (transparent/translucent panels of windows, doors, ventilators, etc.),
- Solar radiation through non-opaque building envelope components (transparent/translucent panels of windows, doors, ventilators, etc.)

3.4.2 The *RETV* for the building envelope (except roof) for four climate zones, namely, Composite Climate, Hot-Dry Climate, Warm-Humid Climate, and Temperate Climate, shall comply with the maximum *RETV*<sup>19</sup> of  $15 W/m^2$ .

---

<sup>18</sup> To comply with the Code, U value shall be rounded off to one decimal places in accordance with IS 2: 1960 'Rules for rounding off numerical values'.

<sup>19</sup> BEE plans to improve the *RETV* norm to  $12 W/m^2$  in the near future and the building industry and regulating agencies are encouraged to aim for it.



The RETV calculation<sup>20</sup> of the building envelope (except roof) shall be carried out, using Equation 4 as shown below.

$$RETV = \frac{1}{A_{envelope}} \times \left[ \begin{array}{l} \left\{ a \times \sum_{i=1}^n (A_{opaque_i} \times U_{opaque_i} \times \omega_i) \right\} \\ + \left\{ b \times \sum_{i=1}^n (A_{non-opaque_i} \times U_{non-opaque_i} \times \omega_i) \right\} \\ + \left\{ c \times \sum_{i=1}^n (A_{non-opaque_i} \times SHGC_{eq_i} \times \omega_i) \right\} \end{array} \right]$$

where,

- $A_{envelope}$  : envelope area (excluding roof) of dwelling units (m<sup>2</sup>). It is the gross external wall area (includes the area of the walls and the openings such as windows and doors).
- $A_{opaque_i}$  : areas of different opaque building envelope components (m<sup>2</sup>)
- $U_{opaque_i}$  : thermal transmittance values of different opaque building envelope components (W/m<sup>2</sup>.K)
- $A_{non-opaque_i}$  : areas of different non-opaque building envelope components (m<sup>2</sup>)
- $U_{non-opaque_i}$  : thermal transmittance values of different non-opaque building envelope components (W/m<sup>2</sup>.K)
- $SHGC_{eq_i}$  : equivalent solar heat gain coefficient values of different non-opaque building envelope components (refer to Annexure 7)
- $\omega_i$  : orientation factor of respective opaque and non-opaque building envelope components; it is a measure of the amount of direct and diffused solar radiation that is received on the vertical surface in a specific orientation (values are given in Annexure 6)

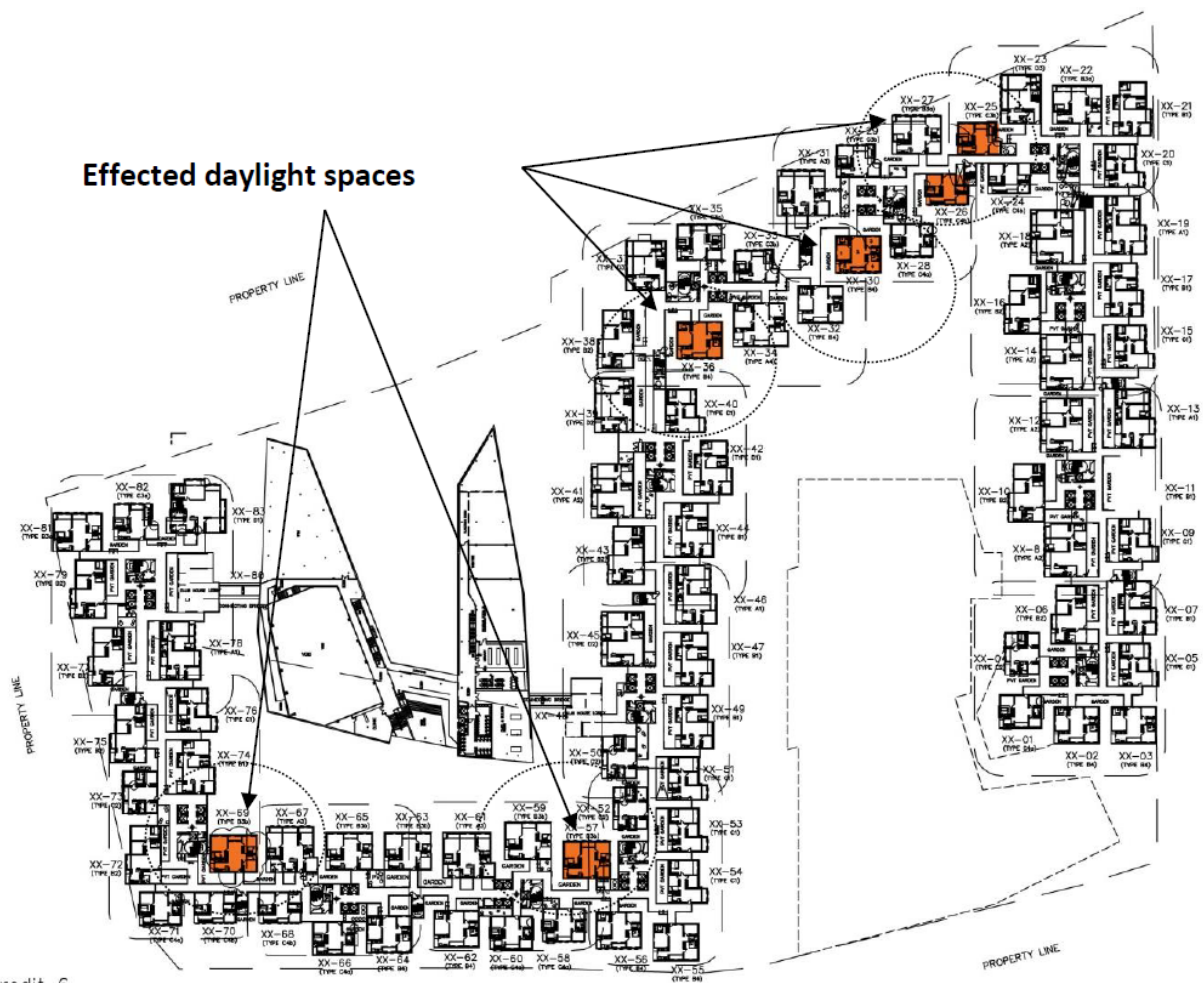


## Performance Approach – Sample of Daylight simulation report

The following example shows how daylight simulation may be used to demonstrate compliance with the daylight requirements of the mandatory requirement.

The Project has multiple buildings with different types of flats. Daylight simulation has been for the worst case scenarios of each flat type, i.e. for the flat on the lowest floor.

The site layout plan given below illustrates the flats for which the daylight simulation has been carried out.

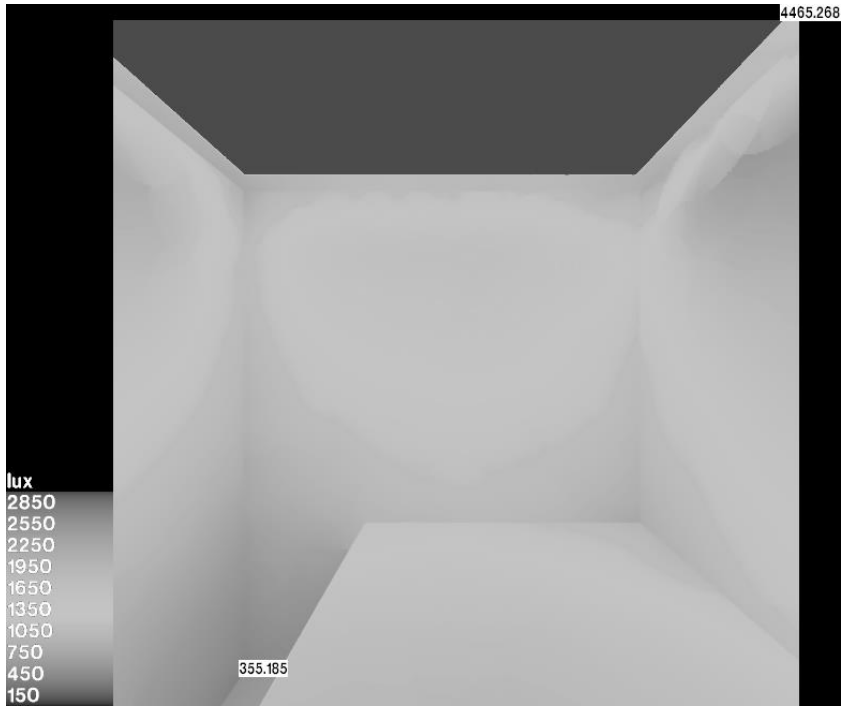


credit 6

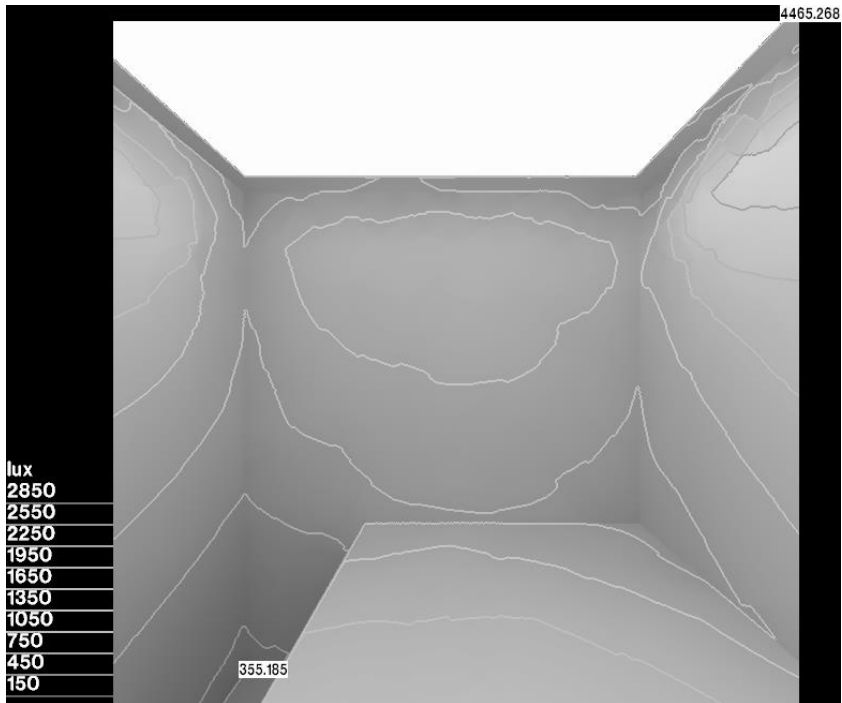
The images given below show the lux levels in various regularly occupied spaces like bedrooms, living rooms and kitchens for different types of the flats.

