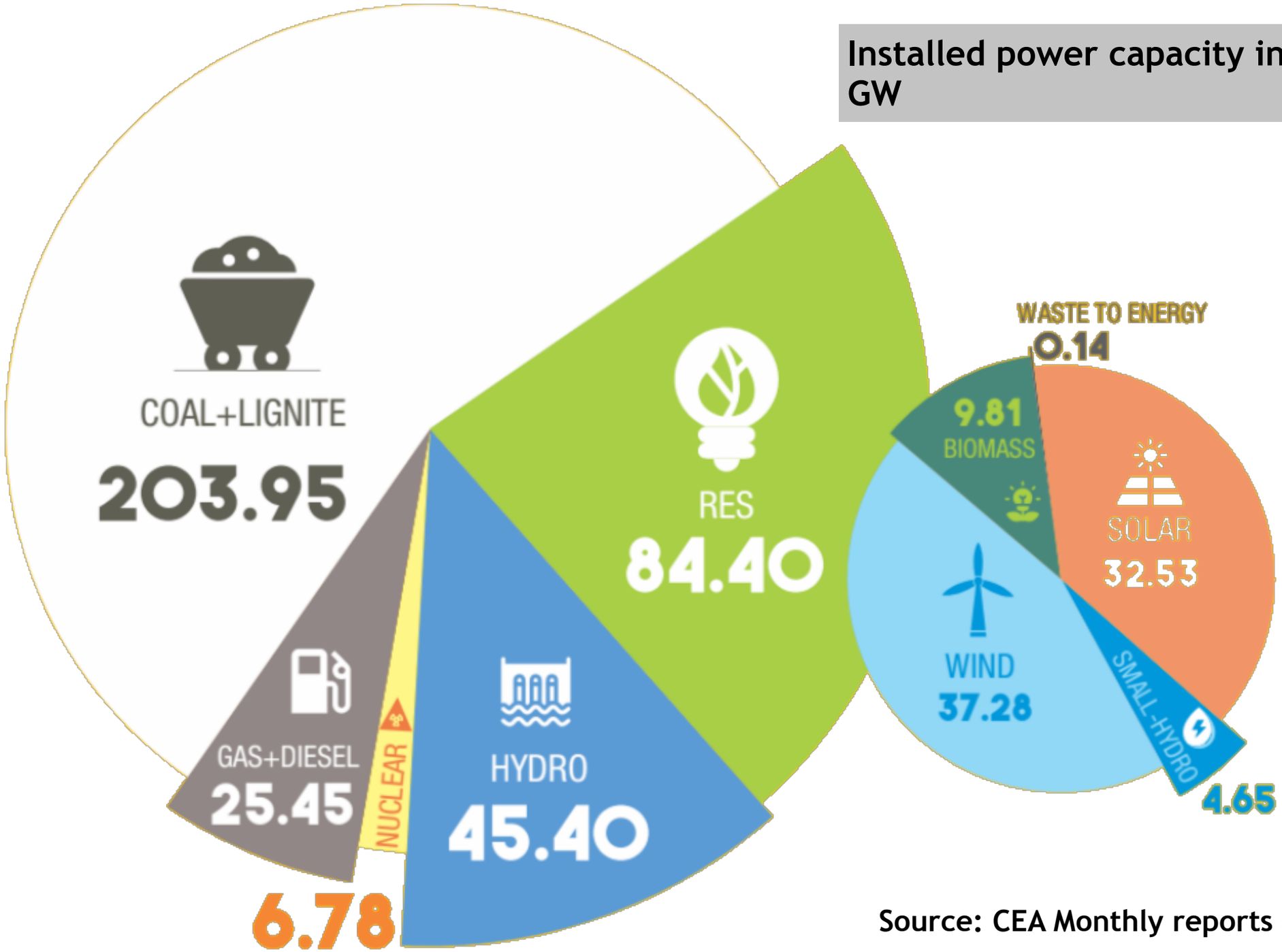
Eco Niwas Samhita - Karnataka

Energy Conservation Building Code for Residential Building

Power Consumption

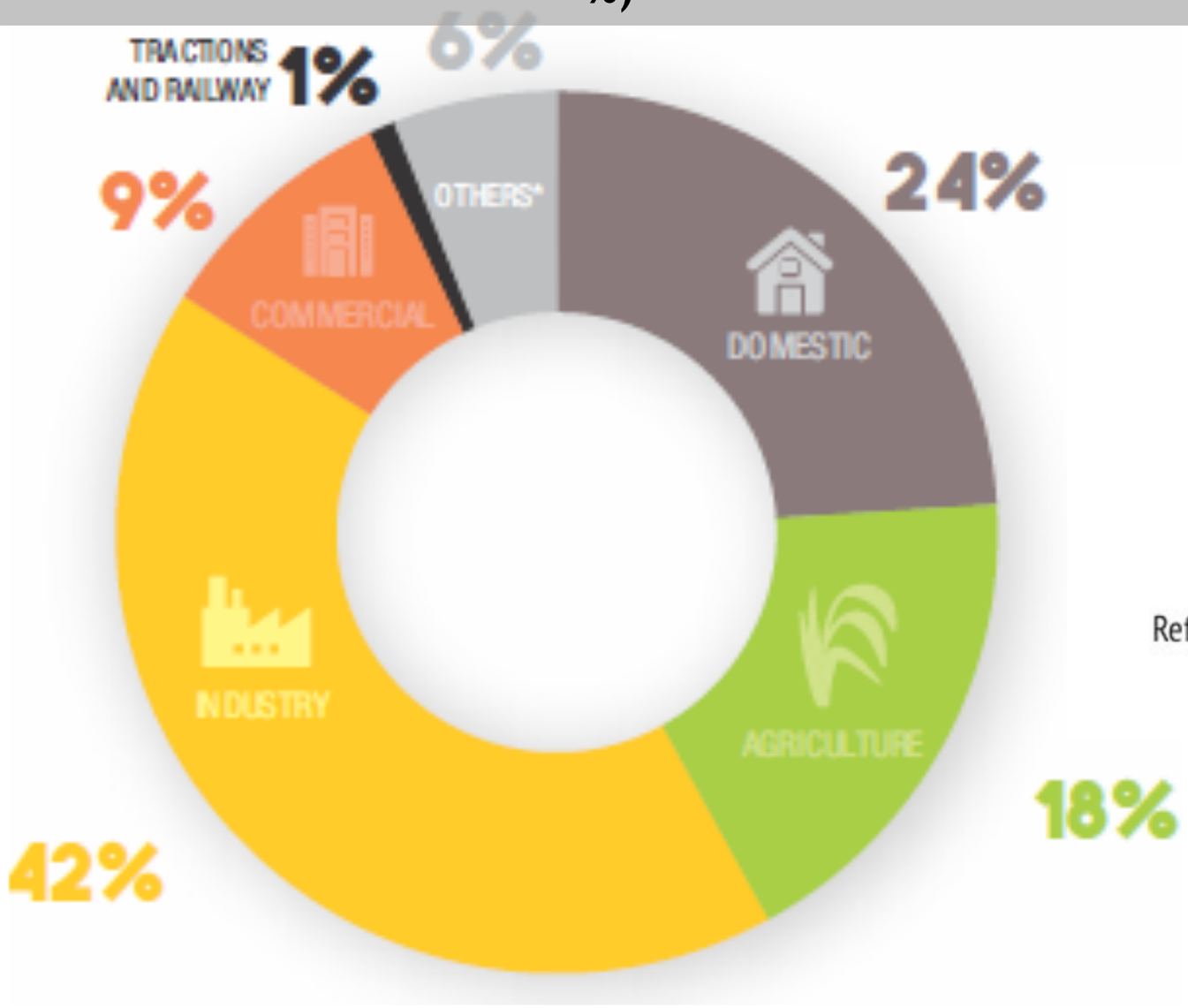
Installed power capacity in GW

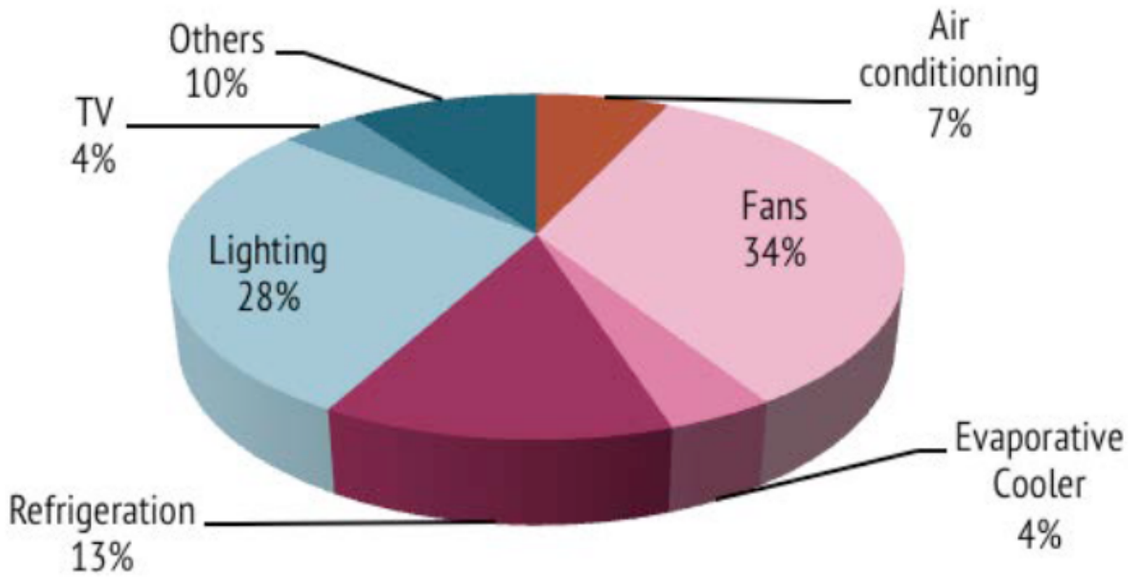


Source: CEA Monthly reports on installed capac

Source wise Energy Consumption

Domestic has the second highest energy consumption rate (24 %)





Energy consumption in Residential Buildings

Planning Commission, 201

Source : Climate Works, Foundation, 201

Introduction to Eco Niwas Samhita (ENS)

BEE
(BUREAU OF ENERGY EFFICIENCY)

+

GIZ
(Deutsche Gesellschaft für Internationale Zusammenarbeit)

Government of India

Government of Germany

Eco Niwas Samhita

Launch of Eco Niwas Samhita in December 2018

Karnataka Eco Niwas Samhita (ENS) Cell

KREDL, State Designated Agency (Karnataka Renewable Energy Department Limited)

Government of Karnataka

+

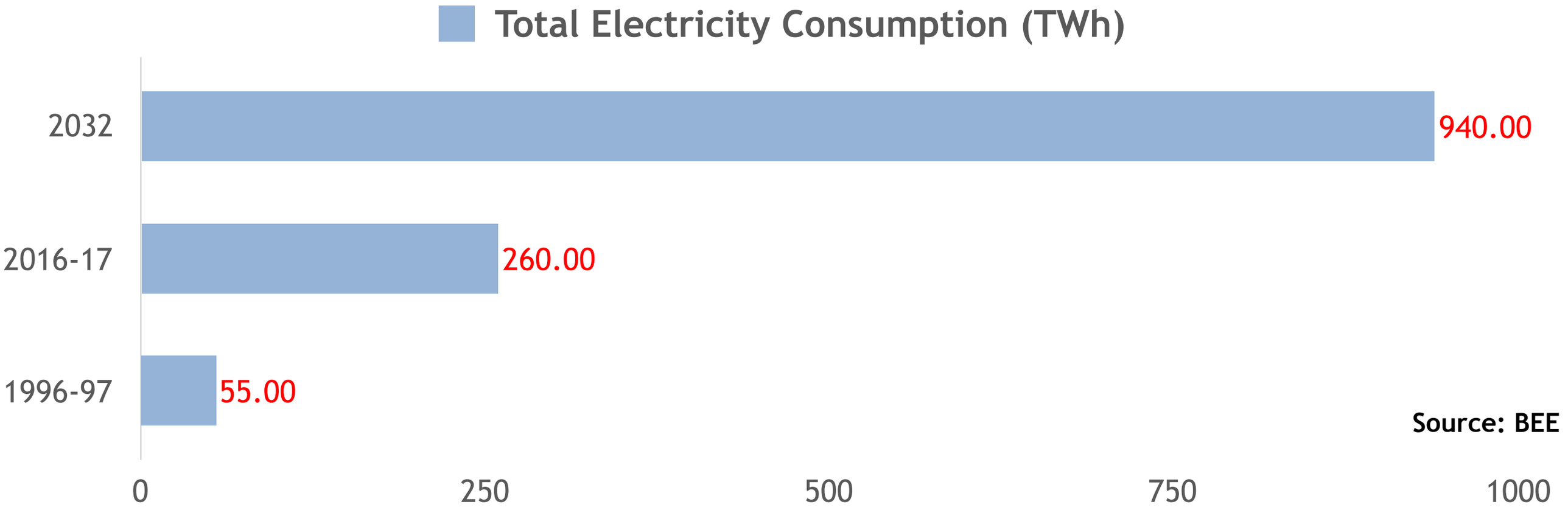
KA ENS Cell

- ENS-CODE
- ENS-Rules
- ENS-Case Studies
- ENS-Demonstration Projects
- ENS-Manual
- ENS-Compliance Verification System

Need for ENS

With respect to **BUILT-UP AREA** , approximately **3 Billion sq-m** of Residential Built-up area will be added by **2030** with an exponential land use increase from **24% to 60%** by **2047.**

ENERGY DEMAND increase is as indicated below



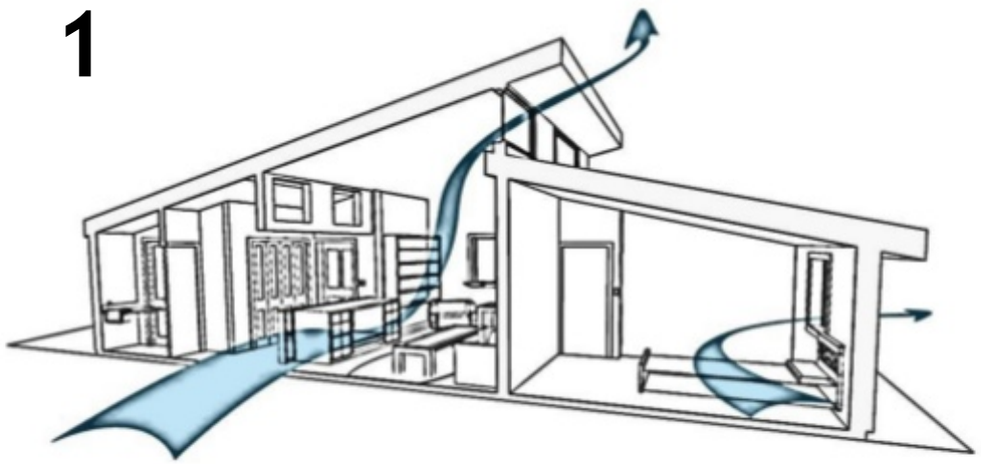
Source: BEE

Bureau of Energy Efficiency, Ministry of Power, Government of India

Eco Niwas Samhita (ENS) - Part 1

Eco Niwas Samhita – Part 1 is designed to define minimum Building Envelope design standards to improve Energy Efficiency in Residential Buildings