Simulation has been performed using and daylight simulation tool for the worst case scenario flats and it has been observed that the diffused lighting and light coming in due to the reflection increases the daylight levels inside the rooms.

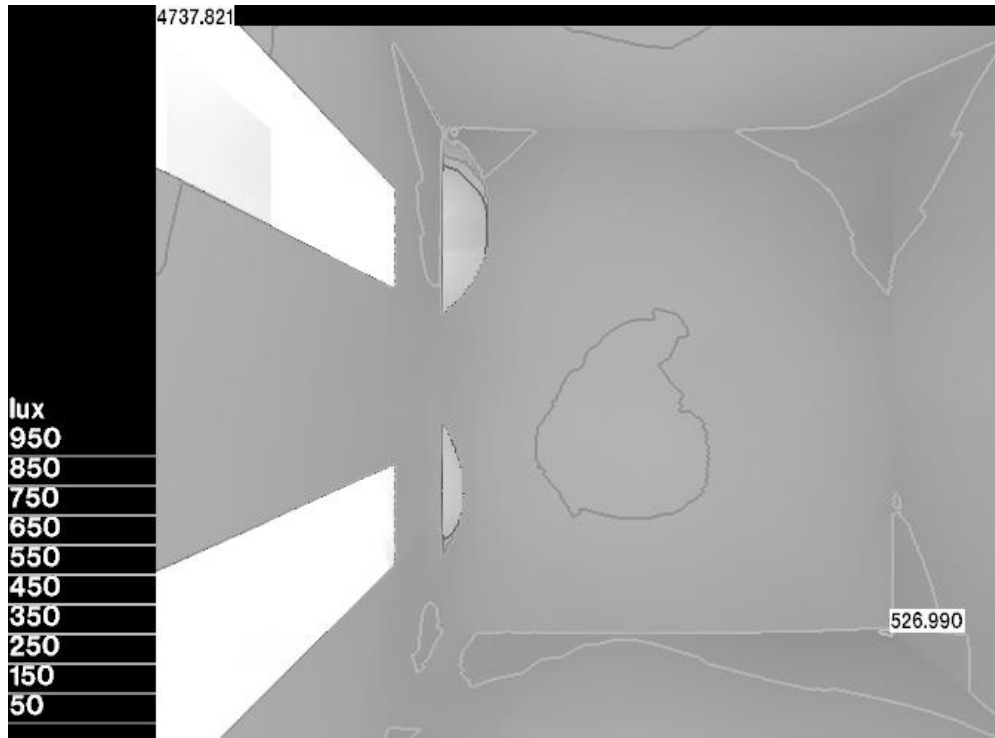
All the regularly occupied areas have a daylight level not less than 108 lux, which is more than the 1% Daylight Factor in all living spaces, 2% daylight factor in kitchen is required. The same is demonstrated in the images given below:



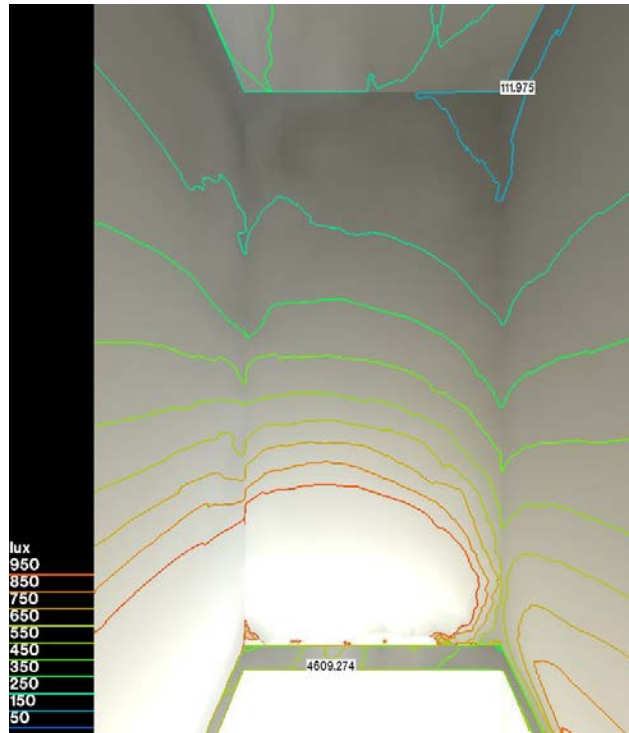
**Flat- type-1 Bedroom-1**



**Flat- type-1 Bedroom-2**



**Flat- type-1 Living- Dining Room**



**Flat- type-1 Kitchen**

## List of Plants: Drought Tolerant Species for different Climatic Zones in India

LIST OF DROUGHT TOLERANT PLANT SPECIES OF DIFFERENT CLIMATIC ZONES				
HOT - DRY	TREES		SHRUBS	
	Botanical Name	Common Name	Botanical Name	Common Name
1	<i>Prosopis cinerarea</i>	Khejdi, Saangri	<i>Bambusa Sps.</i>	Bamboo
2	<i>Ficus religiosa</i>	Peepal	<i>Asparagus racemosus</i>	Shatawari
3	<i>Syzigium cumini</i>	Jaamun	<i>Commiphora mukul</i>	Indian bedellium, Guggal
4	<i>Ziziphus mauritiana</i>	Ber, Indian jujube		
5	<i>Phoenix dactylifera</i>	Khajur, Dates palm		
6	<i>Acacia leucophloea</i>	Ronjh, Ahite barked acacia		
7	<i>Holoptelea integrifolia</i>	Kanju, Indian elm		
WARM - HUMID	TREES		SHRUBS	
	Botanical Name	Common Name	Botanical Name	Common Name
1	<i>Lagerstromia Lanceolata</i>	Crape-myrtle	<i>Bambusa Sps.</i>	Bamboo
2	<i>Saraca Ashoka</i>	Ashoka	<i>Ocimum sanctum</i>	Tulasi
3	<i>Ficus bengalensis</i>	Banyan	<i>Hybiscus rosasinensis</i>	Jupa
4	<i>Dalbergia latifolia</i>	Shisham, Indian Rosewood	<i>Vetiveria zizanioides</i>	Vetiver grass, Khas
5	<i>Terminalia paniculata</i>	Kindal	<i>Alpinia sps.</i>	
6	<i>Madhuca indica</i>	Mahua	<i>Hedychium coronarium</i>	
7	<i>Musa paradisiaca</i>	Plantain	<i>Pleomele reflexa</i>	
8	<i>Barringtonia racemosa</i>	Cornbeefwood	<i>Bougainvillea sps.</i>	

## LIST OF DROUGHT TOLERANT PLANT SPECIES OF DIFFERENT CLIMATIC ZONES

LIST OF DROUGHT TOLERANT PLANT SPECIES OF DIFFERENT CLIMATIC ZONES				
WARM - HUMID	TREES		SHRUBS	
9	Cassia fistula	Indian Laburnum, Amaltas	Acalypha wilkesiana	
10	Prosopis juliflora	Kabuli keekar	Eclipta alba	Brungaraja
11	Cocos nucifera	Coconut	Chrysanthem Indicum	Sevantika
COMPOSITE	TREES		SHRUBS	
	Botanical Name	Common Name	Botanical Name	Common Name
1	Azadirachta indica	Neem	Alpinia Sps.	
2	Cassia fistula	Indian Laburnum, Amaltas	Barleria cristata	
3	Delonix regia	Gulmohur	Bougainvillea sps.	
4	Ficus religiosa	Peepal	Caesalpinia pulcherimma	
5	Syzigium cumini	Jaamun	Tabernamontana	
6	Albizia lebek	Shirish, East Indian walnut	Furcraea gigantea	
7	Callistemon lanceolatus	Bottlebrush	Hibiscus Sps.	
8	Erythrina variegata	Indian coral tree	Ixora varities	
9	Dalbergia latifolia	Shisham, Indian Rosewood	Nerium oleander	
10	Jacaranda mimosaefolia	Jacaranda	Ocimum sanctum	Tulasi
11	Grevillea robusta	Silver Oak	Solanum Indicum	Bruhathi
12	Anthocephalus cadamba	Kadamba	Datura alba	Dhatura, Thorn apple
13	Plumeria	Temple tree, Frangipani	Calatropis gigantea	Arka
14	Polyalthia longifolia	Ashok	Jasminum sambac	Mallika
15	Pongamia pinnata	Karanj, Indian Elm	Indian pennywort	Brahmi
16	Tectona grandis	Teak		

## LIST OF DROUGHT TOLERANT PLANT SPECIES OF DIFFERENT CLIMATIC ZONES

COMPOSITE	TREES		SHRUBS	
	Botanical Name	Common Name	Botanical Name	Common Name
17	Michelia Champaka	Champaka		
18	Emblica officinalis	Indian gooseberry, Amla		

TEMPERATE	TREES		SHRUBS	
	Botanical Name	Common Name	Botanical Name	Common Name
1	Jacaranda mimosaeifolia	Jacaranda	Allamanda neriifolia	
2	Butea monosperma	Flame of the forest, Palash	Alpinia Sps.	
3	Nyctanthes arbor-tristis	Parijatha	Bauhinia galpinii	
4	Dalbergia latifolia	Shisham, Indian Rosewood	Hibiscus	
5	Cocos nucifera	Coconut	Yucca	
6	Tabebuia	Tabebuia	Cassia biflora	Twin flowered cassia
7	Bombax ceiba	Silk Cotton	Ficus benjamina	Weeping fig
8	Erythrina variegata	Indian coral tree	Hamelia patens	Fire bush
9	Lagerstromia Lanceolata	Crape-myrtle	Heliconia psittacorum	Parakeet flower
10	Peltophorum ferrugineum	Copper pod tree	Hymenocallis littoralis	Spider lily
11	Pongamia pinnata	Karanj, Indian Elm	Jasminum auriculatum	
12	Polyalthia longifolia	Mast tree	Ocimum sanctum	Tulasi
13	Cassia javanica	Java cassia	Vitex nigundo	Nirgundi
14	Millingtonia hortensis	Indian Cork tree	Nerium indicum	Karaveera
15	Bauhinia variegata	Kachnar	Ricinuc communis	Castor
16	Albizia saman	Rain tree		
17	Spathodea companulata	Tulip tree, Fountain tree		
18	Terminalia Arjuna	Arjuna		
19	Aegle marmelos	Bel, Bilva		