1



1. For Adequate natural ventilation potential

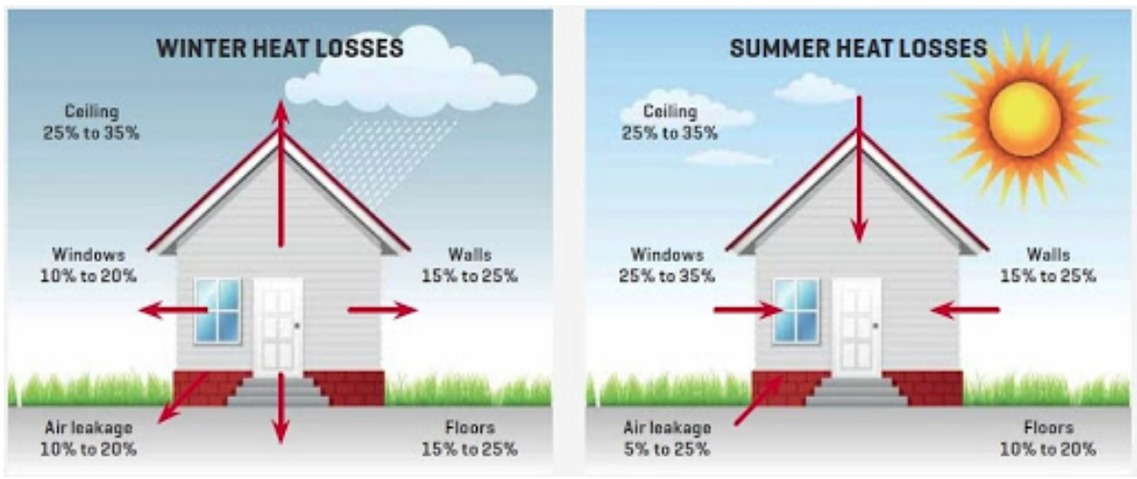
(WFR – Window to Floor Area Ratio)

2. For adequate day light

(WWR- Window to Wall area Ratio)

2

3



3. Limit heat gains / heat loss (U Value – Thermal Transmittance, RETV- Residential Envelope Transmittance Value)

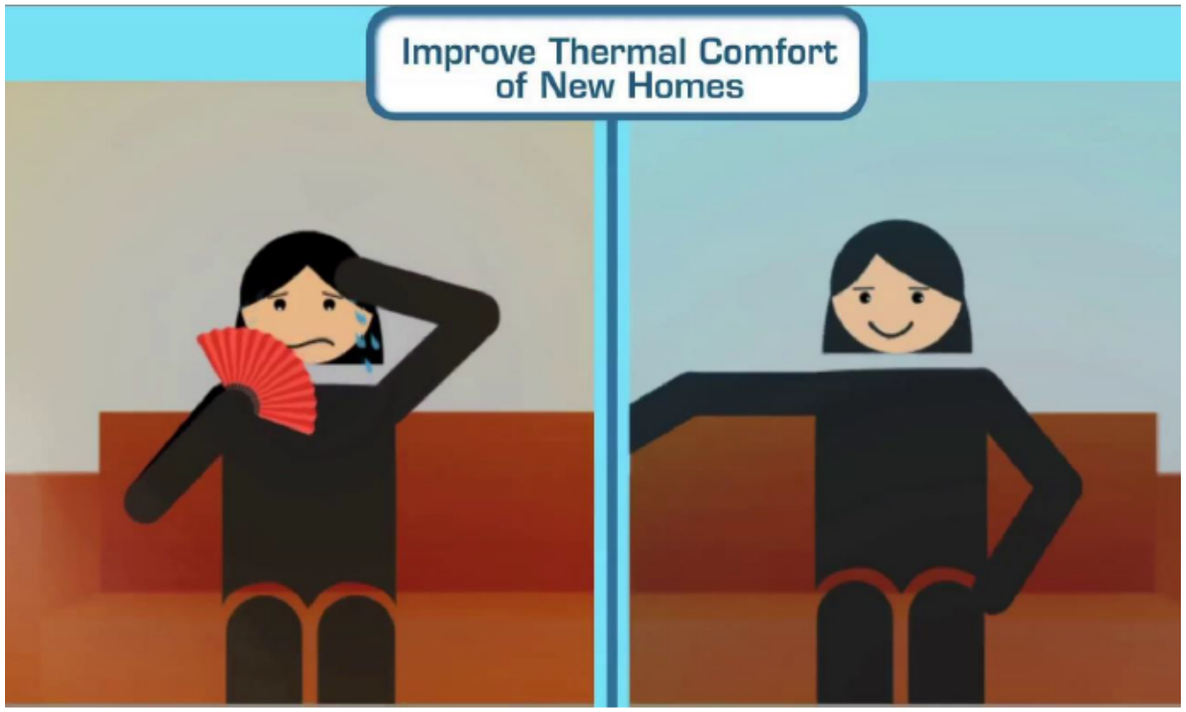
Salient Features of ENS

- ❑ Simple-to-apply format **(Prescriptive Compliance Approach)**
- ❑ Simple calculations based on inputs from the architectural design drawings of buildings.
- ❑ Will **not require any simulation software**.
- ❑ Code to be readily **adopted in the building bye-laws.**
- ❑ A **compliance tool** is also available on BEE website to aid in the calculations and compliance check.

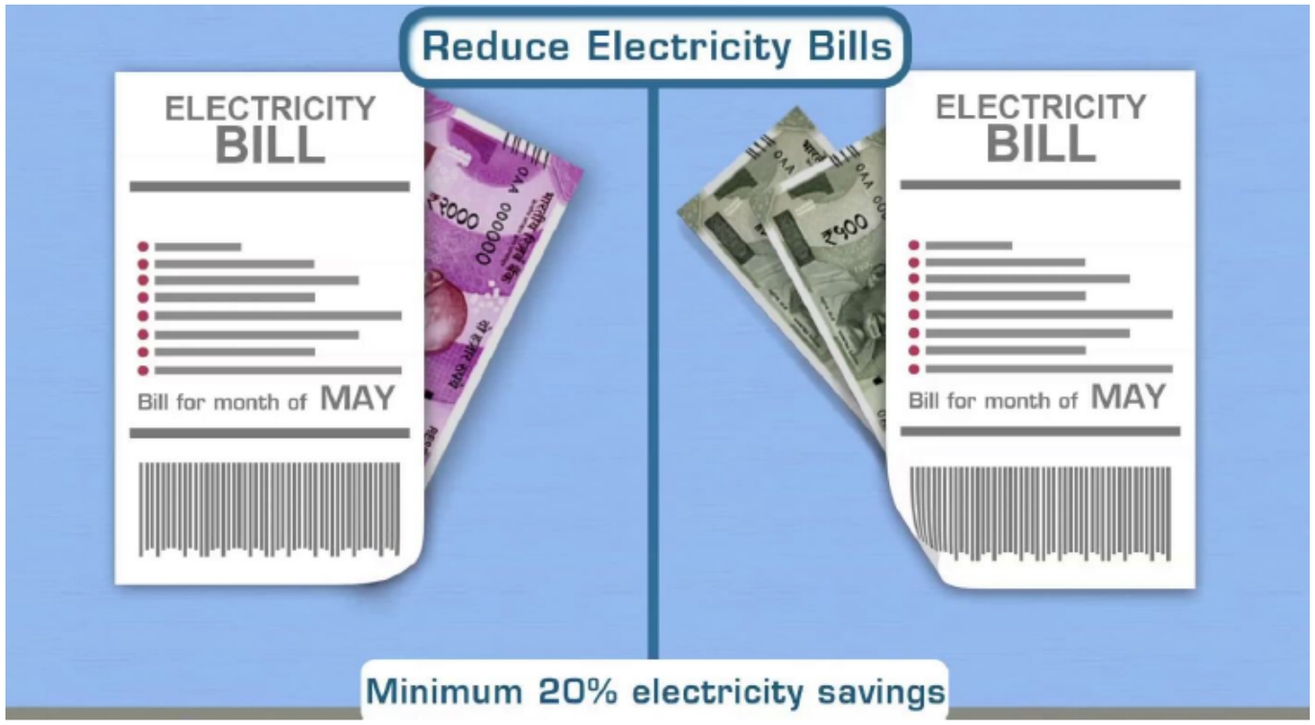
http://www.econiwas.com/

Benefits of ENS

Improve Thermal Comforts



Reduce Electricity Bills



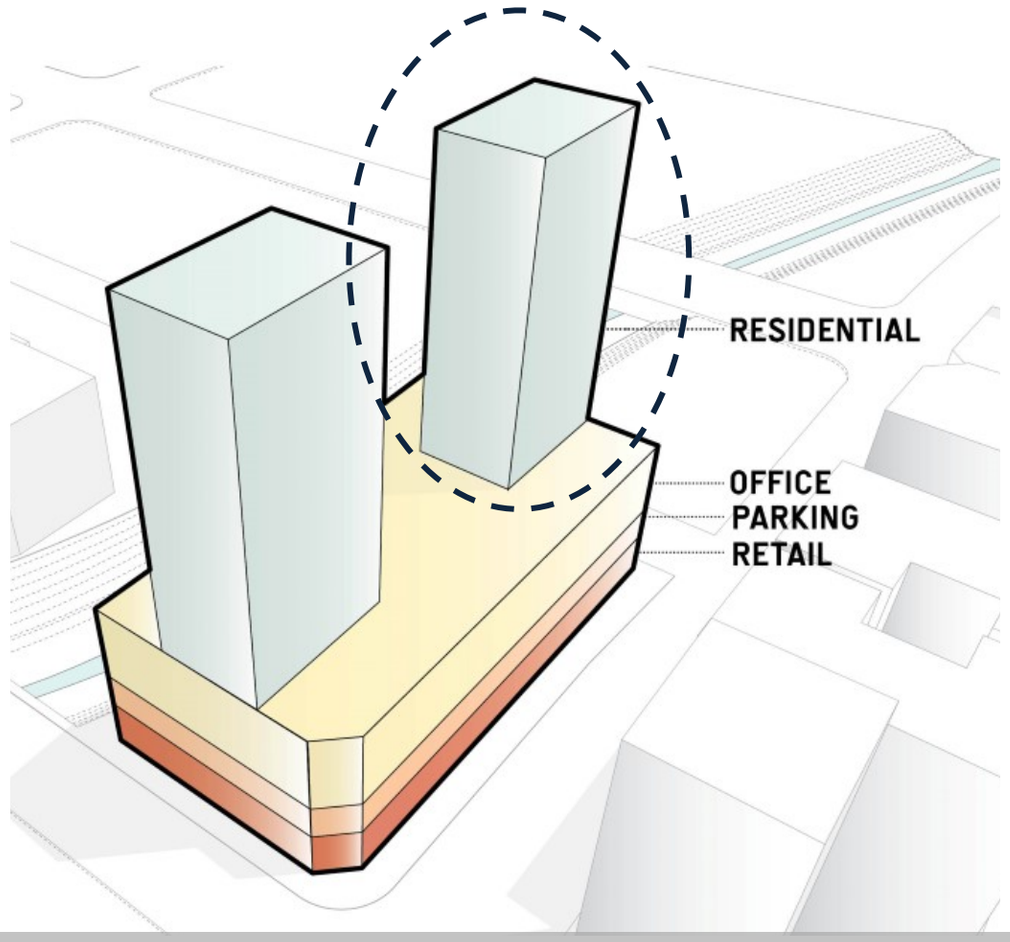
Estimated Impact Of Implementing Eco Niwas Samhita

- Minimum **20% energy saving** as compared to a typical Building
- **125 billion KWH** of electricity Saving
- **100 million tones of CO_2** equivalent abatement

Scope of ENS

The code is applicable to

(a)Residential Buildings with **plot area ≥ 500m²**



(b) Residential part of **"Mixed Land-use building projects" built on plot area of ≥ 500m².**

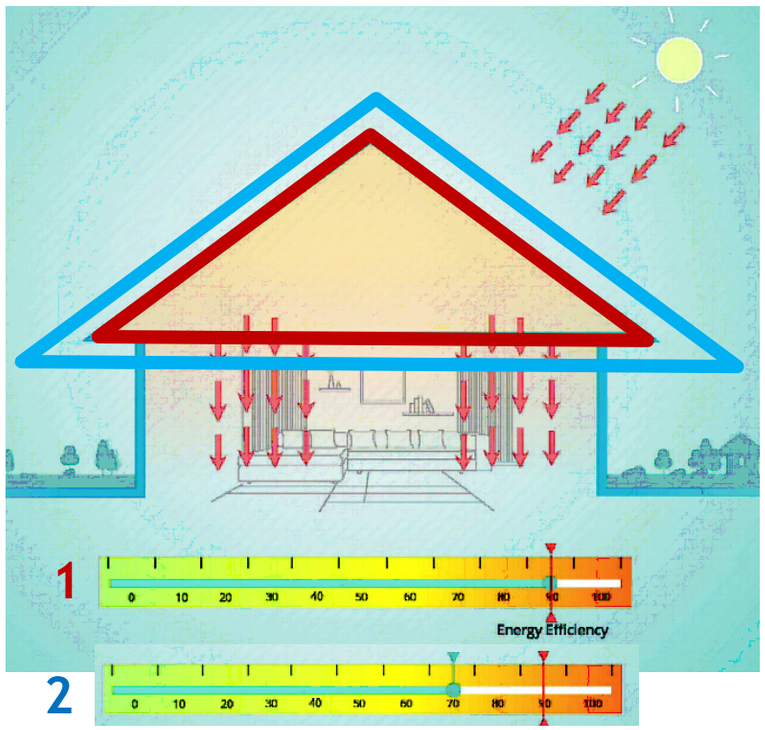
Excluded from the code

Dormitories

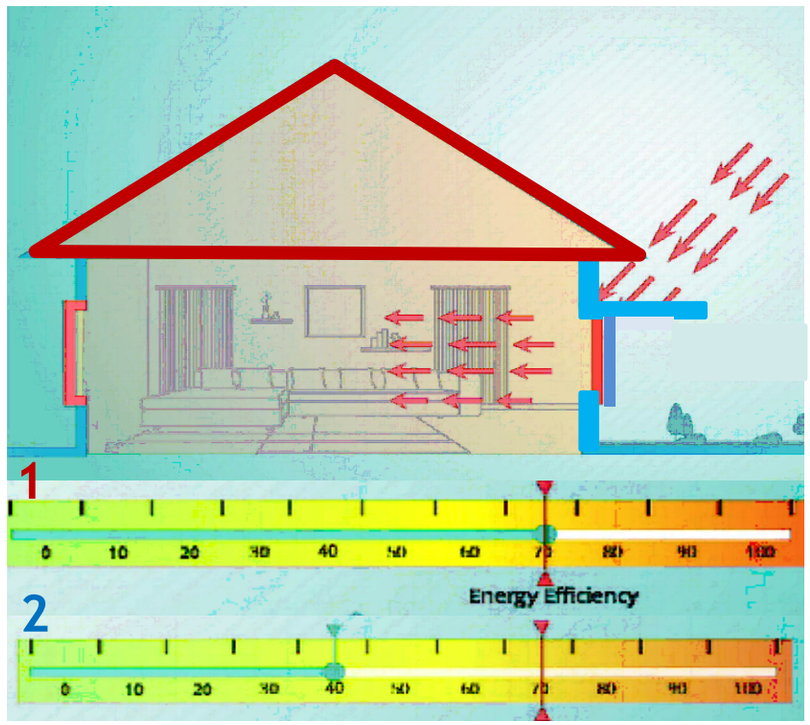
Hotels

Lodging Rooms

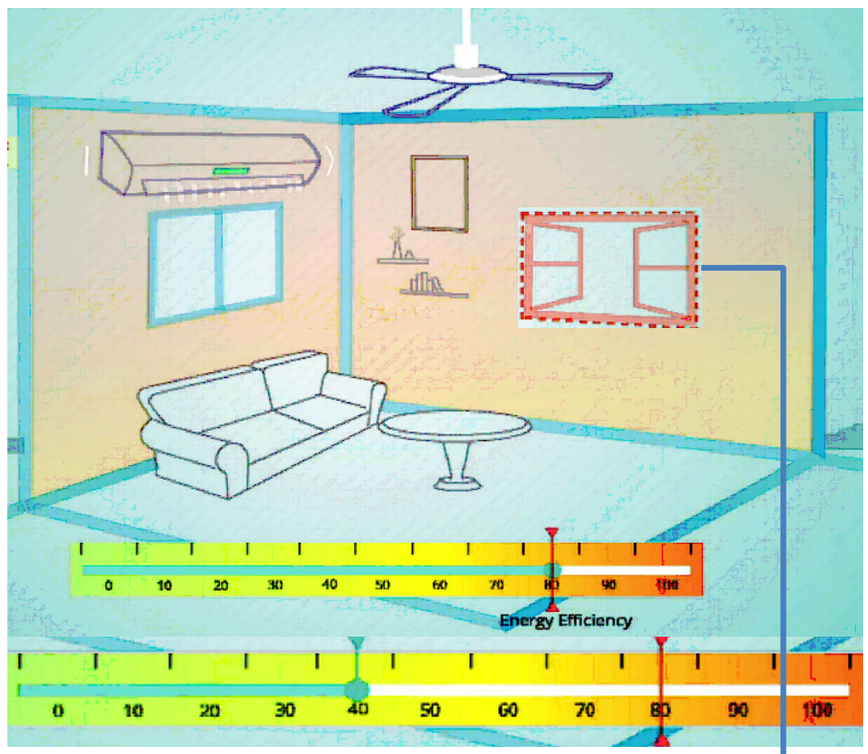
Conventional Building VS ENS Compliant Building



1. Non-insulated roof absorbs more heat and radiates inside the building ; 90 EPI (approx.)
2. Proper Insulating materials can reduced heat gain ; 70 EPI (approx.)



1. Conventional Brick wall, roof and single glazed windows, traps heat ; 70 EPI (approx.)
2. Proper shading, glazing, Wall & Roof insulation reduces impact of heat ; 40 EPI (approx.)



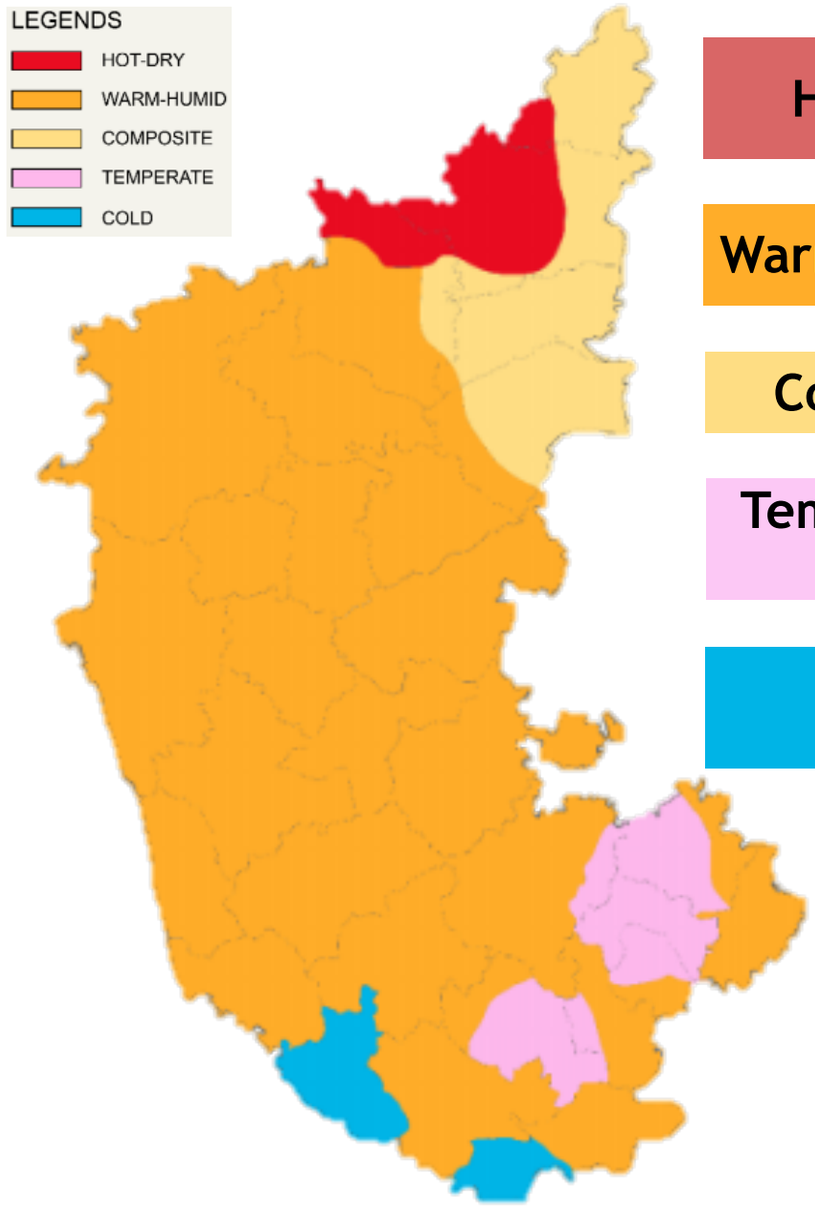
Increases in cross-ventilation reduces dependency on Air conditioners & coolers, thereby reduces electricity bills

Karnataka ENS Code

SCOPE: The Karnataka ENS code is applicable to Residential Buildings with **plot area ≥ 500m²** and Residential part of **"Mixed Land-use building projects" built on plot area of ≥ 500m².**

APPLICABILITY: The Karnataka ENS code is applicable to **all 5 climatic zones** (Composite, Hot & Dry, Warm & Humid, Temperate & Cold), that all districts fall under. **Latitude below 23.5 ° N**

Climate Map -Karnataka



Hot -Dry : Tumkuru

Warm-Humid : Mangaluru

Composite : Belagavi

Temperate : Bengaluru, Mysuru

Cold : Coorg

Performance Standards for Building Envelope

- 3.1 Openable Window to Floor Area Ratio (WFR_{op})
- 3.2 Visible Light Transmittance (VLT)- Derived from WWR

→ For Natural Ventilation

→ For Day Light Potential

- 3.3 Thermal Transmittance of Roof (U_{roof})
- 3.4 Residential Envelope Transmittance Value (RETV)
- 3.5 Thermal Transmittance for Cold Climate ($U_{envelope,cold}$)

→ For Thermal Transmission

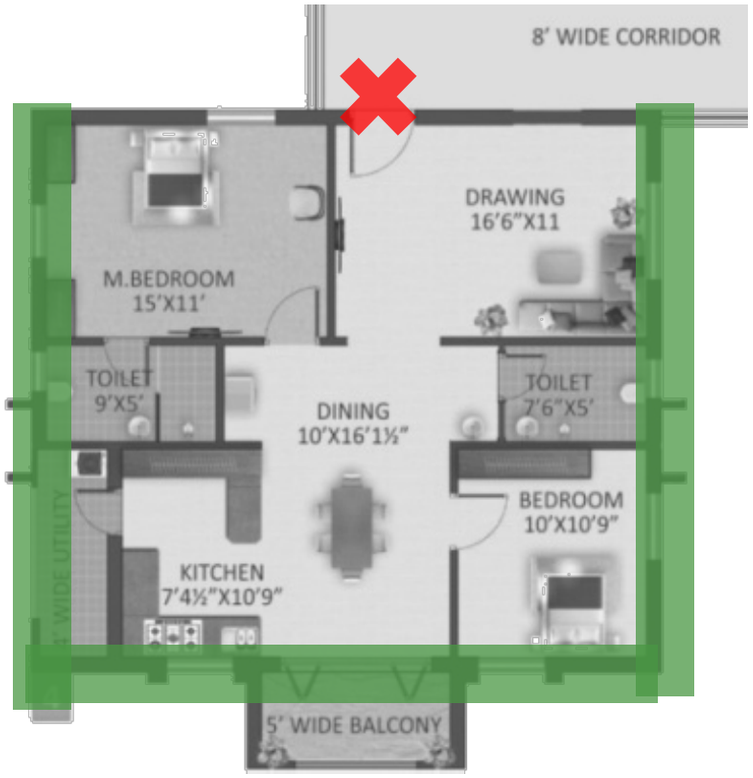
Source: Eco Niwas Samhita 2018

3.1 Openable Window to Floor Area Ratio (WFR$_{op}$)

$$WFR_{op} = \frac{A_{openable}}{A_{carpet}}$$

Window to floor area ratio is the ratio of Openable area to the carpet area of the dwelling Units.

Openable Area



Windows, Ventilators, opening directly to
- External air,
- Open balcony,
- Corridor,
- Shaft

Doors opening directly into
- Open balcony

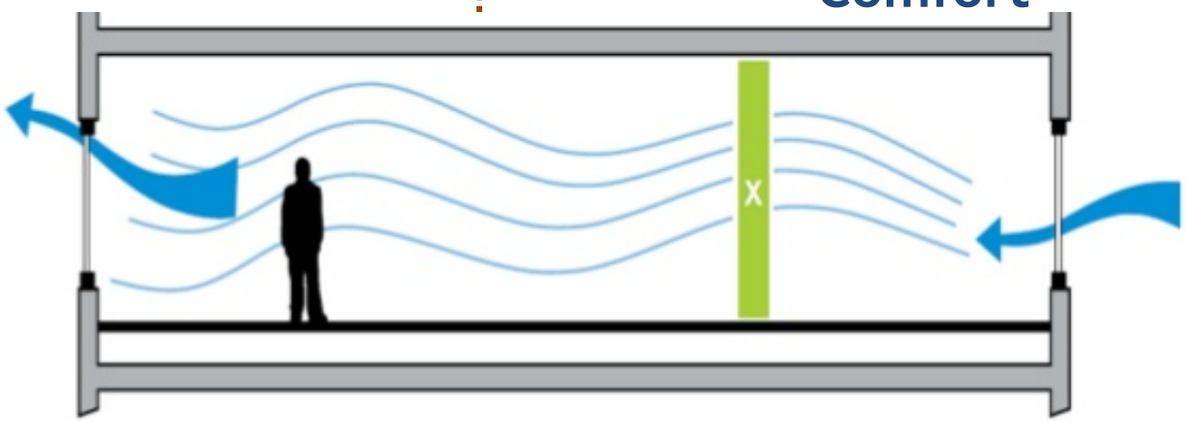
Carpet Area

- Total Internal Area of the habitable space Balconies - Excluded

3.1 Openable Window to Floor Area Ratio (WFR_op)

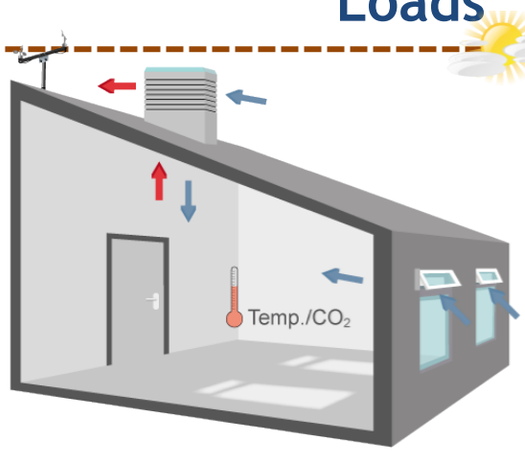
Minimum WFRop helps in

Natural Ventilation



Improvement in Thermal Comfort

Reduction in Cooling Energy Loads



Minimum requirement of window-to-floor area Ratio	
Climate Zone	**Minimum WFRop**
Composite	12.50
Hot-Dry	10.00
Warm-Humid	16.66
Temperate	12.50
Cold	8.33

Openable Area Percentages (In case the exact Openable is not known)	
Type of Window/Door/ Ventilator	**Percentage Openable Area**
Casement	90%
Sliding (2 Panes)	50%
Sliding (3 Panes)	67%

3.1 WFR_{op} - Example

Calculation of WFR for a dwelling unit situated in Belagavi, Karnataka (Composite)

Wall

200 mm AAC blocks with plaster on both sides; U-value = 0.78 W/ m2.K

Roof

150 mm RCC with 40mm Polyurethane foam (PU) insulation

Glass in windows

Single clear glass with; SHGC = 0.80, VLT = 85%, and U-value = 5.80 W/m2.K

Opening window/ door/ ventilator	Opening width (m)	Opening height (m)	Opening area (m2)	Width of glass in Opening (m)	Height of glass in Opening (m)	Glass area in opening (m2)	Opaque area (m2)
W1	1.20	1.60	1.92	1.20	0.53	0.64	1.28
W2	0.80	1.30	1.04	0.80	0.43	0.35	0.69
W3	0.80	1.60	1.28	0.80	1.60	1.28	0.00
D	0.75	2.50	1.87	0.00	0.00	0.00	1.87
V (2 nos)	0.65	0.40	0.26	0.65	0.40	0.26	0.00

3.1 WFR_{op} - Example

Opening name	Opening area (m2)	Openable area (m2)	Remarks
W1	1.92	1.73	90% Openable
W2	1.04	0.94	
W3	1.28	1.15	
D (opening into balcony)	1.87	1.69	
V(2nos)	0.52	0.47	
Openable area for the dwelling unit		**5.97**	

Carpet Area - $A_{carpet} = 26.6\ m^2$

$$WFRop = \frac{A_{openable}}{A_{carpet}} = \frac{5.97}{26.6}$$

= 22.44%

Belagavi is in the composite climate.

As per Table, the minimum *WFRop for this climate is 12.5%.*

Thus, this project complies with this requirement.