## LIST OF DROUGHT TOLERANT PLANT SPECIES OF DIFFERENT CLIMATIC ZONES

COLD	TREES		SHRUBS	
	Botanical Name	Common Name	Botanical Name	Common Name
1	Abies pindrow	Himalayan Silver fir	Ocimum sanctum	Tulasi
2	Tectona grandis	Teak	Jasminum multiflorum	
3	Rhododendron		Withania somnifera	Winter cherry
4	Cedrus deodara	Deodar		
5	Salix tetrasperma	Indian Willow, Bilsa		
6	Shorea robusta	Sal		
7	Pinus roxburghii	Chir pine		
8	Juglans regia	Walnut, Akhrot		
9	Nyctanthes arbor-tristis	Parijat		
10	Morus	Mulberry		
11	Epiphyllum oxypetalum	Brahmakamal, Queen of the night		
12	Cassia fistula	Indian Laburnum, Amaltas		
13	Dalbergia latifolia	Shisham, Indian Rosewood		
14	Bauhinia variegata	Kachnar		

**Performance Approach – Sample energy simulation report** *(It is based on IGBC Green Homes Ver 2.0, only for reference; Project need to use the baselines from Ver3.0)*

The following is an example that shows how the performance based approach is applied to a Green Home Project. The apartment is a 37-storey multi-dwelling residential complex consists of 7 podium floors for parking with fitness center on 7<sup>th</sup> podium. The residential units comprise from 9<sup>th</sup> floor to 37<sup>th</sup> floor. The Project is analyzed for energy performance using the **Visual DOE 4.1 software program**.

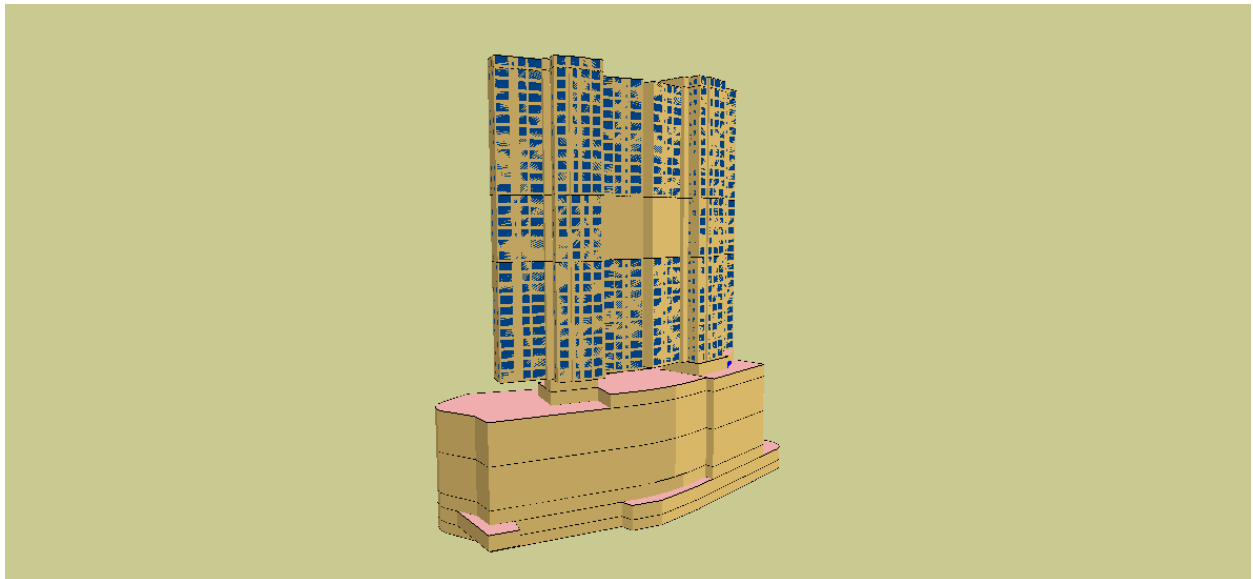
The base building is simulated with actual orientations and then again simulated after rotating the buildings to 90, 180 and 270 degrees. The average of all the 4 cases is the considered as Baseline case for comparing the energy consumption with the proposed building case.

**The Proposed case is determined by incorporating the feasible Energy Conservation Measures to the baseline case.** Annual Energy saving compared to the budget case are determined in the terms of percentage of operational cost savings.

Note: Actual Geometry of the Budget and the proposed building remains the same.

**Building Model & Geometry:**

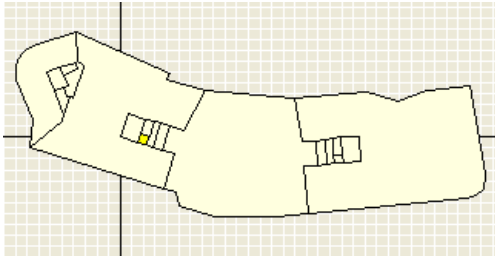
The 3-dimensional graphical display of the proposed project as seen in the Visual DOE is attached below:



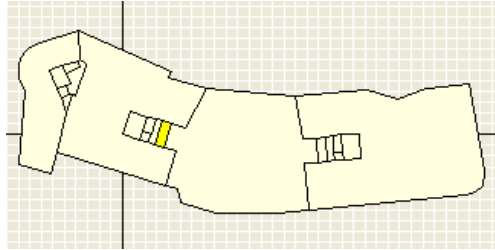
**3D Model of project**

Following are the **Individual Floor Plans** which are modeled close to the actual floor plans and only few simplifications were made to improve the accuracy of the modeling software.

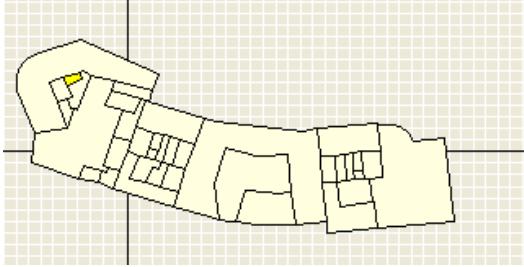




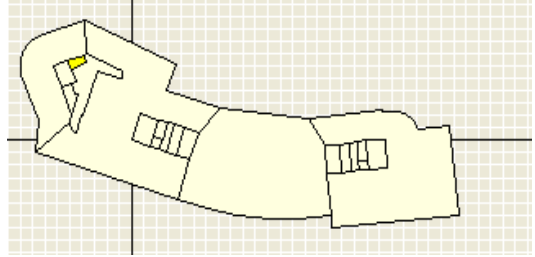
Lower basement



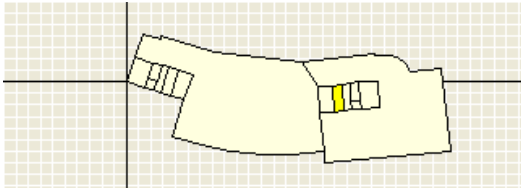
Upper basement



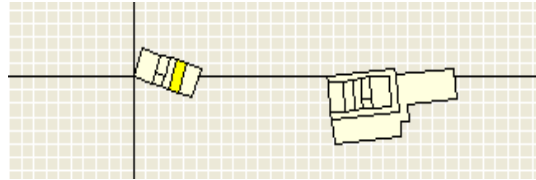
Ground Floor



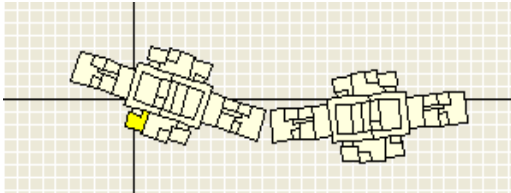
Podium Floors



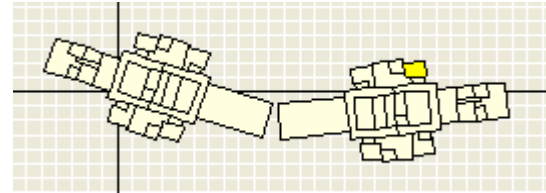
7<sup>th</sup> Podium Floor



8<sup>th</sup> Service floor



Typical Floors



Refuge Floors

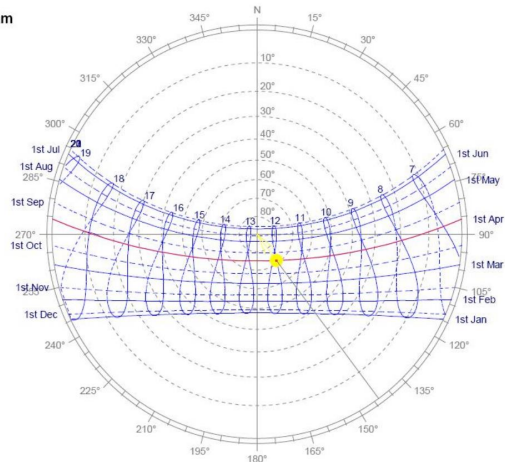
**Weather Data:**

The weather data file for city of Mumbai was taken from ISHRAE with the following details:

Latitude (°N) : 18.9

Longitude (°E) : 72.8

**Stereographic Diagram**  
 Location: 18.9°, 72.8°  
 Sun Position: 143.6°, 71.9°  
 HSA: 143.6°  
 VSA: 104.7°



Time: 12:00  
 Date: 1st Apr (91)  
 Dotted lines: July-December.

**Sun-Path Diagram for Mumbai**

**Baseline & Proposed Design Input parameters:**

The building was first modeled on the basis of the **guidelines specified in reference guide of IGBC Green Homes**. The building was simulated with following input parameters:

**Comparison of Proposed & Baseline Parameters:**

Building Element	Proposed Design Input	Baseline Design Inputs ( Annexure-I)
<b>Envelope</b>		
Exterior Wall Construction	U-factor= 0.28Btu/hr.ft <sup>2</sup> °F (6" flyash brick wall with plaster on both sides)	U-factor=0.22Btu/hr.ft <sup>2</sup> °F
Roof Construction	RCC slab+ 3" overdeck insulation + China mosaic U-factor=0.088 Btu/hr.ft <sup>2</sup> .°F	Insulation entirely over deck U-factor = 0.088 Btu/hr.ft <sup>2</sup> .°F.
Window-to-gross wall ratio	19.2%	19.2%
Fenestration type	Single glazed unit (SGU)	All Orientations
Fenestration U-factor	0.99 Btu/hr.ft <sup>2</sup> .°F	0.88 Btu/hr.ft <sup>2</sup> .°F
Fenestration SHGC - North	0.47	0.38
Fenestration SHGC - Non-North	0.47	0.38
Fenestration Visible Light Transmittance	0.52	0.30
Shading Devices	Yes in the form of overhangs for windows of bedrooms and living rooms	None
<b>Electrical Systems &amp; Process Loads</b>		
Interior Lighting Power Density (W/sq. ft.)	Space by space method –As per the design provided – 20% reduction only in common areas like stairs, lift lobbies, parking etc	Space by space method – as provided in Annexure 1 of IGBC HOMES guidelines
Exterior Lighting Power	Total Power = 12 kW	Total Power = 15 kW
Process Lighting (kW)	None	None
Receptacle Equipment Power Density (Watts)	Different values for different areas: 1. Liv./Din. : 1.5 w/sq.ft. 2. Kit. : 3.0 w/sq.ft. 3. Bed. : 1.0 w/sq.ft. 4. Gym : 2.0 w /sq.ft.	Different values for different areas: 1. Liv./Din. : 1.5 w/sq.ft. 2. Kit. : 3.0 w/sq.ft. 3. Bed. : 1.0

Building Element	Proposed Design Input	Baseline Design Inputs ( Annexure-I)
		w/sq.ft. 4. Gym : 2.0 w /sq.ft.
<b>Mechanical &amp; Plumbing Systems</b>		
Primary HVAC System Type	<b>Packaged terminal air conditioner of EER of 2.7</b> Note: All bedrooms & living are considered as Air-conditioners to quantify the effect of excellent envelope. The developer would not provide air-conditioner to these areas. Hence EER will be considered 2.7. EER considered for Gymnasium is 3.1	This is a Residential building. Baseline System Description is as follows:- <b>Packaged terminal air conditioner of EER of 2.7</b> Note: All bedrooms and living rooms are considered as Air-conditioners to quantify the effect of excellent envelope. The developer would not provide air-conditioner to these areas.
Water Heating system	Same as baseline	Electric water heating with 20 lit/person/day as prescribed by IGBC Green Homes Guidelines
Basement Ventilation	CO sensor based ventilation	No sensor based operation

**Basement Ventilation:**

CO monitoring would be installed in basement and it was modeled with a shift of 9 hours, it is assumed that the maximum vehicular movement in the parking areas would happen only for 2 hours, in which the amount of CO levels would raise above the acceptable level, triggering the fans. (Since Visual DOE has restriction on number of end meters basement ventilation and elevator kW was clubbed under Ext. Equipment energy end use).

Here as the usage is residential we have assumed the operation for 12 hours wherein maximum vehicular movement would be for 4 hours.

Base case : 224 kW

Proposed case : 196 kW

**Table - Average budget case figures of Annual Energy Consumption**

The following tabulated values determine the Average budget case figures of annual energy consumption of the building. The budget case was initially modeled with the original orientation and then again modeled each time by rotating the same to 90, 180 and 270 degrees.

<b>Table 5: Baseline Performance – Performance Rating Method Compliance</b>							
Particulars	Energy Type	Annual Energy & Peak Demand	0° rotation	90° rotation	180° rotation	270° rotation	Average Baseline
Interior Lighting	Electricity	Energy Use (Kwh)	848,568	848,568	848,568	848,568	<b>848,568</b>
Equipment	Electricity	Energy Use (Kwh)	641,174	641,174	641,174	641,174	<b>641,174</b>
Heating	Electricity	Energy Use (Kwh)	0	0	0	0	<b>0</b>
Cooling	Electricity	Energy Use (Kwh)	629,276	678,424	631,262	675,746	<b>653,677</b>
Ventilation Fans	Electricity	Energy Use (Kwh)	388,190	402,307	395,067	396,113	<b>395,419</b>
Hot Water	Electricity	Energy Use (Kwh)	38,647	38,647	38,647	38,647	<b>38,647</b>
Exterior Lighting	Electricity	Energy Use (Kwh)	50,644	50,644	50,644	50,644	<b>50,644</b>
External Equip.	Electricity	Energy Use (Kwh)	897,017	897,017	897,017	897,017	<b>897,017</b>
<b>Total</b>	<b>Electricity</b>	<b>Energy Use (Kwh)</b>	<b>3,493,516</b>	<b>3,556,781</b>	<b>3,502,379</b>	<b>3,547,909</b>	<b>3,525,146</b>

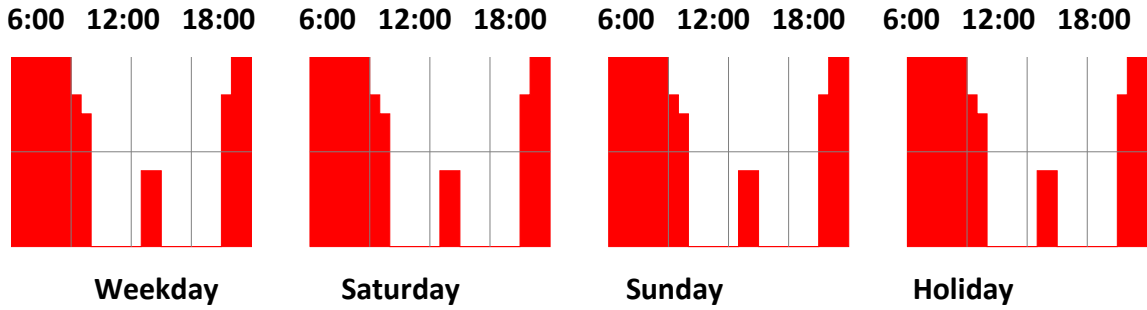
<b>Table 6: Percentage Improvement</b>				
Particulars	Energy Type	Annual Energy & Peak Demand	Proposed Building results	Baseline building results
Interior Lighting	Electricity	Energy Use (Kwh)	<b>771,364</b>	<b>848,568</b>
Equipment	Electricity	Energy Use (Kwh)	<b>641,174</b>	<b>641,174</b>
Heating	Electricity	Energy Use (Kwh)	<b>0</b>	<b>0</b>
Cooling	Electricity	Energy Use (Kwh)	<b>588,490</b>	<b>653,677</b>
Ventilation Fans	Electricity	Energy Use (Kwh)	<b>313,512</b>	<b>395,419</b>
Hot Water	Electricity	Energy Use (Kwh)	<b>38,647</b>	<b>38,647</b>
Exterior Lighting	Electricity	Energy Use (Kwh)	<b>40,516</b>	<b>50,644</b>
External Equip.	Electricity	Energy Use (Kwh)	<b>775,669</b>	<b>897,017</b>
<b>Total</b>	<b>Electricity</b>	<b>Energy Use (Kwh)</b>	<b>3,169,372</b>	<b>3,525,146</b>
<b>Savings</b>	<b>Electricity</b>	<b>Energy Use (Kwh)</b>		<b>11.23%</b>

The proposed project can achieve 11.23% savings over the base building thus yielding 6 points for Energy Efficiency.