3.2 Window to Wall Area Ratio (To arrive at Optimum VLT)

$$WWR = \frac{A_{non-opaque}}{A_{envelope}}$$

WWR - Window to wall area ratio
Area (non-opaque) -
Total glass area in the opening .
Excluded - Opaque part of the total opening size.
Area(Envelope) -
Total envelope area of all facades.
Included – opaque and non-opaque

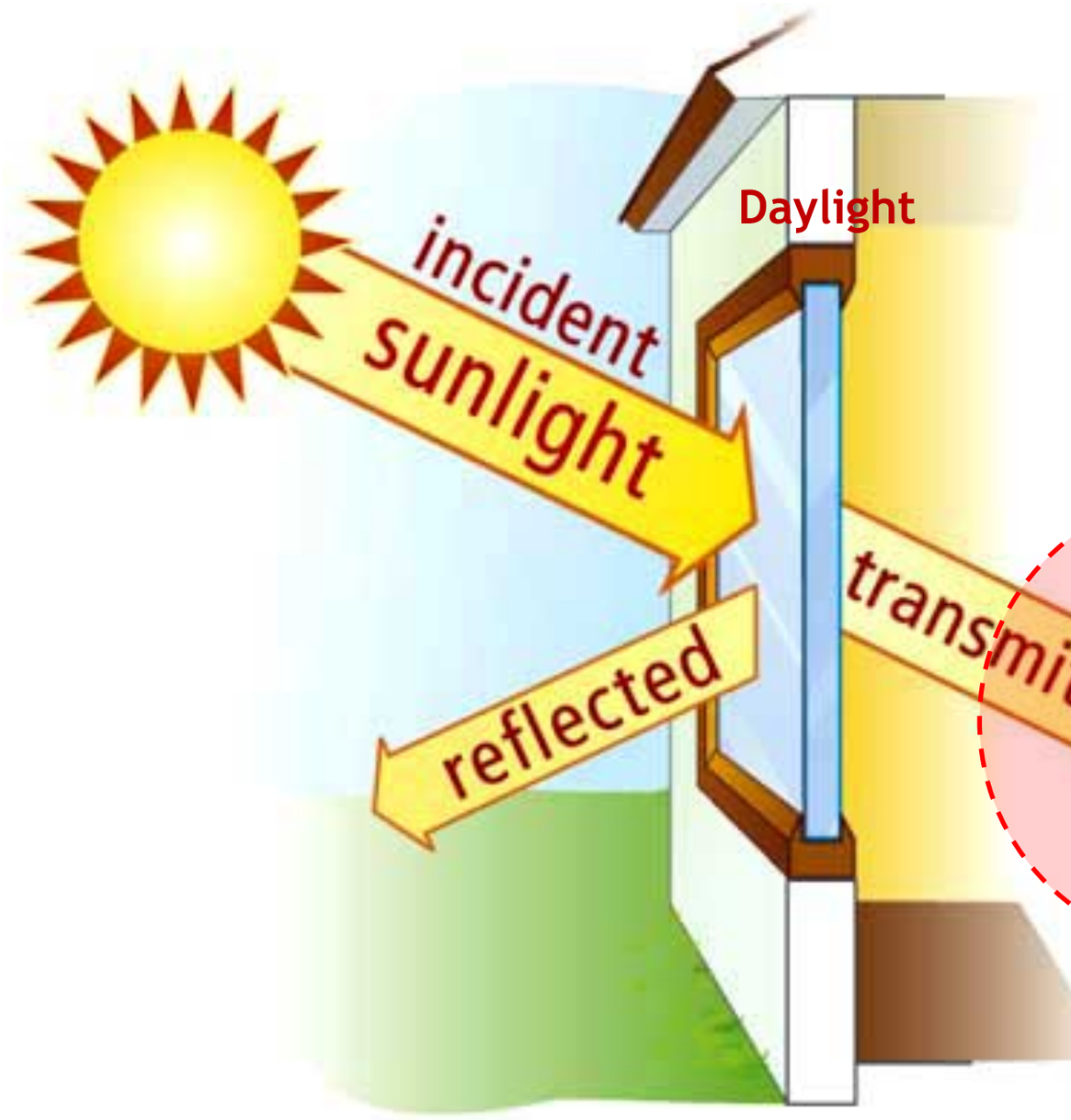
*** Note for WWR ≤ 0.15 , VLT - 40%**

Relation between WWR and Visual Light Transmittance

Window to Wall Ratio (WWR)	Minimum VLT
0-0.30	0.27
0.31-0.40	0.20
0.41-0.50	0.16
0.51-0.60	0.13
0.61-0.70	0.11

3.2 Window to Wall Area Ratio (To arrive at Optimum VLT)

Total light transmitted in any area through Glass.



- **Factors affecting VLT**
  - Glazing type,
  - No. of panes in an area,
  - Coating on the glass

Reduced energy usage for artificial lighting

Daylight savings

3.2 Window to Wall Area Ratio (To arrive at Optimum VLT)

From where can we obtain the VLT of the Glass ?

Colour / Performance	Thickness (mm)	Light Transmittance LT	Light Reflectance LR	Total Solar Radiant Heat Transmittance	Total Shading Coefficient	U Value (W/m^2K)	R_w Value (dB)
Clear	10	0.77	0.14	0.67	0.77	2.7	38
Clear	12	0.76	0.14	0.64	0.74	2.7	38
Clear	15	0.74	0.13	0.60	0.69	2.6	40
73/42	10	0.69	0.10	0.40	0.46	1.4	38
70/39	10	0.67	0.12	0.37	0.43	1.3	38
69/37	10	0.66	0.11	0.35	0.40	1.3	38
62/29	10	0.58	0.09	0.29	0.33	1.3	38
50/27	10	0.48	0.10	0.26	0.30	1.3	38
30/17	10	0.29	0.24	0.19	0.22	1.3	38

VLT of a Glass can be obtained from the Glass cut sheet available with any Glass manufacturer

3.2 Window to Wall Area Ratio (To arrive at Optimum VLT)

Calculation of WWR for a dwelling unit situated in Belagavi, Karnataka (Composite)

$$WWR = \frac{A_{non\text{-}opaque}}{A_{envelope}} = \frac{253.16}{3478.26} = 0.073$$

As per Table, for WWR of 0.073 (range 0-0.30), **the minimum required VLT is 27%.** The glass used in this **project has a VLT of 85%** (as mentioned).Thus, this project complies with this requirement.

Orientation	Opening name	Opening area (m2)	Non-opaque (glass) area in opening (m2)	No. of openings	Total opening area (m2)	Total non-opaque (glass) area (m2)
North	W1	1.92	0.64	56	107.52	35.62
North	W2	1.04	0.35	56	58.24	19.26
North	W3	1.28	1.28	56	71.68	71.68
North	D	1.88	0.00	56	105.00	0.00
South	W1	1.92	0.64	56	107.52	35.62
South	W2	1.04	0.35	56	58.24	19.26
South	W3	1.28	1.28	56	71.68	71.68
South	D	1.88	0.00	56	105.00	0.00
Total					684.88	**253.16**

Orientation	Total wall length (m), exposed to ambient	Total wall height (m), exposed to ambient	Envelope area (m_2)
North	51.58	21.06	1086.27
South	51.58	21.06	1086.27
East	31.00	21.06	652.86
West	31.00	21.06	652.86
Envelope area(m_2),excluding roof			**3478.26**

3.3 Thermal Transmittance - U_{roof}

Thermal Transmittance of roof U_{roof} - Is the rate of transfer of heat through the roof structure (which can be a single material or an assembly), divided by the difference in temperature across that structure.

Limiting U_{roof} by helps in reducing heat gains or losses from the roof. Ex : Insulation, Cool Roofs, Green Roofs

Thermal transmittance of roof shall comply with U_{roof} value - 1.2 W/ m^2.k

Source: Eco niwas Samhita -2018, Annexure -

3.3 Thermal Transmittance - U_{roof}

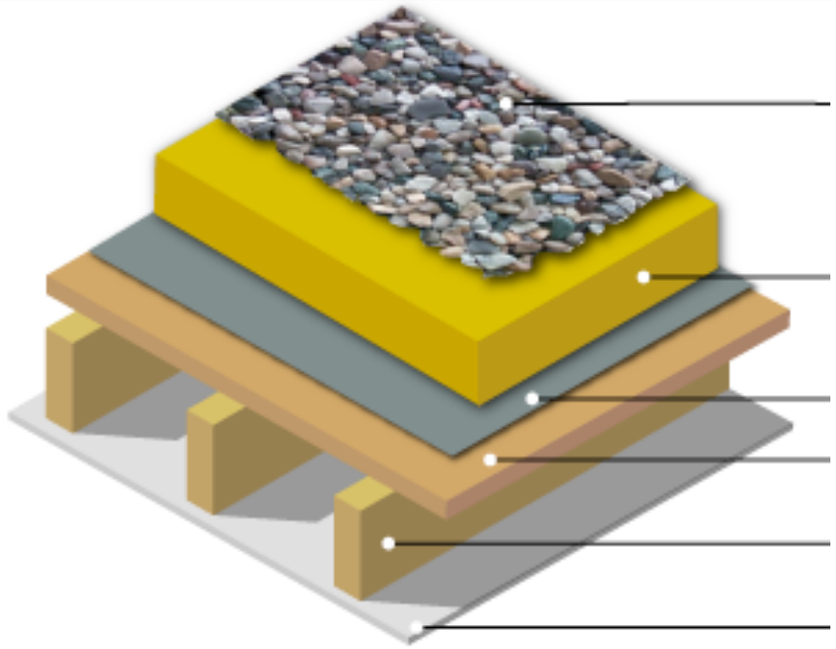
Total thermal Resistance -

$R_t = R_{si} + R_{se} + R1 + R2 + R3 \ldots\ldots$

$= 0.17 + 0.04 + 1.917 = 2.127\ m^2.K/w$

Total Thermal Transmittance (Roof)-

$U_{roof} = 1/RT = 0.47\ W/m^2.K$



Material Layer	Thickness,(t)	Thermal Conductivity- k (W/m.K)	Thermal Resistance , R=t/k(m^2.K/w)
China mosaic tile	0.007	1.500	0.005
Concrete (laid to slope)	0.050	1.740	0.029
Polyurethane foam (PUF)	0.040	0.023	1.739
Cement screed	0.020	0.720	0.028
RCC slab	0.150	1.580	0.095
Internal plaster	0.015	0.720	0.021
Sum of all material thermal resistance			1.917

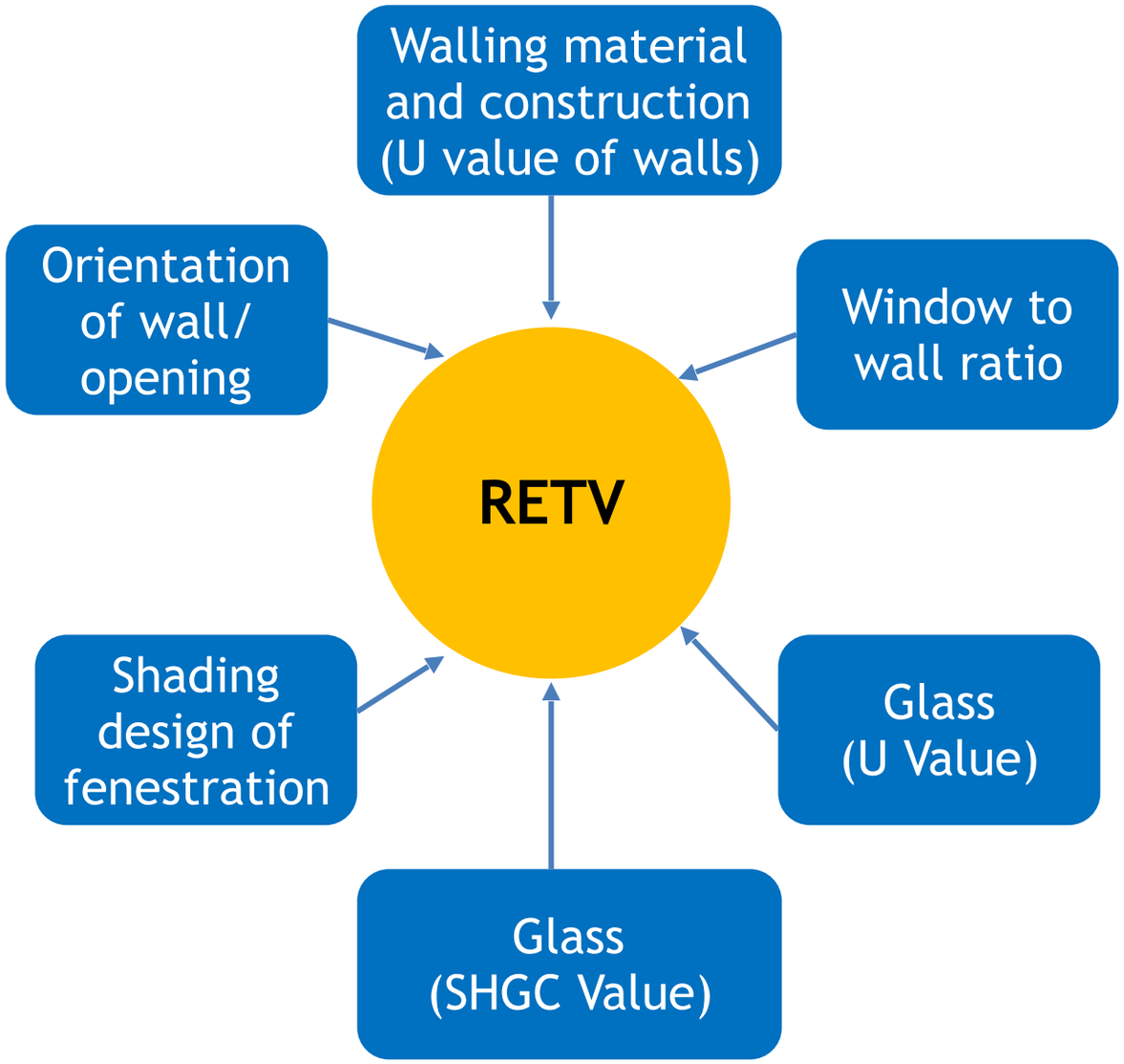
Source: Eco niwas Samhita -2018, Annexure -

3.4 Residential Envelope Transmittance Value (RETV)

Solar Radiation through non-opaque surfaces

Conduction through opaque surfaces

Conduction through non-opaque surfaces



3.4 Residential Envelope Transmittance Value (RETV)

The net heat gain rate through building Envelope

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

RETV accounts for -

➢ heat conduction through opaque and non-opaque building envelope components and **does not include ROOFS.**

➢ Solar radiation through non-opaque building envelope components

SHGC –Solar heat gain coefficient

A_{opaque} , $A_{non\text{-}opaque}$ - area of opaque and non-opaque areas in the building envelope

W_i - Orientation Factor

U_{opaque}, $U_{non\text{-}opaque}$ - Thermal transmittance of opaque and non-opaque building envelope components.