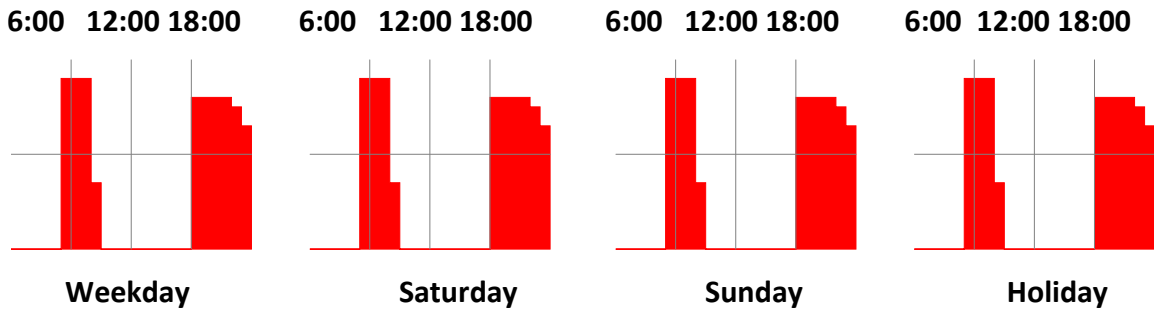
**Schedules**

**A. Schedules for Bedrooms**

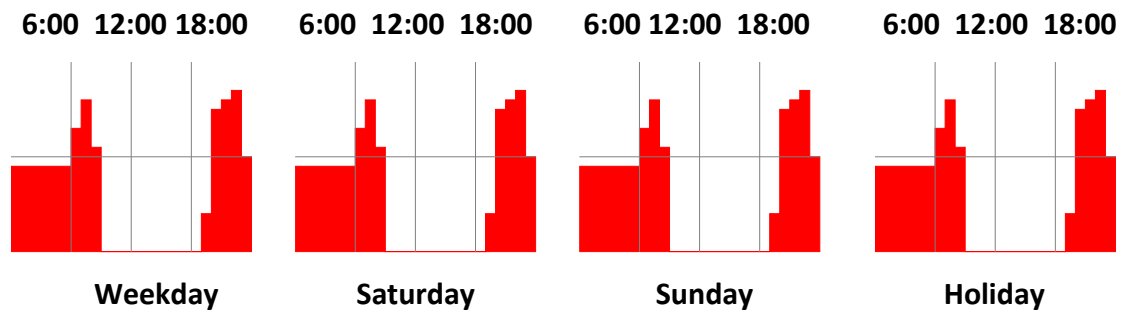
*Occupancy*



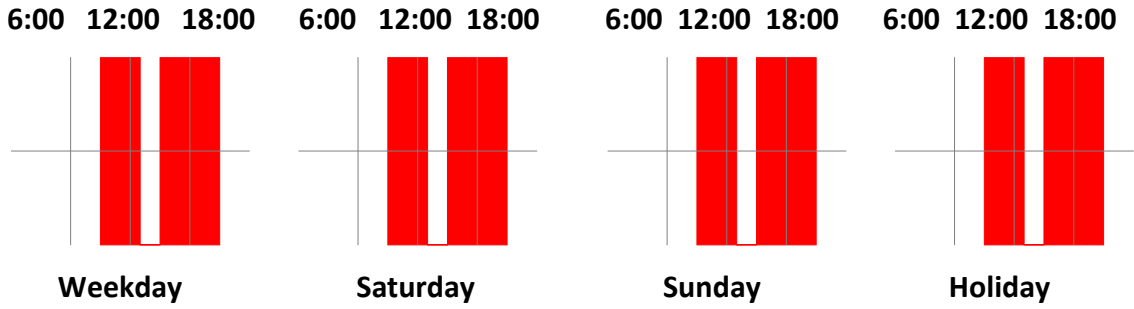
*Lighting*



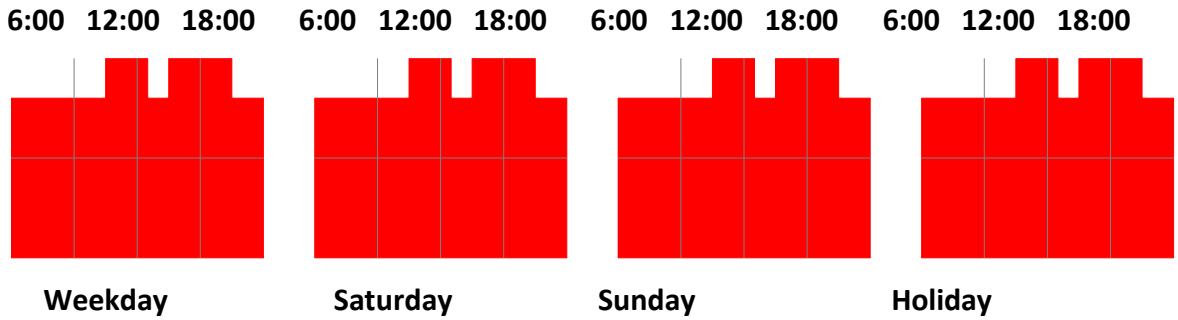
*Equipment*



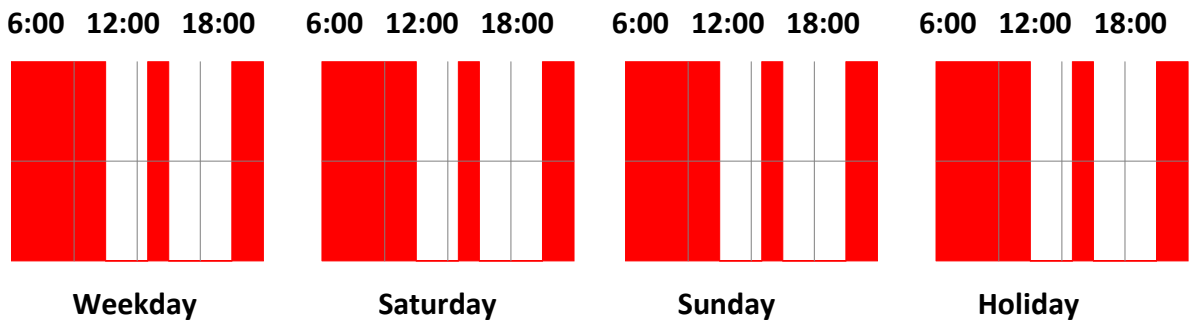
***Infiltration***



***Space Cooling 81°F***

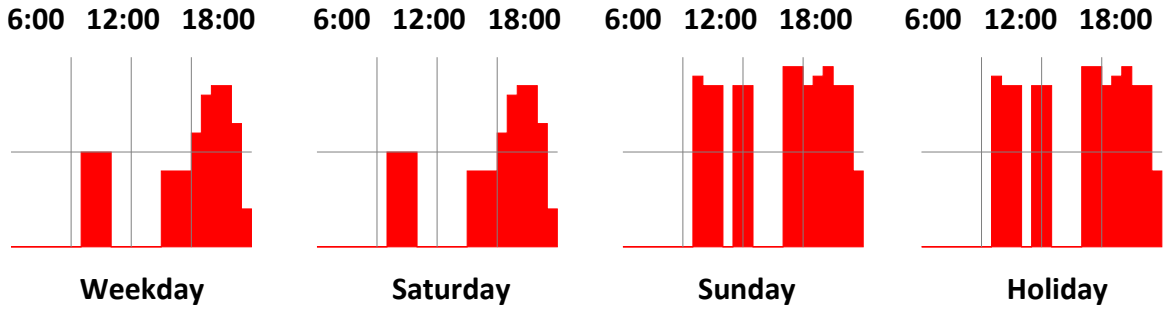


***Fan***

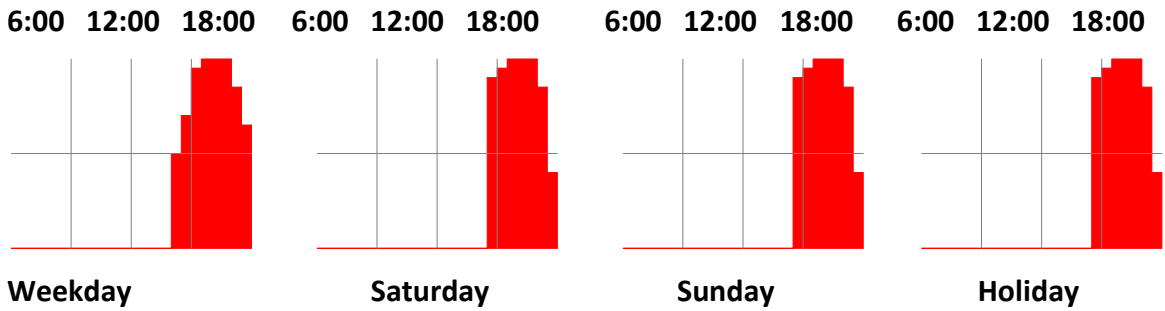


**Schedules for Living Rooms**

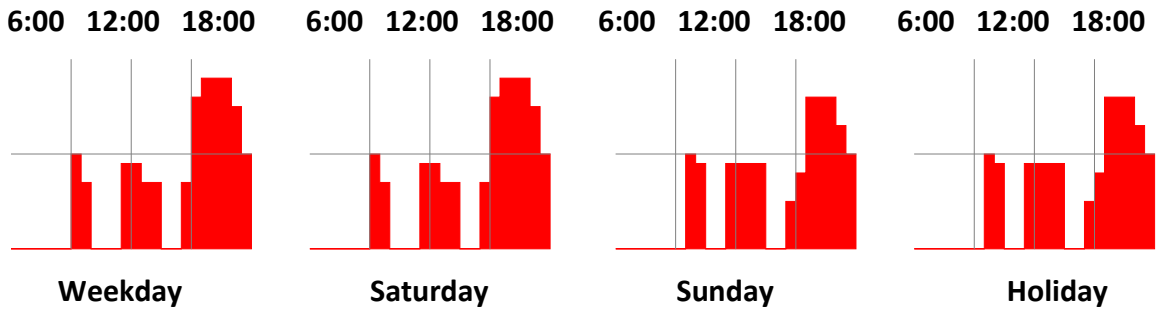
**Occupancy**



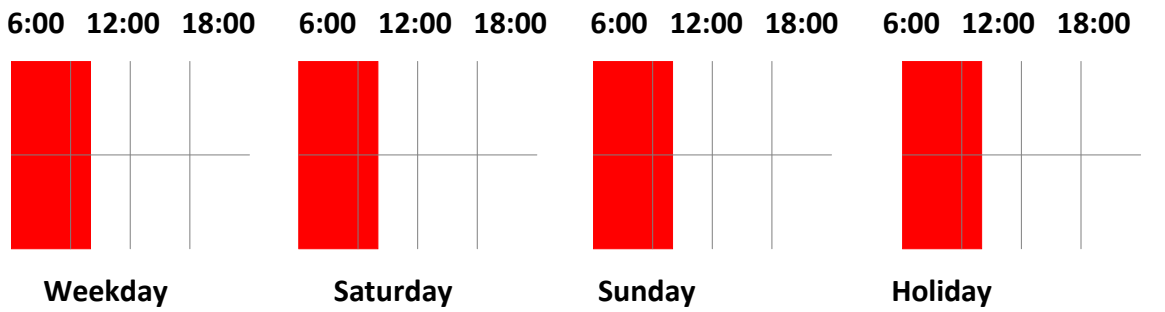
**Lighting**



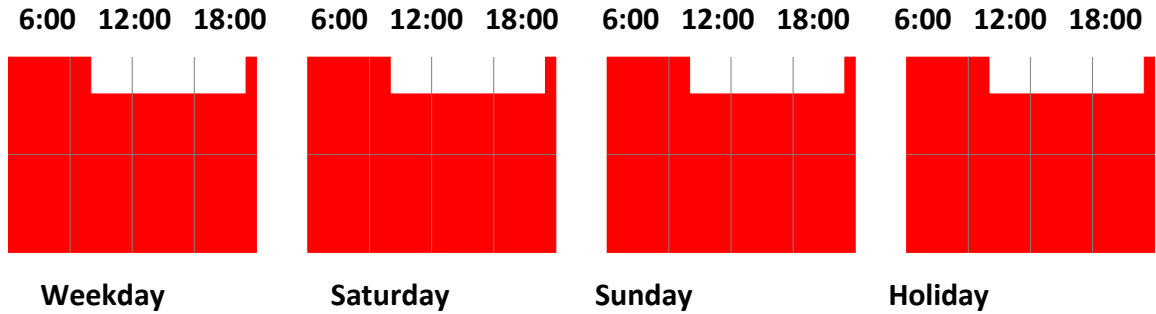
**Equipment**



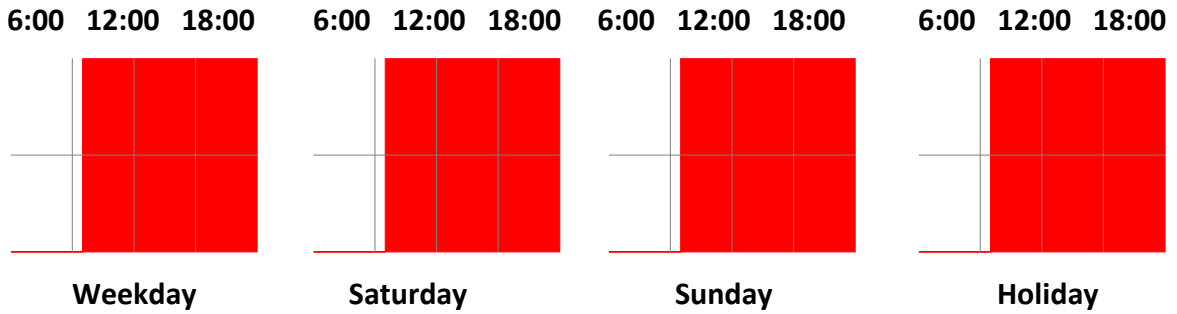
**Infiltration**



**Space Cooling 81°F**



**Fan**



REPORT- BEPS BUILDING ENERGY PERFORMANCE SUMMARY WEATHER FILE- EPW Mumbai, Maharashtra  
Proposed Case