a,b,c – Coefficients for different climatic zones

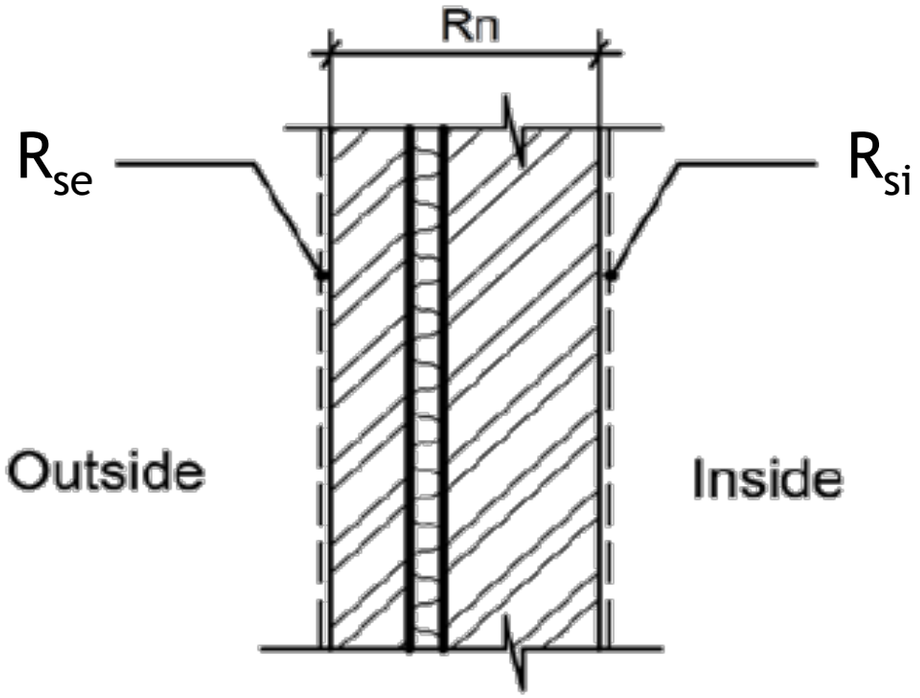
$A_{envelope}$ – Envelope area of dwelling units, **except roof area.**

3.4.1 U- Value - Thermal Transmittance - Wall

U-value - Rate of transfer of heat through a structure (which can be a single material or an assembly), divided by the difference in temperature across that structure. **(W/m²K)**

$$U = 1 / R_t$$

$$U = 1/ (R_{so} + \sum R_n + R_{si})$$



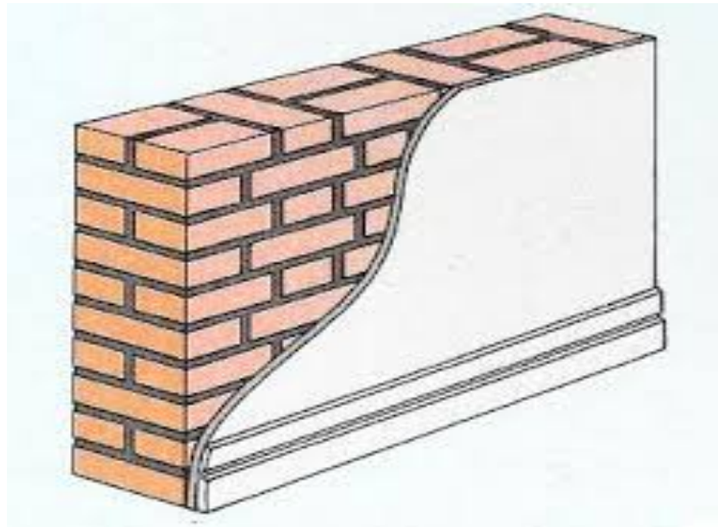
	Wall	Roof	
	All climatic Zones	Composite , Hot-Dry, Warm-humid, and Temperate climate	Cold climate
Rsi (m2.K/W)	0.13	0.17	0.10
Rse (m2.K/W)	0.04	0.04	0.04

Source: Eco Niwas Samhita -2018, Table 6, Annexu

3.4.1 Types of wall and their U-value

150 mm RCC (No plaster)
U Value - 3.77 W/m²K

200 mm Solid Concrete Block with 15 mm plaster on both sides
U Value- 2.8 W/m²K

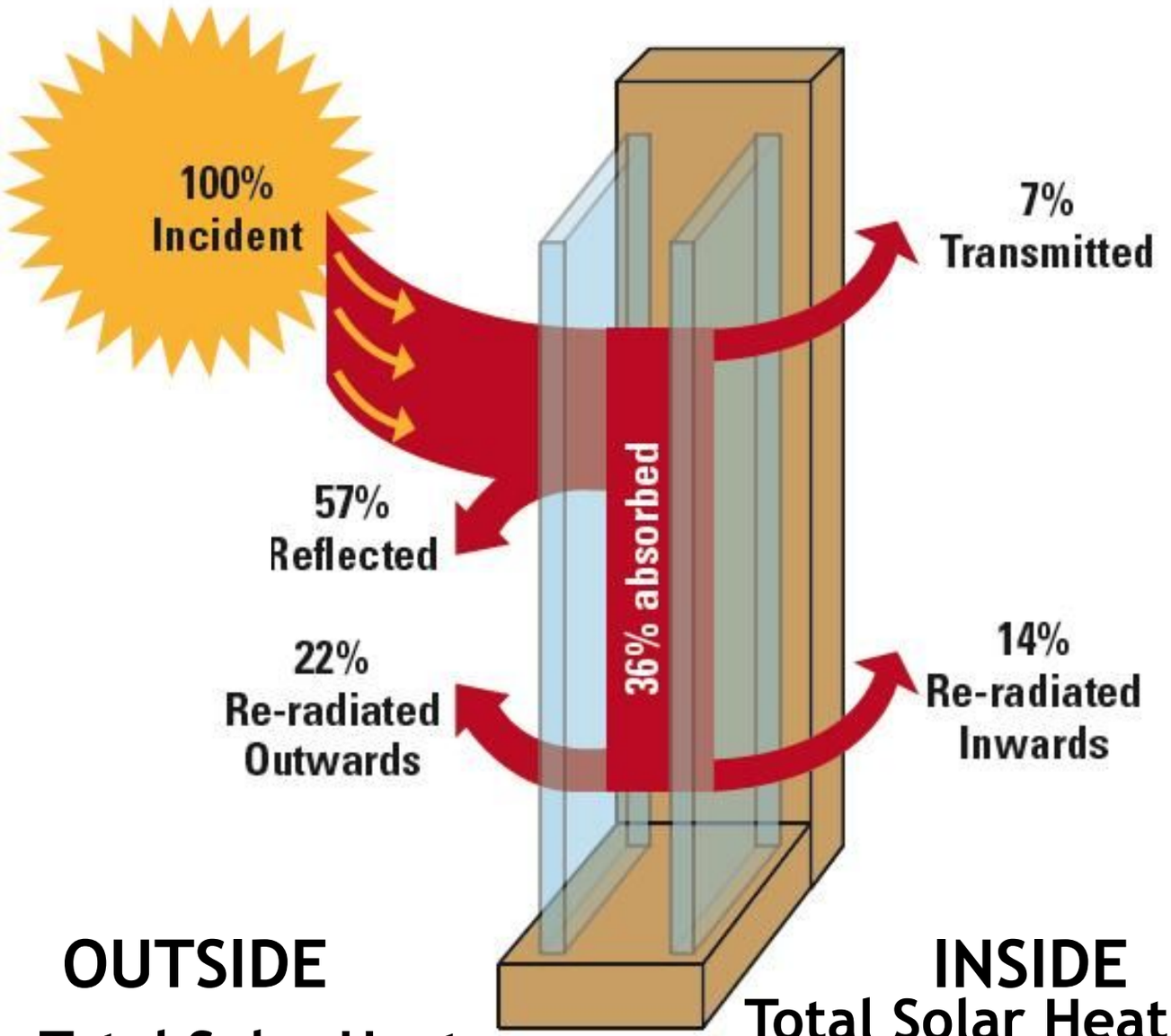


230 mm Brick with 15 mm plaster on both sides
U Value 1.72 - 2.24 W/m²K

200 mm Autoclaved Aerated Concrete (AAC) with 15 mm plaster on both side
U Value- 0.77 W/m²K

300 mm Autoclaved Aerated Concrete (AAC) with 15 mm plaster on both sides
U Value - 0.54 W/ m²K

3.4 U- Value - Thermal Transmittance - Non-Opaque



OUTSIDE

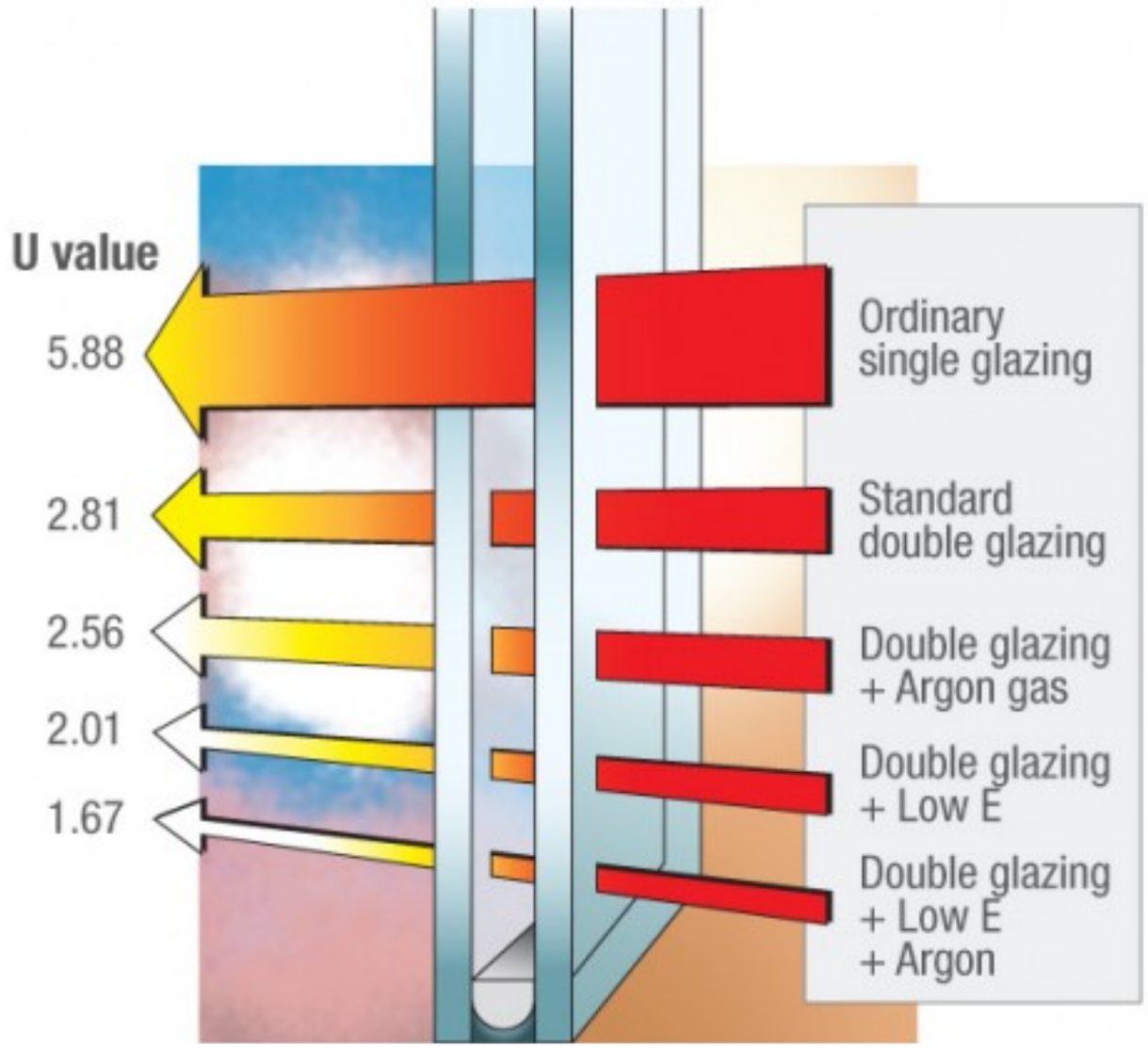
Total Solar Heat

Elimination : 79%

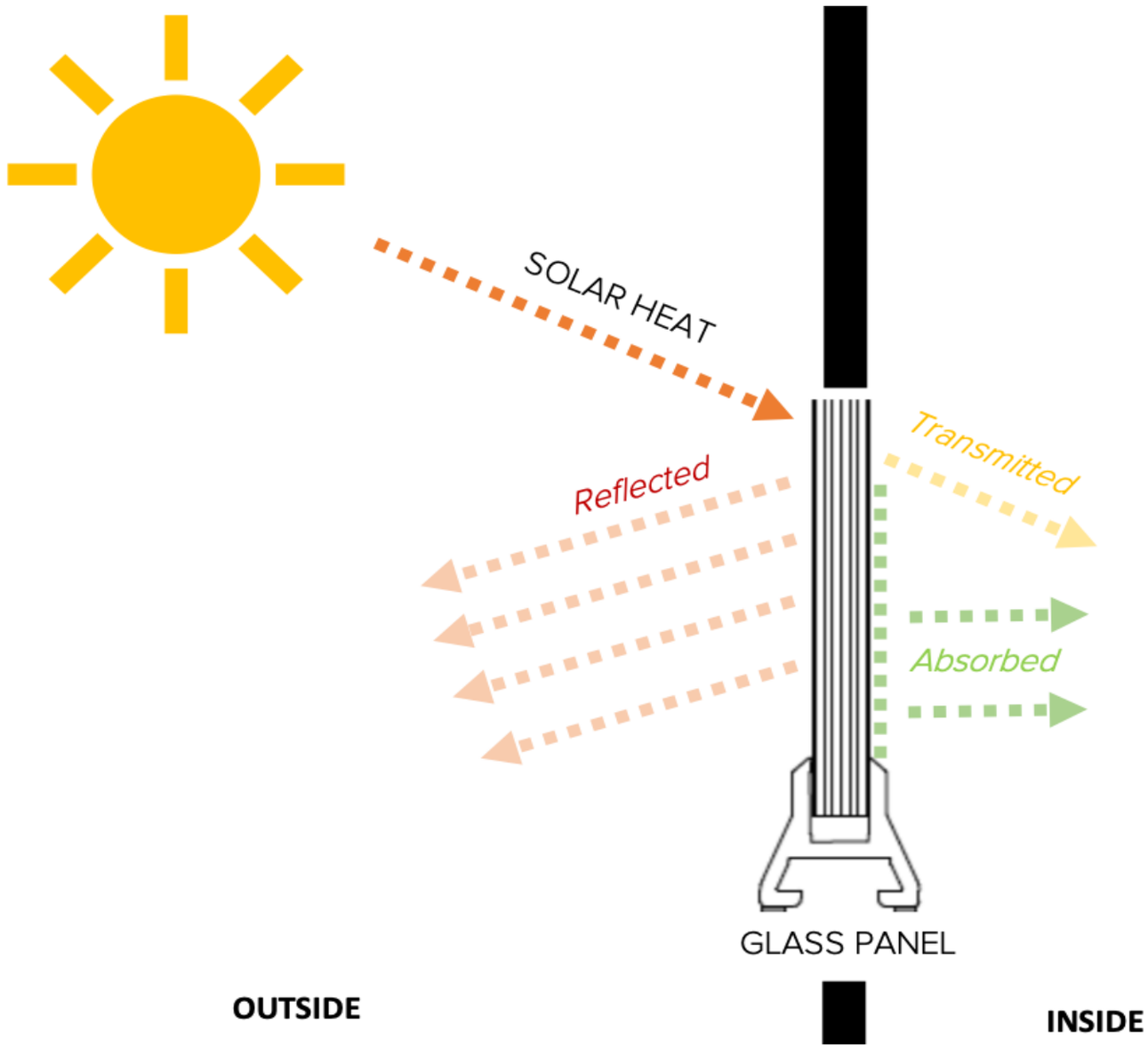
INSIDE

Total Solar Heat

Transmission : 21%



3.4 Solar Heat Gain Coefficient (SHGC) - Non-Opaque



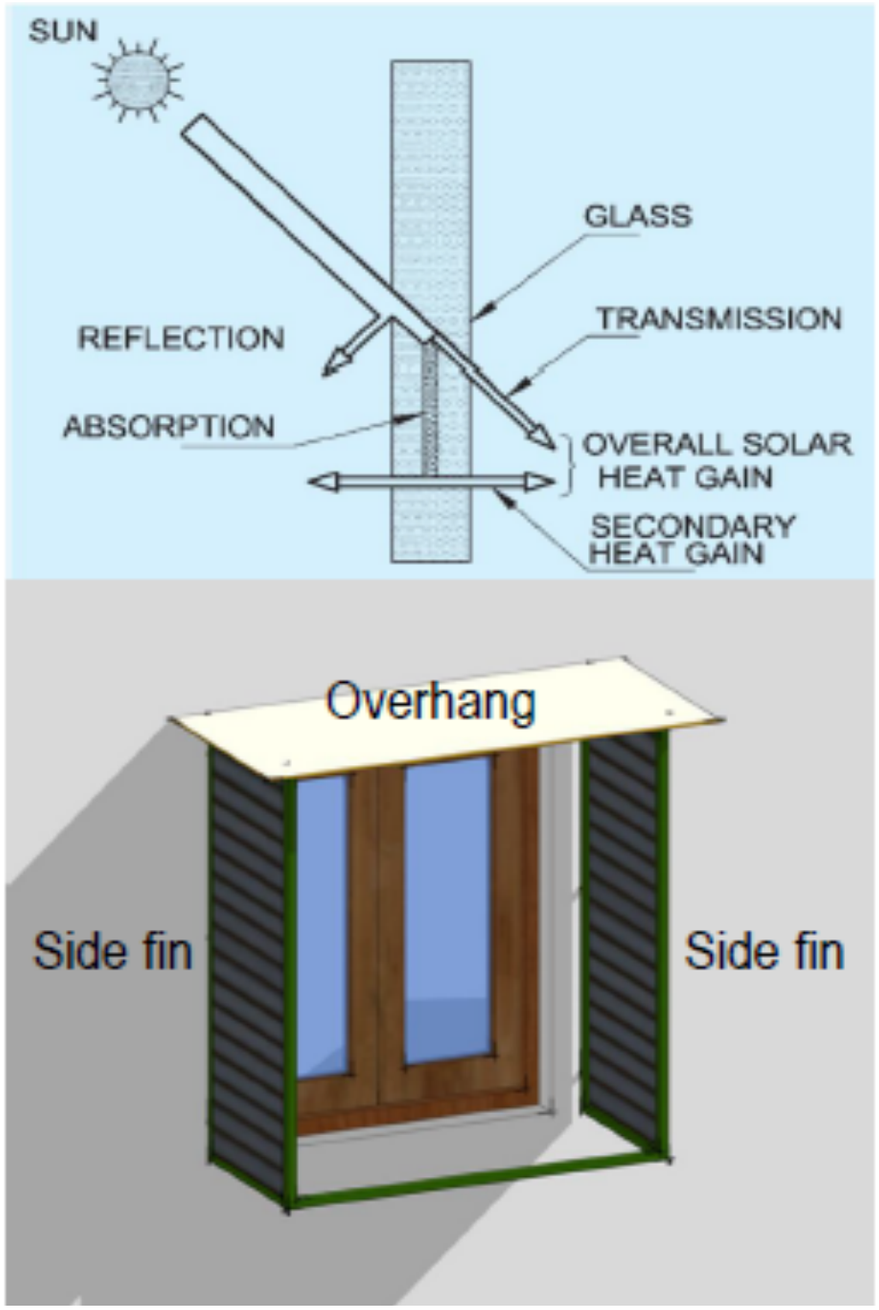
Solar heat gain coefficient is the measure of solar heat –

- Absorbed
- Transmitted

Lower SHGC ∝ lesser Heat Transfer

Solar Radiation is subsequently released inward through conduction, convection and radiation.

3.4 Equivalent SHGC



$$SHGC_{\text{unshaded gain}} = \frac{\text{Transmission + Secondary heat}}{\text{Incident Solar radiation}}$$

External Shading (overhang, side fins)cut the solar radiation

External Shading Factor ($ESF_{total} \leq 1$) accounts the impact of shading.

$$SHGC_{eq} = SHGC_{unshaded} \times ESF_{total}$$

$SHGC_{eq}$ - Equivalent SHGC

$SHGC_{unshaded}$ - Unshaded SHGC

ESF_{total} - Total External Shading Factor

3.4 Equivalent SHGC

Orientation / $PF_{overhang}$	External Shading Factor for Overhang ($ESF_{overhang}$) for LAT < 23.5°N							
	North (337.6°–22.5°)	North-east (22.6°–67.5°)	East (67.6°–112.5°)	South-east (112.6°–157.5°)	South (157.6°–202.5°)	South-west (202.6°–247.5°)	West (247.6°–292.5°)	North-west (292.6°–337.5°)
<0.10	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.10-0.19	0.931	0.924	0.922	0.910	0.896	0.910	0.922	0.924
0.20-0.29	0.888	0.864	0.855	0.834	0.816	0.834	0.854	0.864
0.30-0.39	0.860	0.818	0.797	0.771	0.754	0.771	0.796	0.818
0.40-0.49	0.838	0.782	0.747	0.721	0.708	0.720	0.746	0.782
0.50-0.59	0.820	0.755	0.705	0.682	0.675	0.681	0.705	0.755
0.60-0.69	0.806	0.734	0.670	0.651	0.653	0.651	0.670	0.734
0.70-0.79	0.793	0.718	0.641	0.628	0.638	0.627	0.640	0.717
0.80-0.89	0.783	0.706	0.616	0.610	0.628	0.609	0.615	0.705
0.90-0.99	0.775	0.696	0.596	0.596	0.621	0.596	0.595	0.695
≥1	0.768	0.688	0.579	0.585	0.616	0.585	0.578	0.688

$$SHGC_{eq} = SHGC_{unshaded} \times ESF_{total}$$

$$= 0.6 * 0.820$$

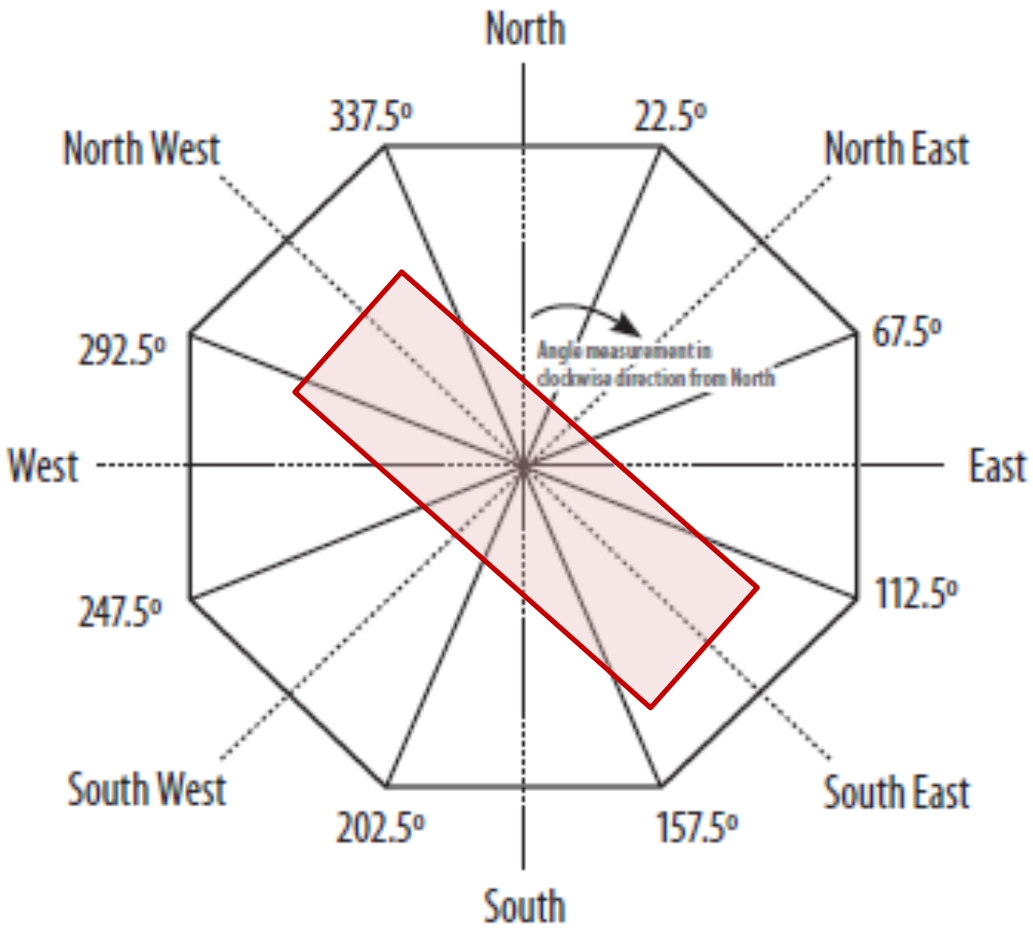
$$= 0.492$$

Source: Eco Niwas Samhita -2018, Table 11, Annexure

3.4 Orientation factor (ω)

The orientation factor (ω) is a measure of the amount of direct and diffused solar radiation that is received on the vertical surface in a specific orientation

Orientation	Orientation factor (ω) Latitudes <23.5°N
North (337.6°–22.5°)	0.659
North-east (22.6°–67.5°)	0.906
East (67.6°–112.5°)	1.155
South-east (112.6°–157.5°)	1.125
South (157.6°–202.5°)	0.966
South-west (202.6°–247.5°)	1.124
West (247.6°–292.5°)	1.156
North-west (292.6°–337.5°)	0.908



The building is oriented at 45 ° N, then the corresponding Orientation factor = 0.906

3.4 Residential Envelope Transmittance Value (RETV)

TABLE 3 Coefficients (a, b, and c) for RETV formula

Climate zone	a	b	c
Composite	6.06	1.85	68.99
Hot-Dry	6.06	1.85	68.99
Warm-Humid	5.15	1.31	65.21
Temperate	3.38	0.37	63.69
Cold	Not applicable (Refer Section 3.5)		

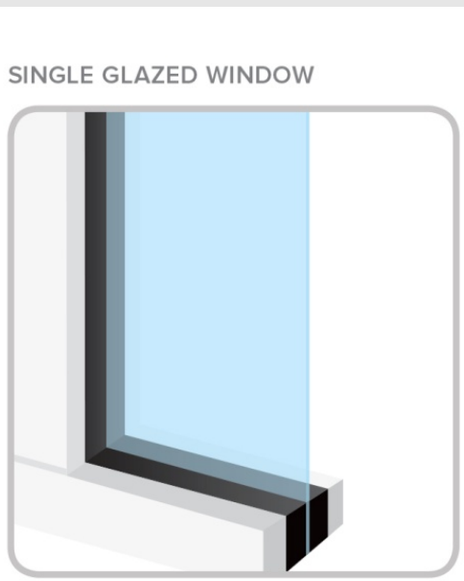
RETV for the building envelope (except roof) for four climate zones, namely, Composite Climate, Hot-Dry Climate, Warm-Humid Climate and Temperate

Climate shall comply with the maximum RETV of **15 W/m²**

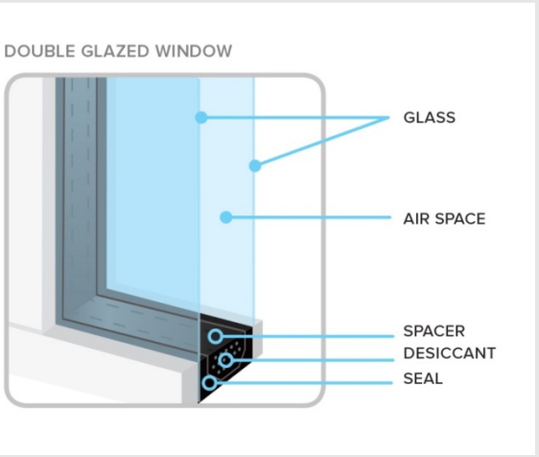
RETV Case - 1 ; Belagavi, Karnataka (Composite)

Case 1	 	External wall	Roof Construction	Glazing	Window to wall Ratio
		230mm thick Solid Burnt Clay Brick	150 mm thick RCC slab + 50mm thick EPS	50 mm Steel Frame; Single glazed Unit U Value = 5.7 W/m2k, SHGC = 0.56, VLT=0.51	22.55%
		RETV - 14.92 W/m².K			

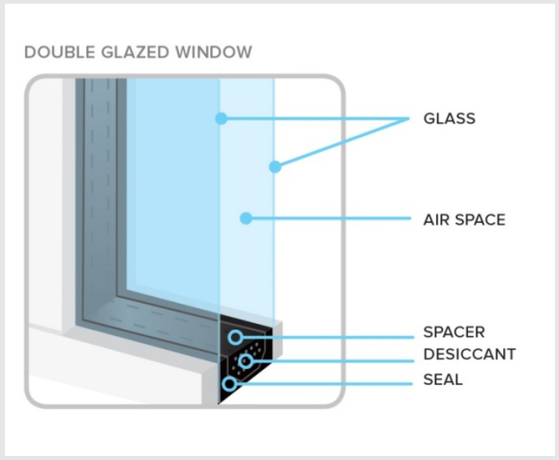
RETV Case - 2 ; Belagavi, Karnataka (Composite)

Case 2	 	**External wall**	**Roof Construction**	**Glazing**	**Window to wall Ratio**
		200mm thick AAC Block wall	150 mm thick RCC slab + 50mm thick EPS	50 mm Steel Frame; Single glazed Unit U Value = 5.7 W/m2k, SHGC = 0.56, VLT=0.51	22.55%
		RETV - 9.71 W/m².K			

RETV Case - 3 ; Belagavi, Karnataka (Composite)

Case 3		External wall	Roof Construction	Glazing	Window to wall Ratio
		200mm thick AAC Block wall	150 mm thick RCC slab + 50mm thick EPS	Double glazed Unit -Asahi LC 54/37 U Value = 1.64 W/m2k, SHGC = 0.36, VLT=0.52	22.55%
					