ENERGY TYPE:	ELECTRICITY	NATURAL-GAS
UNITS: MBTU		
CATEGORY OF USE		
AREA LIGHTS	2632.6	0.0
MISC EQUIPMT	2188.3	0.0
SPACE COOL	1911.9	0.0
VENT FANS	1056.4	0.0
DOMHOT WATER	131.3	0.0
EXT LIGHTS	138.3	0.0
EXT MISC	2647.3	0.0
TOTAL	10706.2	0.0

TOTAL SITE ENERGY 10706.22 MBTU 72.8 KBTU/SQFT-YR GROSS-AREA 72.8 KBTU/SQFT-YR NET-AREA  
TOTAL SOURCE ENERGY 32121.88 MBTU 218.5 KBTU/SQFT-YR GROSS-AREA 218.5 KBTU/SQFT-YR NET-AREA

PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0  
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0



**Annexure - Weather Data:**

Statistics for IND\_Mumbai\_ISHRAE  
 Location -- Mumbai Maharashtra IND  
 {N 18° 53'} {E 72° 49'} {GMT +5.5 Hours}  
 Elevation -- 11m above sea level  
 Standard Pressure at Elevation -- 101193Pa  
 Data Source - ISHRAE

DOE-2.1E-119 WEATHER UTILITY PROGRAM

INPUT VERIFICATION

RUN TYPE STAT  
 -----

EPW Mumbai,Maharasht MONTHLY WEATHER DATA SUMMARY

DOE-2.1E-119

LATITUDE = 18.90

LONGITUDE = -72.82

TIME ZONE = -6

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. TEMP. (F) (DRYBULB)	75.3	76.3	80.6	83.8	86.2	84.2	82.0	81.0	81.6	82.5	80.5	76.8	80.9
AVG. TEMP. (F) (WETBULB)	65.3	65.0	71.6	76.2	78.3	79.5	78.2	77.0	76.7	76.4	70.8	66.4	73.5
AVG. DAILY MAX. TEMP.	86.6	87.9	89.6	90.5	90.8	88.1	85.9	84.9	86.7	90.2	91.5	89.6	88.5
AVG. DAILY MIN. TEMP.	65.2	65.3	71.1	76.1	81.6	79.6	77.8	77.6	77.0	75.9	71.5	65.1	73.7
HEATING DEG. DAYS (BASE 65)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BASE 60)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BASE 55)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BASE 50)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COOLING DEG. DAYS (BASE 80)	0.0	10.0	31.5	104.5	191.5	118.0	59.5	43.0	56.5	93.5	60.0	12.5	780.5
(BASE 75)	43.0	64.5	165.0	249.0	346.5	266.5	212.5	194.0	206.0	248.5	194.5	81.5	2271.5
(BASE 70)	183.5	184.5	320.0	399.0	501.5	416.5	367.5	349.0	356.0	403.5	344.5	227.0	4052.5
(BASE 65)	338.5	324.5	475.0	549.0	656.5	566.5	522.5	504.0	506.0	558.5	494.5	382.0	5877.5
HEATING DEG. HRS./24 (BASE 65)	3.5	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	13.8
(BASE 60)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5
(BASE 55)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(BASE 50)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COOLING DEG. HRS./24 (BASE 80)	40.0	53.8	93.4	132.5	191.4	132.1	77.5	45.5	68.5	108.0	98.4	70.8	1112.0
(BASE 75)	101.0	116.2	191.5	266.0	346.1	275.5	218.4	185.4	199.3	234.2	195.8	144.0	2473.4
(BASE 70)	192.9	203.8	329.1	413.6	501.1	425.4	373.4	340.4	349.3	387.8	319.4	244.1	4080.3
(BASE 65)	324.1	320.5	482.3	563.4	656.1	575.4	528.4	495.4	499.3	542.8	466.0	372.2	5825.8
MAXIMUM TEMP.	93	97	98	101	98	91	89	88	93	95	95	95	101
MINIMUM TEMP.	58	59	66	68	77	74	75	76	75	73	65	59	58

Annexures

NO. DAYS MAX. 90 AND ABOVE	5	12	12	18	27	12	0	0	3	16	23	15	143
NO. DAYS MAX. 32 AND BELOW	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. DAYS MIN. 32 AND BELOW	0	0	0	0	0	0	0	0	0	0	0	0	0
NO. DAYS MIN. 0 AND BELOW	0	0	0	0	0	0	0	0	0	0	0	0	0
AVG. WIND SPEED (MPH)	3.5	4.7	4.2	4.6	6.0	6.1	7.2	7.2	4.6	2.4	3.0	3.1	4.7
AVG. WIND SPEED (DAY)	5.6	7.0	6.9	7.3	8.1	7.0	8.2	8.3	6.9	3.7	4.8	4.6	6.6
AVG. WIND SPEED (NIGHT)	2.4	3.4	2.4	2.6	4.3	5.4	6.5	6.4	3.0	1.5	1.9	2.3	3.4
AVG. TEMP. (DAY)	82.8	84.1	86.8	88.4	89.1	86.0	84.0	82.6	84.5	87.2	87.4	85.2	85.7
AVG. TEMP. (NIGHT)	71.3	71.9	76.6	80.4	83.8	82.7	80.5	79.8	79.6	79.3	76.1	72.0	77.7
AVG. SKY COVER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG. SKY COVER (DAY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG. REL. HUM. AT 4AM	75.2	74.8	84.7	88.0	80.4	87.6	90.0	87.2	89.2	88.7	77.8	76.4	83.4
10AM	46.3	43.3	55.4	61.6	64.6	79.6	81.6	83.1	75.9	69.7	51.0	43.6	63.1
4PM	51.2	47.6	54.0	61.3	65.2	78.1	80.0	78.5	73.7	67.7	54.6	49.6	63.5
10PM	71.1	65.6	75.3	78.4	76.2	84.3	87.5	87.1	83.9	82.8	74.2	70.1	78.1

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. DAILY DIRECT NORMAL SOLAR	1856.2	1895.0	1844.8	1717.1	1336.6	718.2	637.9	728.6	1023.2	1348.7	1857.2	1924.2	1404.2
AVG. DAILY TOTAL HORIZNTL SOLAR	1546.8	1796.1	1861.7	1917.8	1765.4	1397.6	1355.4	1367.1	1418.3	1454.1	1602.3	1526.7	1582.4
MAX. DAILY DIRECT NORMAL SOLAR	2275.0	2226.0	2271.0	2185.0	2103.0	1232.0	884.0	1182.0	1677.0	2134.0	2308.0	2282.0	2308.0
MAX. DAILY TOTAL HORIZNTL SOLAR	1799.0	2079.0	2157.0	2247.0	2243.0	1733.0	1573.0	1614.0	1762.0	2009.0	1970.0	1692.0	2247.0
MIN. DAILY DIRECT NORMAL SOLAR	1111.0	783.0	834.0	665.0	682.0	447.0	520.0	466.0	616.0	594.0	771.0	1012.0	447.0
MIN. DAILY TOTAL HORIZNTL SOLAR	1155.0	1067.0	1291.0	1316.0	1385.0	1202.0	1219.0	1202.0	1165.0	1073.0	1026.0	1053.0	1026.0
MAX. HRLY DIRECT NORMAL SOLAR	457.0	288.0	300.0	295.0	294.0	290.0	291.0	272.0	292.0	302.0	296.0	298.0	457.0
MAX. HRLY TOTAL HORIZNTL SOLAR	285.0	316.0	317.0	310.0	309.0	228.0	208.0	230.0	276.0	308.0	312.0	272.0	317.0
AVG. MAX. HRLY DIRECT NORML SOLAR	276.3	264.6	268.0	260.2	238.8	244.5	243.3	221.5	232.1	254.4	267.1	267.0	253.1
AVG. MAX. HRLY TOTAL HRZNTL SOLAR	247.5	275.1	282.2	277.5	243.2	184.0	176.4	182.6	199.6	219.6	255.9	245.3	232.1
AVG. DAILY TOTAL VERTICAL SOLAR													
AZIMUTH													
N	501.8	559.2	622.0	767.3	953.0	967.7	917.2	764.5	615.6	526.9	508.7	487.6	683.3
E	1342.9	1527.3	1514.0	1550.5	1430.5	1207.6	1186.8	1190.4	1192.6	1208.6	1375.3	1339.9	1337.4
S	1870.1	1683.3	1303.8	939.3	732.6	664.3	674.0	744.0	960.6	1299.4	1802.6	1954.0	1216.6
W	904.1	971.0	1162.6	1251.8	1200.7	1011.6	995.2	1033.8	1056.7	970.0	924.3	886.7	1030.9
MAX. DAILY TOTAL VERTICAL SOLAR													
AZIMUTH													
N	550.5	611.1	686.4	871.1	1106.5	1088.1	1018.4	827.4	725.3	575.4	590.6	515.5	1106.5
E	1620.5	1836.7	1761.3	1842.1	1764.9	1468.9	1361.1	1328.1	1414.4	1651.9	1735.2	1537.6	1842.1
S	2189.3	1910.2	1502.4	1126.2	809.6	712.5	716.5	874.3	1226.2	1704.7	2226.6	2140.3	2226.6
W	1257.2	1026.2	1270.6	1354.3	1350.4	1160.7	1048.1	1201.9	1175.2	1234.7	992.4	924.2	1354.3



**Notes:**

- *The tables detailed are not exhaustive and only indicate the format for energy savings from the energy simulation results.*
- *\*Interior space lighting, common area lighting, exterior lighting and parking area lighting power density calculations should also be submitted along with simulation report.*

**Amenity-** Includes roads, street, open spaces, parks, recreational grounds, play grounds, gardens, water supply, electric supply, street lighting, sewerage, drainage, public works and other utilities, services and conveniences

**Approved-** As approved/sanctioned by the Authority under these Bye-Laws

**Adapted Plants:** Plants that reliably grow well in a given habitat with minimal attention from people in the form of water irrigation, or fertilization once root systems are established in the soil. Adapted plants are considered to be low maintenance but not invasive.