		RETV - 6.62 W/m².K			

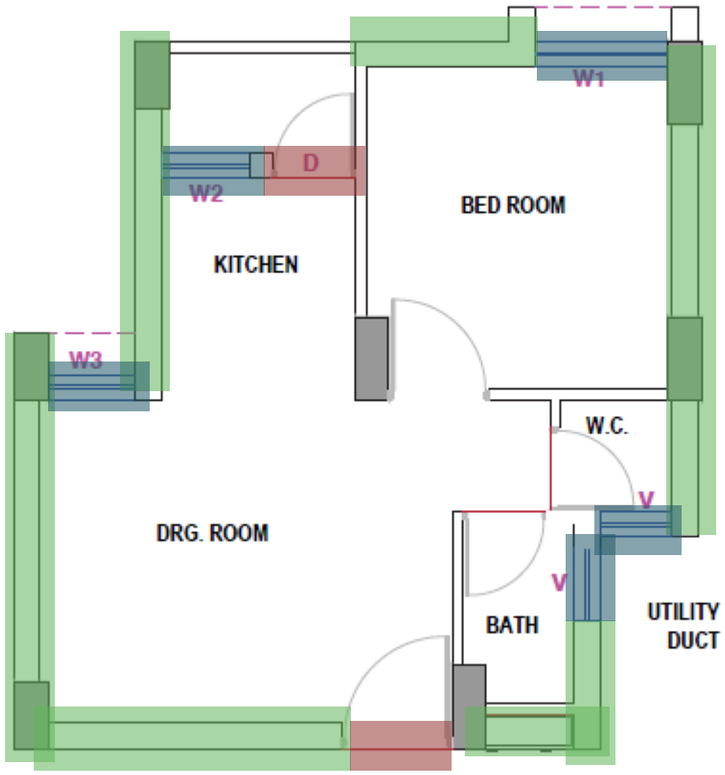
RETV Case - 4 ; Belagavi, Karnataka (Composite)

Case 4		External wall	Roof Construction	Glazing	Window to wall Ratio
		200mm thick AAC wall, 50 mm EPS, high SRI paint	150 mm thick RCC slab + 50mm thick EPS	Double glazed Unit -Asahi LC 54/37 U Value = 1.64 W/m2k, SHGC = 0.36, VLT=0.52	22.55%
					
		RETV - 5.13 W/m².K			

3.5 Thermal Transmittance - Wall (Except roof) for Cold Climate (U envelope, cold)

$$U_{envelope,cold} = \frac{1}{A_{envelope}}\left[\sum_{i=1}^{n}(U_i \times A_i)\right]$$

➢The thermal transmittance of the building envelope (except roof) for cold climate shall comply with the maximum of **1.8 w/M²K**



	Area (sq mt)	U- value (w/ m²k)
Wall (opaque)	2793.38	0.78
Door (opaque)	210	5.23
Window (non-opaque)	475.88	5.80

AAC Wall
Wooden Door
Glass Window

$$U_{envelope,cold} = \frac{(2793.38 \times 0.78) + (210.00 \times 5.23) + (474.88 \times 5.80)}{2793.38 + 210.00 + 474.88} = 1.73 \ \mathbf{W/m^2.K}$$

Case Study Analysis

Project Description and Details

Building Type	High Rise Residential
Location	Bengaluru
Climate Condition	Temperate
Residential Segment	Luxury Segment Project
Site Area	14,999 m^2
Total Built-up Area	35,525 m^2
Total No of Residential Units	214
Type of Units	3 BHK, 2 BHK
Orientation of Building	North with tilt of 5˚

Project Description and Details

3 BHK - Block - A

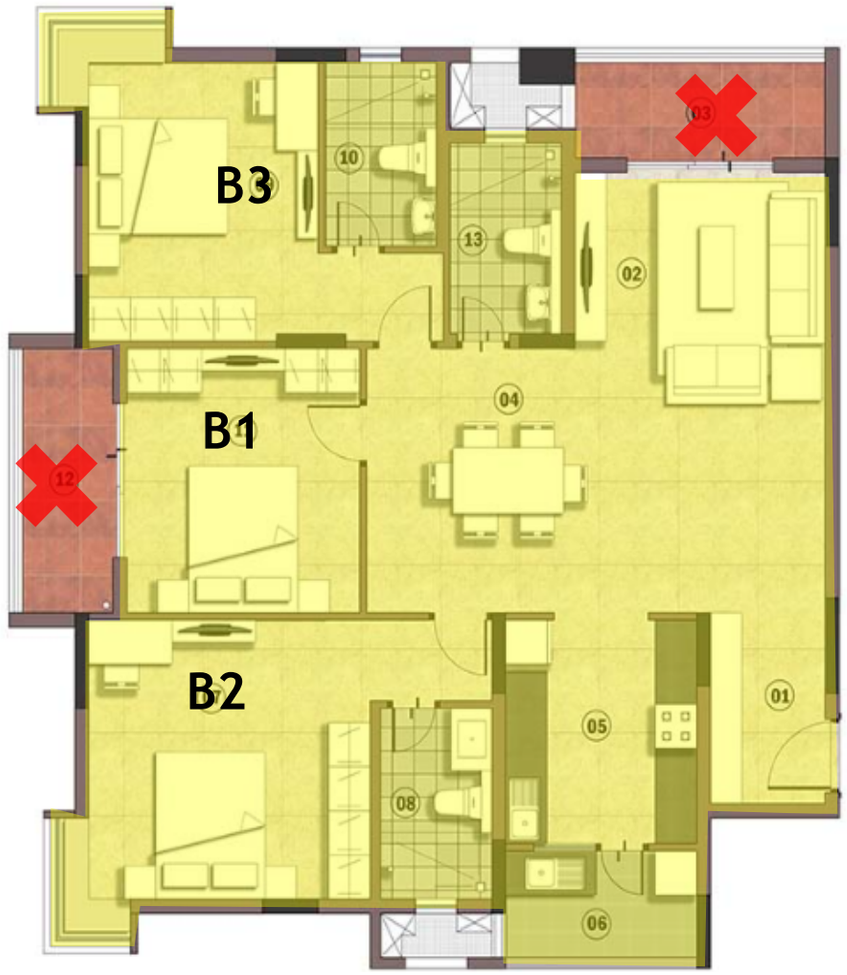
2 BHK - Block - B

Total Blocks	5 Blocks (A-E)
3 BHK	40 units (each block)
Floor area (3 BHK)	70.7 to 98.5 sqm
2 BHK	3 units (each block)
Floor area (2 BHK)	92.4 to 98.5 sqm
Other Amenities	Gymnasium, Indoor Games, Swimming Pool, Badminton Court

Envelope Type	Construction Configuration
Wall	External Cement Mortar (15mm) + Concrete Wall (200mm) + Internal Cement Mortar (12mm)
Roof	SRI Paint + Internal Cement Mortar (15mm) + BBC (150mm) + Expanded Poly Styrene (EPS) (50mm) + RCC Slab (200mm)
Fenestration & Glazing	UPVC frame SGU with 6mm clear glass, SHGC = 0.84, VLT = 0.82

Openable Window to Floor Area Ratio (WFR_{op}) - 3 BHK

BLOCK C (3-BHK Unit)								
Area	Floor Area			Openable Window/Door Area				
	Width (m)	Length (m)	Area (m2)	Type	Qty	Width (m)	Length (m)	Area (m2)
Bedroom-1	3.35	3.8	**12.73**	SD	1	0.925	1.8	**1.665**
Bedroom-2	3.15	3.8	**11.97**	W/W1	1	0.625	1.374	**0.86**
Bedroom-3	3.15	3.8	**11.97**	W/W2	1	0.625	1.374	**0.86**
Living/ Dining Room/ Foyer	3.45	6.4	**22.08**	SD	1	0.925	1.8	**1.66**
Kitchen	2.8	2.8	**7.84**	KW	1	0.6	0.78	**0.47**
				KD	1	0.59	1.8	**1.1**
Bathroom-1	2.6	1.7	**4.42**	V	1	0.9	0.6	**0.54**
Bathroom-2	1.75	2.8	**4.9**	V	1	0.9	0.6	**0.54**



WFR_{op} = 10.9

Openable Window to Floor Area Ratio (WFR_{op}) - 2 BHK

BLOCK C (2-BHK Unit)								
Area	Floor Area			Openable Window/Door Area				
	Width (m)	Length (m)	Area (m2)	Type	Qty	Width (m)	Length (m)	Area (m2)
Bedroom-1	3.35	3.7	12.395	W/ W1	1	0.925	1.8	1.665
Bedroom-2	3.6	3.35	12.06	W/ W2	1	0.925	1.8	1.665
Living/ Dining Room	7.2	3.45	24.975	SD	1	0.925	1.8	**1.66**
Kitchen	2.6	3.45	8.97	KW	1	0.6	0.78	0.468
				KD	1	0.59	1.8	1.062
Bathroom-1	1.6	2.5	4	V	1	0.9	0.6	0.54
Bathroom-2	1.6	2.5	4	V	1	0.9	0.6	0.54

WFR_{op} = 11.4

Openable Window to Floor Area Ratio (WFR_{op})

Climate Zone	Minimum WFRop (%)
Composite	12.5
Hot-Dry	10
Warm-Humid	16.66
Temperate	12.5
Cold	8.33

3 BHK

$$WFRop = \frac{A_{openable}}{A_{carpet}} = \frac{8.3}{75.91} = 10.9\%$$

2 BHK

$$WFRop = \frac{A_{openable}}{A_{carpet}} = \frac{7.59}{66.4} = 11.4\%$$

Bengaluru is in the temperate climate.

As per Table, the minimum WFRop for this climate is 12.5%.

Thus, this project does not complies with this requirement.

Window to Wall Area Ratio (To arrive at Optimum VLT)

Wall area calculations

Orientation	Areas			WWR
	Opaque Wall Area (m^2)	Non-Opaque Area (m^2)	Total Envelope Area (m^2)	
North	2842.82	1578.88	4421.7	0.30
South	3028.92	1393.38	4422.3	
East	922.26	137.34	1059.6	
West	678.17	107.68	785.85	

Building Envelope Details of the Project

Envelope Type	Construction Configuration	Thermal Transmittance (W/ m^2. K)
Fenestration & Glazing	UPVC frame SGU(Single Glazed Unit) with 6mm clear glass, SHGC = 0.84, **VLT = 0.82**	5.68

WWR to arrive at optimum VLT - As per Code

Window to Wall Ratio (WWR)	Minimum VLT
0-0.30	0.27
0.31-0.40	0.20
0.41-0.50	0.16
0.51-0.60	0.13
0.61-0.70	0.11

In this project and Single Glazed Unit with UPVC frame having a **VLT of 0.82** is used for construction.
Therefore, it is seen that the project **is meeting the compliance requirement for VLT.**

Thermal Transmittance - U_{roof}

Roof Construction Details of the Project

Building Envelope Type	Construction Configuration	Thickness (m)	Thermal Conductivity, "K" (W/m. K)	Thermal Resistance Total, "R"(m^2.K/W)	Thermal Transmittance, "U" (W/m^2. K)
Roof	Internal Cement Mortar	0.012	0.719	0.764 (including Rs_i = 0.17 m^2. K/W and Rs_e = 0.04 m^2. K/W)	**1.31**
	RCC Slab	0.2	1.58		
	Brick Bat Coba	0.15	0.62		
	Expanded Poly Styrene Insulation (EPS)	0.05	0.35		
	External Cement Mortar	0.015	0.719		
	SRI Paint	0.0005	0.09		

Thermal transmittance of roof shall comply with U_{roof} value - 1.2 W/ m^2. K

	Roof	
	Composite climate, hot-Dry climate, warm-humid climate, and temperate climate	Cold Climate
Rsi(m2.K/W)	0.17	0.10
Rse(m2.K/W)	0.04	0.04

The project has **U-value of 1.31 W/m^2. K.**
Hence the building's roof configuration **does not complies with this requirement.**

Source- Adapted from Bureau of Energy Efficiency (BEE), 2009. *Energy Conservation Building Code User Guide*, New Delhi

Residential Envelope Transmittance Value (RETV)

Orientation	Orientation factor (ω) Latitudes <23.5°N
North (337.6°–22.5°)	0.659
North-east (22.6°–67.5°)	0.906
East (67.6°–112.5°)	1.155
South-east (112.6°–157.5°)	1.125
South (157.6°–202.5°)	0.966
South-west (202.6°–247.5°)	1.124
West (247.6°–292.5°)	1.156
North-west (292.6°–337.5°)	0.908

Climate Co-efficient	a	b	c
Temperate	3.38	0.37	63.69

Orientation Factor for Building oriented at 5°N; Latitude < 23.5°N			
N	S	E	W
0.659	0.966	1.155	1.156

Wall and Glazing Details of the Project

Envelope Type	Construction Configuration	Thickness (m)	Thermal Conductivity, "K" (W/m. K)	Thermal Resistance Total, "R"(m^2.K/W)	Thermal Transmittance, "U" (W/m^2. K)
Wall	Internal Cement Mortar	0.015	0.719	0.49	2.06
	Concrete wall	0.2	0.73		
	Exterior Cement Mortar	0.015	0.719		
Glazing	Single Glazed Unit with UPVC Frame; SHGC = 0.84	0.006			5.68

Residential Envelope Transmittance Value (RETV)

Wall												
Envelope	Property	Gross Area (m^2)				Net Area (m^2)						
	U value (W/m^2. K)	North	East	South	West	North	East	South	West			
Concrete Wall	2.06	4421.70	1059.60	4422.30	785.85	2842.82	922.26	3028.92	678.17			
Glazing										RETV (W/m^2)		
	SHGC EQ						Window Area (m^2)					
SHGC	Type	North	East	South	West	U value (W/m^2. K)	North	East	South	West	Total	Standard	Achieved
0.84	W/W1	0.72	0.74	0.70	0.74	5.70	461.25	67.50	380.25	18.00	927.00	15.00	13.04
	W2	0.72	0.74	0.70	0.74		17.55	0.00	20.40	28.80	66.75		
	KW	0.54	0.00	0.43	0.43		21.06	0.00	23.40	9.36	53.82		
	SD	0.55	0.43	0.46	0.00		905.52	46.20	803.88	0.00	1755.60		
	SDs	0.50	0.00	0.39	0.00		26.40	0.00	33.00	0.00	59.40		

The above table describes the suitable values considered for calculating thermal transmittance based on the orientation of the building

The project has **RETV value as 13.04 W/m^2.**
Hence the building's RETV configuration **complies with this requirement.**

Code Compliance Report

Compliance Parameters	Achieved	Requirement	Compliance Status
Openable Window to Floor Area Ratio (WFR_{op})	8.95 % to 10.09 %	≥ 12.5 %	**NOT COMPLIANT**
Visible Light Transmittance (VLT)	0.87	≥ 0.27	**COMPLIANT**
Thermal Transmittance of Roof (U_{roof})	1.31	≤ 1.2 W/m². K	**NOT COMPLIANT**
Residential Envelope Transmittance Value (RETV)	13.04	≤ 15 W/m²	**COMPLIANT**

There is scope for improvement in the design aspects to glazing components of the building.

Reducing these values will limit the amount of heat gained inside the dwelling units and will provide thermal comfort to occupants at a lower cost of energy.