**Albedo** is synonymous with solar reflectance.

**Air-conditioning** is the process of treating air to meet the requirements of a conditioned space by controlling its temperature, humidity, cleanliness and distribution.

**Agrifiber** products are made from agricultural fiber. Examples include particleboard, medium-density fibreboard (MDF), plywood, oriented-strand board (OSB), wheatboard, and strawboard.

**Building Envelope:** The elements of a building that separate the habitable spaces of dwelling units from the exterior and are exposed to the ambient (i.e., exposed directly to external air and opening into balconies). It does not include walls facing open corridors and enclosed shafts, as well as walls of common services such as lifts and staircase.

**Biodiversity:** The variety of life in all forms, levels and combinations, including ecosystems diversity, species diversity, and genetic diversity.

**Balcony-** A horizontal projection, cantilevered or otherwise including a parapet" handrail, balustrade, to serve as a passage or sit out place

**Built-up-Area:** Built-up area is the carpet area plus the thickness of outer walls, common areas such as the lobby, lifts shaft, stairs, etc. The plinth area along with a share of all common areas proportionately divided amongst all unit owners makes up the super built-up area.

**Basement** is the lower storey of a building below or partly below ground level.

**Blackwater** is wastewater from toilets and urinals is always considered blackwater

**Baseline** building performance is the annual energy cost for a building design intended for use as a baseline for rating above standard design, as defined in IGBC Green Homes Annexure-I & II.

**BEE Star Rating System for Buildings**, developed by Bureau of Energy Efficiency, Ministry of Power, Govt. of India, rates energy efficient buildings based on their actual performance in terms of specific energy use. The Rating is on a 1-5 Star scale, with 5 labeled buildings being the most energy efficient. For latest list of air-conditioners rated by BEE, please refer BEE website <https://www.beestarlabel.com/>

**Carpet Area:** Carpet area is the net usable floor area of a dwelling unit, excluding the area covered by the external walls, areas under services shafts, exclusive balcony or verandah area and exclusive open terrace area, but includes the area covered by the internal partition walls of the dwelling unit.

**Courtyard-** A spaces permanently open to sky, enclosed fully or partially by buildings and may be at ground level or any other level within or adjacent to a building.

# GLOSSARY

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**Chlorofluorocarbons (CFC)** are hydrocarbons that deplete the stratospheric ozone layer.

**Coefficient of Performance (COP)** - cooling is the ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

**Contaminant** is an unwanted airborne constituent that may reduce quality of the air.

**Drought tolerant species** are those species that do not require supplemental irrigation. Generally accepted time frame for temporary irrigation is one to two years.

**Drain-** A system or a line of pipes, with their fittings and accessories, such as manholes, inspection chambers, traps, gullies, floor traps used for drainage of building or yards appurtenant to the buildings within the same cartilage; and includes an open channel for conveying surface water or a system for the removal of any waste water.

**Dwelling-** A building or a portion thereof which is designed or used wholly or principally for residential purposes for one family.

**Daylighting** is the controlled admission of natural light into a space through glazing with the intent of reducing or eliminating electric lighting. Day lighting creates a stimulating and productive environment for building occupants.

**Drip Irrigation** is a high-efficiency irrigation method in which water drips to the soil from perforated tubes or emitters. Drip irrigation is 90% efficient than conventional irrigation system.

**Dual flush Water Closet:** A dual-flush toilet WC is a variation of the flush toilet that uses two handles to flush different levels of water. The smaller level is designed for liquid waste, and the larger is designed for solid waste.

**Envelope Area:** Envelope area (excluding roof) of dwelling units is the overall area of the building envelope (see definition 'Building Envelope'). It is the gross external wall area (includes the area of the walls and the openings such as windows and doors), with measurement taken horizontally from outside surface to outside surface and measured vertically from the top of the floor to the top of the roof.

**Erosion:** A combination of processes in which materials of the earth's surface are loosened, dissolved or worn away, and transported from one place to another by natural agents (such as water, wind or gravel).

**E-waste:** It includes discarded materials from a range of electronic devices such as computers, refrigerators, televisions, air-conditioners, personal stereos, mobile phones etc.

**Exhaust System** is a mechanical ventilation system which, when ducted to the exterior of the building, draws out stale, impure and humid air thereby improving the quality of indoor air.

**Energy simulation model** is a computer-generated representation of the anticipated energy consumption of a building. It permits a comparison of energy performance, given proposed energy efficiency measures, with the baseline

**Fit for Occupancy Certificate:** A certificate of occupancy is a legal binding document that permits the construction of a building. It indicates that the building complies with the building codes set by the law. The building is termed as fit for occupancy. The certificate is mandatory in the case a new building is constructed

# GLOSSARY

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**Fly Ash:** The solid residue derived from incineration processes. Fly ash can be used as substitute for Portland cement in concrete.

**Flow rate:** Flow rate is a parameter used to mark the efficiency of appliances using liquids. For water fixtures, flow rates give the amount of water (in litres) that flows from a particular fixture in a given time (in minutes)

**Fire Tower:** Means an enclosed staircase that can only be approached from the various floors through landings or lobbies separated from both the floor area and the staircase by fire resistant doors.

**Forest Stewardship Council** is an independent, non-governmental, not for profit organisation established to promote the responsible management of the world's forests. Products carrying the FSC label are independently certified to assure consumers that they come from forests that are managed to meet the social, economic and ecological needs of present and future generations.

**Floor Area Ratio (FAR)-** The quotient of the ratio of the combined covered area (plinth area) of all floors, excepting areas specifically exempted under these regulations, to the total area of plot, viz.: -

$$\text{Floor Area Ratio (FAR)} = \frac{\text{Total Covered Area on All Floors}}{\text{Plot Area}} \times 100$$

**Group Housing** means a building unit constructed or to be constructed with one or more floors having more than two dwelling units having common service facilities

**Grey Water** is waste water from showers, bathtubs, washing machines and sinks that are not used for disposal of hazardous or toxic ingredients or wastes from food preparation

**Greenhouse Gases:** Gases such as carbon dioxide, methane and Chlorofluorocarbons CFCs that are relatively transparent to the higher-energy sunlight, but trap lower –energy infrared radiation.

**Grass Pavers:** Cellular blocks with grass growing in the voids. These are mostly used for external paving, gardens. They need maintenance and have good infiltration capacity.

**Heat Island Effect:** Occurs when warmer temperatures are experienced in urban landscapes compared to adjacent rural areas as a result of solar energy retention on constructed surfaces. Principal surfaces that contribute to the heat island effect include streets, sidewalks, parking lots and buildings.

**Hydrofluorocarbons (HFCs)** are refrigerants that do not deplete the stratospheric ozone layer but may have high global warming potential. HFCs are not considered environmentally benign

**HVAC systems:** Include heating, ventilation and air-conditioning systems used to provide thermal comfort and ventilation for building interiors.

**Impervious Surfaces** are surfaces that promote runoff of precipitation volumes instead of infiltration into the subsurface.

**In-vessel composting** is an industrial form of composting biodegradable waste that occurs in enclosed reactors. These generally consist of metal tanks or concrete bunkers in which air flow and temperature can be controlled, using the principles of a "bioreactor".

# GLOSSARY

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Generally the air circulation is metered in via buried tubes that allow fresh air to be injected under pressure, with the exhaust being extracted through a bio filter, with temperature and moisture conditions monitored using probes in the mass to allow maintenance of optimum aerobic decomposition conditions.

**Irrigation:** Technique for applying water or wastewater to land areas to supply the water and nutrient needs of plants.

**Landscape** refers to soft landscaping which include only vegetative materials.

**Local Materials** are those materials which are manufactured close to the site location. For the purpose of this credit, the distance between location of site and place of manufacture is defined as 400 km.

**Local Zoning Requirements:** Local government regulations imposed to promote orderly development of private lands and to prevent land use conflicts.

**Land fill:** A waste disposal site for the deposit of solid waste from human activities

**Landscape Area:** Area of the site equal to the total site area less the building footprint, paved surfaces, water bodies, patios. Etc.,

**Laminate adhesive** is used in wood or agrifiber products, such as veneered panels, composite wood products contained in engineered lumber, and door assemblies.

**Lighting Power Density (LPD):** The installed lighting power, per unit area.

**Low-flow fixtures:** Low-flow fixtures use high pressure to produce a comfortable, pleasing flow without using much water.

**Mixed Land Use Building-** A building partly used for non-residential activities and partly for residential purpose

**Mechanical Ventilation** is ventilation provided by mechanically powered equipment, such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows.

**Mulching** is placing hay, grass, wood chips, straw or gravel on the soil surface to cover and hold soil.

**Native (Indigenous) Plants:** Any plant species that occurs and grows naturally in a specific region. Native plant species do not require watering other than during the initial years of establishment.

**Natural Topography** in its broad sense means preserving natural features of the terrain.

**Natural ventilation**, or passive ventilation, is provided by thermal, wind, or diffusion effects through doors, windows, or other intentional openings in the building; it uses the building layout, fabric, and form to achieve heat transfer and air movement.

**Non-occupied** spaces include all rooms used by maintenance personnel that are not open for use by occupants. Examples are closets and janitorial, storage, and equipment rooms

**Non-opaque Building Envelope Components:** Non-opaque building envelope components include transparent/translucent panels in windows, doors, ventilators, etc.

**Orientation Factor ( $\omega$ ):** It is a measure of the amount of direct and diffused solar radiation that is received on the vertical surface in a specific orientation. This factor accounts for



# GLOSSARY

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and gives weightage to the fact that the solar radiation falling on different orientations of walls are not same.

**Opaque Building Envelope Components:** Opaque building envelope components include walls, opaque panels in doors, windows, ventilators, etc.

**Open Space Area:** The property area minus the development footprint or as defined by local zoning requirements. Open space must be vegetated and pervious, also includes non-vehicular, pedestrian oriented hardscape spaces.

**Open-grid pavement** is less than 50% impervious and accommodates vegetation in the open cells.

**Projection Factor, Overhang:** Projection factor (overhang) is the ratio of the horizontal depth of the external shading projection to the sum of the height of a non-opaque component and the distance from the top of the same component to the bottom of the farthest point of the external shading projection, in consistent units

**Projection Factor, Side Fin:** Project factor (side fin) is the ratio of the horizontal depth of the external shading projection to the distance from a non-opaque component to the farthest point of the external shading projection, in consistent units

**Perviousness** is the percentage of the surface area of a paving system that is open and allows moisture to soak into the ground below.

**Porous Pavement** and **Permeable Surfaces** are used to create permeable surfaces that allow runoff to infiltrate into the subsurface.

**Potable water** is water that is sourced from wells or municipal water systems. Well water, which is not of potable quality, would also be deemed as potable water.

**Preferred Parking** refers to parking areas which are closer and have easy access to the main entrance of the project.

**Proposed Building Performance** is the annual energy cost calculated for a proposed design.

**Residential Building-** includes a building in which sleeping and living accommodation is provided for normal residential purposes, with cooking facilities and includes one or more family dwellings, apartment houses, flats, and private garages of such buildings.

**Residential Envelope Heat Transmittance (RETV):** RETV is the net heat gain rate (over the cooling period) through the building envelope of dwelling units (excluding roof) divided by the area of the building envelope (excluding roof) of dwelling units. Its unit is W/m<sup>2</sup>.

**Permission or Permit-** A valid permission or authorization in writing by the competent Authority to carryout development or a work regulated by the Bye-Laws

**Ramp** is a sloping surface connecting two level surfaces that deviate from what would otherwise be considered as normal level.

**Rapidly renewable material** is defined as material considered to be an agricultural product, that takes ten years or less period to grow or rise, and to harvest in an ongoing and sustainable manner.

**Recycling** is the collection, reprocessing, marketing and use of materials that were diverted or recovered from the solid waste stream

# GLOSSARY

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**Refrigerants** are the working fluids of refrigeration cycles. They absorb heat from a reservoir at low temperatures and reject heat at higher temperatures.

**Reuse** is a strategy to return materials for active use in the same or a related capacity.

**Refurbished materials** are products that could have been disposed of as solid waste. These products have completed their life cycle as consumer items and are then refurbished for reuse without substantial alteration of their form. Refurbishing includes renovating, repairing, restoring, or generally improving the appearance, performance, quality, functionality, or value of a product.

**Roof** is the upper portion of the building envelope, including opaque areas and fenestration that is horizontal or tilted at an angle of less than 60° from horizontal.

**Renewable Energy:** The electricity generated by renewable energy sources such as solar, wind, water, biomass & geothermal sources reduce the impact of air pollution.

**Solar Heat Gain Coefficient (SHGC):** SHGC is the fraction of incident solar radiation admitted through non-opaque components, both directly transmitted, and absorbed and subsequently released inward through conduction, convection, and radiation

**SHGC Equivalent:** SHGC Equivalent is the SHGC for a non-opaque component with a permanent external shading projection. It is calculated by multiplying the External Shading Factor (ESF) with the SHGC of unshaded non-opaque component.

**Salvaged materials** are construction materials recovered from existing buildings or construction sites / second hand market and reused in other buildings. Commonly salvaged materials include timber frames, MS railing, door shutters, window shutters, decorative items, railway sleepers etc.

**Sedimentation** is the addition of soil to water bodies by natural and human-related activities. Sedimentation decreases water quality and accelerates the aging process of lakes, rivers and streams.

**Sediment Trap** is an excavated pond area or constructed earthen embankments which allow for settling of sediment from storm water volumes.

**Site boundary** is the portion of the project site submitted for IGBC green homes certification. For single apartment, this is the entire project scope and is generally limited to the site boundary. For multiple residential apartments, the IGBC project boundary may be a portion of the development as determined by the project team.

**Sewage Treatment** is a process of removing contaminants from waste water and house-hold sewage. Its objective is to produce an environmentally safe fluid waste stream suitable for disposal or reuse using advanced technology it is possible to reuse sewage effluent for drinking water (e.g. Singapore).

**Sick Building Syndrome** is a situation in which a substantial portion of building occupants experience acute discomfort and negative health effects as a result of exposure to contaminated air inside the building.

**Skylight** is a fenestration surface having a slope of less than 60° from the horizontal plane. Other fenestration, even if mounted on the roof of a building, is considered vertical fenestration.

# GLOSSARY

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**Solar Heat Gain Coefficient (SHGC)** is the ratio of the solar heat gain entering the space through fenestration area to incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then re-radiated, conducted into space.

**Solar Reflectance (Albedo)** is the ratio of the reflected solar energy to the incoming solar energy over wavelengths of approximately 0.3 to 2.5 micrometers. A reflectance of 100% means all the energy striking the reflecting surface is reflected back into the atmosphere and none of the energy is absorbed by the surface.

**Stilts** are one of several posts supporting a structure built above the surface of land or water.

**Solar Reflectance Index (SRI):** A measure of a material's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and standard white (reflectance 0.80, emittance 0.90) is 100. Materials with highest SRI values are the coolest choices for paving.

**Swales:** Low tract of land, especially one that is moist and marshy. Kind of open drain system is usually designed to manage runoff.

**Top soil conservation:** The process of removing and protecting the top soil from any construction or development site for reusing it onsite later.

**Transplantation:** The process of digging up a plant / tree and moving it to another location.

**Temporary Seeding** is planting fast growing grasses to temporarily stabilise soils.

**Tertiary treatment** is the highest form of wastewater treatment that includes the removal of nutrients, organic and solid material, along with biological or chemical polishing generally to effluent limits of 10 mg/L BOD<sub>5</sub> and 10 mg/L TSS.

**Tobacco Smoke** consists of airborne particles emitted from the burning end of cigarettes, pipes, beedi & cigars and exhaled by smokers. These particles contain about 4000 different compounds, up to 40 of which are known to cause cancer.

**Turf** refers to lawn an area of grass maintained for decorative or recreational use. It involves high water consumption, high continuous maintenance. In green building design it is recommended to limit the use of turf to conserve water.

**U Value:** Thermal transmittance (U value) is the heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on either side. Unit of U value is W/m<sup>2</sup>.K. The U value for a wall/roof/glazing indicates its ability to transfer heat through conduction.

**Window-to-Wall Ratio (WWR):** WWR is the ratio of the non-opaque building envelope components area to the envelope area (excluding roof) of dwelling units.

**Ventilation** is the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity or temperature within the space.

# GLOSSARY

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**Visible Transmittance (Tvis)** is the ratio of total transmitted light to incident light. In other words, it is the amount of light passing through a glazing surface divided by the amount of light striking the glazing surface. A higher Tvis value indicates that a greater amount of incident light is passing through the glazing.

**Volatile Organic Compounds (VOCs)** are carbon compounds that participate in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates and ammonium carbonate). The compounds vaporize (become a gas) at normal room temperatures.

**Vegetated area:** The area in the site which has plantation or greenery on it in any form, such as shrubs, grass, trees etc.

**Window-** An opening to the outside other than a door, which provides all or part of the required natural light or ventilation or both to an interior space and not used as a means of egress/ingress

**Waste Water** from kitchen sinks, showers or bathtubs may be considered grey water by state or local codes. Project teams should comply with the grey water / black water definition as established by the authority having jurisdiction in their areas.

**Xeriscaping** refer to landscaping and gardening in ways that reduce or eliminate the need for supplemental water irrigation. It is promoted in regions that do not have easily accessible, plentiful or reliable supplies of fresh water.





## About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded over 124 years ago, India's premier business association has around 9000 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from around 276 national and regional sectoral industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with over 120 NGOs across the country carry forward corporate initiatives for integrated and inclusive development, in affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

The CII theme for 2019-20 is 'Competitiveness of India Inc - India@75: Forging Ahead', CII will focus on five priority areas which would enable the country to stay on a solid growth track. These are - employment generation, rural-urban connect, energy security, environmental sustainability and governance.

With 66 offices, including 9 Centres of Excellence, in India, and 10 overseas offices in Australia, China, Egypt, France, Germany, Singapore, South Africa, UAE, UK, and USA, as well as institutional partnerships with 355 counterpart organizations in 126 countries, CII serves as a reference point for Indian industry and the international business community.



## About Indian Green Building Council (IGBC)

The Indian Green Building Council (IGBC), part of the Confederation of Indian Industry (CII) was formed in the year 2001. The vision of the council is, "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025".

IGBC is strong with membership base of more than 1857 members which is progressively increasing over the years. Members comprise of all stakeholders of the construction industry viz. Architects, Interior Designers, Landscape Consultants, MEP Consultants, Builders, Developers, Product and Equipment Manufacturers, Corporate, Institutions and Government agencies.

The Council presently has 26 Chapters spread all over the country to cater to the aspirations of various states and regions. These chapters are headed by eminent Architects and Developers.

To seed the ideas of green building concepts in the minds of young people, IGBC has started Student chapters in various architectural and engineering colleges.

The council has in the past 10 years facilitated 5400 Green Buildings in the country with a footprint of 7 Billion sq.ft. covering the varied building types viz. commercial, residential, hospitals, airports, retail, factory buildings and SEZs.

The council closely works with State and Central Governments, World Green Building Council, bilateral and multi-lateral agencies in promoting green building concepts.

IGBC Green Building Rating Systems

National by Choice



Global in Performance

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For more information on Green Buildings, please contact



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