Region Specific Material Directory

- Blocks
- Glazing
- Fenestration Products
- Thermal Insulation
- Cladding material
- Paints, Tiles & Stones
- Other Materials

+

- Manufacturers
- Technical Specifications
- Classification of material
- Contacts & Location details
- Certification of product
- Test Report
- Costing of product

→ COMPENDIUM OF MATERIALS FOR KARNATAKA

Energy Performance for General Construction practices in Karnataka

Base Case : Brick Wall

- A typical construction case for a 2BHK dwelling unit with approx 75 sq.m carpet area is considered, in Bengaluru Karnataka.
- Energy Simulation is carried out using simulation based software, where the following inputs are taken constant, varying only the external envelope parameters.
- The Input parameters are,
  - Dwelling unit : 2BHK, 75 sq.m Carpet Area
  - Climate : Bengaluru – Temperate
  - Occupancy : 5 people (Based on NBC standards)
  - Lighting Loads (LPD) : 0.27 W/sq.ft
  - Equipment Load : BEE 5 Star rated appliances
  - Lighting and Equipment Loads are taken based on the Occupancy pattern
  - EPI Calculation = For Temperate: 100% area operated at IMAC-NV set-point temperature

IMAC refers to India model for adaptive thermal comfort **tool assistant developed by CEPT University. IMAC has defined temperature set points for naturally ventilated spaces and these set points have been used for establishing the EPI.*

Energy Performance for General Construction practices in Karnataka

Base Case 1 : Brick Wall

Envelope Type	Base Case			
	Layer	Thickness (mm)	Thermal Conductivity (W/m.K)	U Value of the assembly (W/sqm.K)
External Walls	Exterior Cement Plaster	18	0.721	2.28
	Red Clay Bricks	230	0.98	
	Interior Cement Plaster	12	0.721	
Roof	Exterior Cement Plaster	18	0.721	
	Water Proofing	150	0.62	
	Insulation	-	-	
	RCC	150	1.58	
	Interior Cement Plaster	12	0.721	
Fenestration & Glazing	Wooden Frames with 6mm clear glass SHGC 0.89 & VLT 0.84			5.8

RETV = 14.35 W/m²

Annual Energy Consumption = 4913.92 kWh

EPI (annual) = 65.51 kWh/ m²

Energy Performance for General Construction practices in Karnataka

Case 2 : Concrete block

Envelope Type	Case 2			
	Layer	Thickness (mm)	Thermal Conductivity (W/m.K)	U Value of the assembly (W/sqm.K)
External Walls	Exterior Cement Plaster	18	0.721	2.72
	Concrete block	230	1.41	
	Interior Cement Plaster	12	0.721	
Roof	Exterior Cement Plaster	18	0.721	
	Water Proofing	150	0.62	
	Insulation	-	-	
	RCC	150	1.58	
	Interior Cement Plaster	12	0.721	
Fenestration & Glazing	UPVC frames with 6mm clear glass SHGC 0.89 & VLT 0.84			5.8

RETV = 16.32 W/m²

Annual Energy Consumption = 4916.25 kWh

EPI (annual) = 65.55 kWh/ m²

Energy Performance for General Construction practices in Karnataka

Case 3 : RCC Mold Wall

Envelope Type	Case 3			
	Layer	Thickness (mm)	Thermal Conductivity (W/m.K)	U Value of the assembly (W/sqm.K)
External Walls	Exterior Cement Plaster	18	0.721	2.85
	RCC Mould WALL	230	1.58	
	Interior Cement Plaster	12	0.721	
Roof	Exterior Cement Plaster	18	0.721	
	Water Proofing	150	0.62	
	Insulation	-	-	
	RCC	150	1.58	
	Interior Cement Plaster	12	0.721	
Fenestration & Glazing	UPVC frames with 6mm clear glass SHGC 0.89 & VLT 0.84			5.8

RETV = 16.68 W/m²

Annual Energy Consumption = 4875.28 kWh

EPI (annual) = 65.00 kWh/ m²

Energy Performance for General Construction practices in Karnataka

Case 4 : Hollow Concrete Blocks

Envelope Type	Case 4			
	Layer	Thickness (mm)	Thermal Conductivity (W/m.K)	U Value of the assembly (W/sqm.K)
External Walls	Exterior Cement Plaster	18	0.721	2.28
	Hollow Blocks	230	0.98	
	Interior Cement Plaster	12	0.721	
Roof	Exterior Cement Plaster	18	0.721	
	Water Proofing	150	0.62	
	Insulation		0.035	
	RCC	150	1.58	
	Interior Cement Plaster	12	0.721	
Fenestration & Glazing	UPVC frames with 6mm clear glass SHGC 0.89 & VLT 0.84			5.8

RETV = 14.35 W/m²

Annual Energy Consumption = 4581.87 kWh

EPI (annual) = 61.09 kWh/ m²

Energy Performance for General Construction practices in Karnataka

Case 5 : AAC Blocks

Envelope Type	Case 5			
	Layer	Thickness (mm)	Thermal Conductivity (W/m.K)	U Value of the assembly (W/sqm.K)
External Walls	Exterior Cement Plaster	18	0.721	0.70
	AAC Blocks	230	0.188	
	Interior Cement Plaster	12	0.721	
Roof	Exterior Cement Plaster	18	0.721	
	Water Proofing	150	0.62	
	Insulation		0.035	
	RCC	150	1.58	
	Interior Cement Plaster	12	0.721	
Fenestration & Glazing	UPVC frames with 6mm glass. SHGC & VLT 0.5			5.6

RETV = 5.08 W/m²

Annual Energy Consumption = 4295.91 kWh

EPI (annual) = 57.27 kWh/ m²

Energy Performance for General Construction practices in Karnataka

Comparison : RETV, EPI, Annual Energy Comparison

		Dwelling Unit-1		
		RETV (W/m^2)	EPI (kWh/m^2)	Annual Energy consumption (kWh)
1	Brick Wall	14.35	65.52	4913.92
3	Concrete Block	16.32	65.55	4916.25
2	RCC Mould Wall	16.68	65.00	4875.28
4	Hollow Block	14.35	61.09	4581.87
5	AAC Block	5.08	57.28	4295.91

Comparison : Construction Cost

		Cost of Construction (Civil +Lighting+Electrical) in INR	Increase in Cost of Construction from Base case in INR	Percentage of Cost increase from Base Case
1	Brick Wall	₹ 16,07,648	Base Case	Base Case
3	Concrete Block	₹ 17,77,648	₹ 1,70,000.00	10.57%
2	RCC Mould Wall	₹ 19,45,253	₹ 3,37,605.00	21.00%
4	Hollow Block	₹ 23,52,708	₹ 7,45,060.00	46.34%
5	AAC Block	₹ 17,47,346	₹ 1,39,698.00	8.69%

Energy Performance for General Construction practices in Karnataka

Comparison : Energy Savings

		Total Annual Rate of Electricity (Rate of 1KWH = INR 6)	Difference in cost from Base Case in INR	Percentage of Cost saving from Base Case
1	Brick Wall	₹ 29,483.52	Base Case	Base Case
3	Concrete Block	₹ 29,497.50	-₹ 13.98	-0.05%
2	RCC Mould Wall	₹ 29,251.68	₹ 231.84	0.79%
4	Hollow Block	₹ 27,491.22	₹ 1,992.30	6.76%
5	AAC Block	₹ 25,775.46	₹ 3,708.06	12.58%

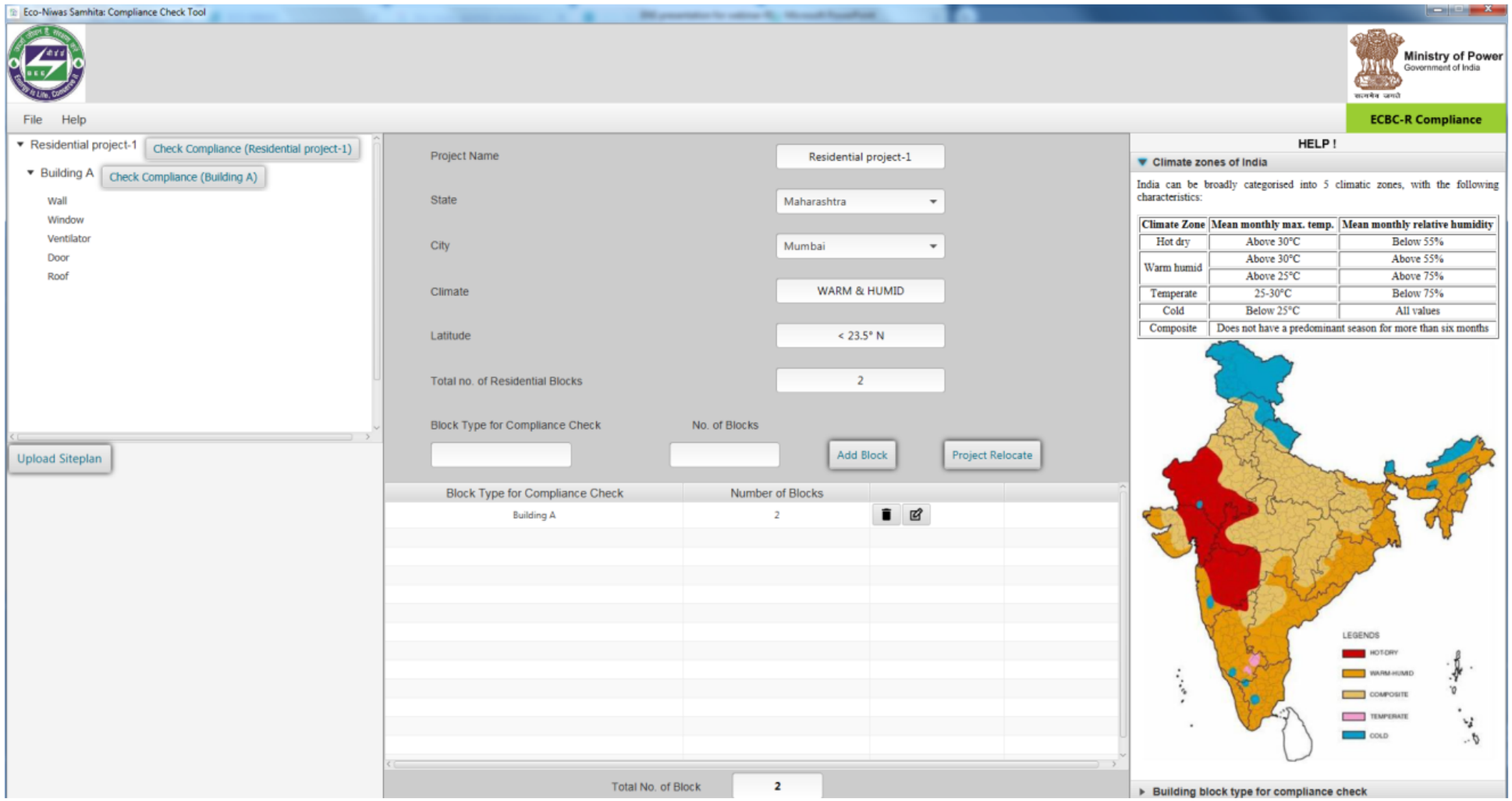
Inference

- **Concrete blocks** have lesser incremental cost when comparing to the Base Case : Brick Wall (10.57 %); although the Annual energy consumption is same to that of the Base case and lesser / no Energy Savings.
- **RCC Mold Wall** has 21 % increase in cost from base case, but only around 1% Energy savings from the base case.
- **Hollow block** has 46 % increase in cost from base case, and around 7% Energy savings from the base case.
- **AAC block** has only 9 % increase in cost from base case, and around 13 % Energy savings from the base case.

Eco-Niwas Samhita Compliance Approach Tool

Eco Niwas Samhita – Compliance Tool

Java based ENS compliance check tool has been developed to check compliance for residential project.



Available on Bureau of Energy Efficiency's website for download.

Link - https://beeindia.gov.in/content/ecbc-residential

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Eco-Niwas Samhita: Compliance Check Tool

Ministry of Power
Government of India
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File Help

Project

Upload Siteplan

ECBC-R Compliance

HELP !

Climate zones of India

Building block type for compliance check

Open

This PC

Search This PC

Organize

Quick access
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
OS (C:)

Folders (7)

3D Objects
Desktop
Documents
Downloads
Music

File name:

PNG files (*.png)
JPG files (*.jpg)
PNG files (*.png)

Ad...

Project Re...

Block Type for Compliance Check | Number of Blocks

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Eco-Niwas Samhita: Compliance Check Tool

Ministry of Power
Government of India
सत्यमेव जयते

File Help

ECBC-R Compliance

Project

Project Name

State Select

City Select

Climate

Latitude

Total no. of Residential Blocks

Block Type for Compliance ...

No. of Blo...

Ad...

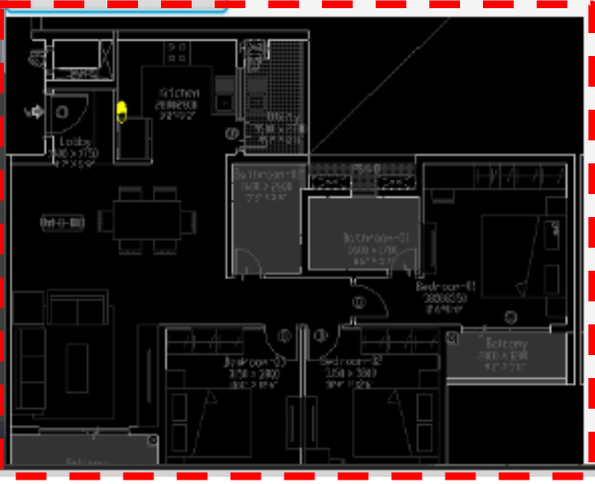
Project Re...

HELP !

Climate zones of India

Building block type for compliance check

Upload Siteplan



Block Type for Compliance Check | Number of Blocks

Eco-Niwas Samhita: Compliance Check Tool

Ministry of Power
Government of India

File Help

ECBC-R Compliance

Project

Project Name: Trial Project

State: Karnataka

City: Bangalore

Climate: TEMPERATE

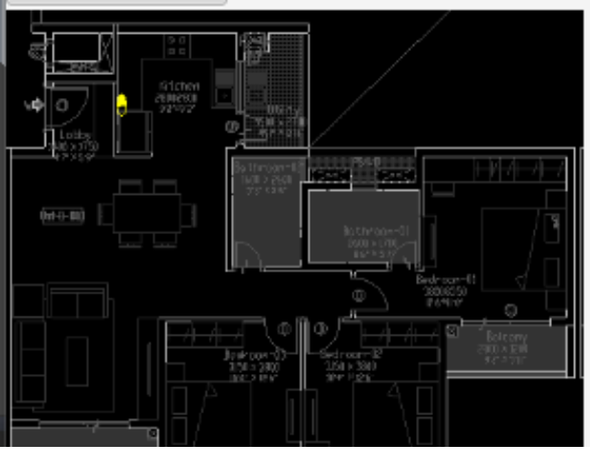
Latitude: < 23.5° N

Total no. of Residential Blocks:

Block Type for Compliance ... | No. of Blo... | Ad... | Project Re...

Block Type for Compliance Check	Number of Blocks

Upload Siteplan

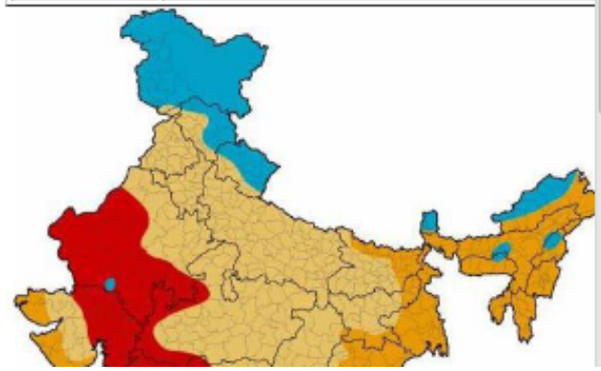


HELP !

Climate zones of India

India can be broadly categorised into climatic zones, with the followin characteristics:

Climate Zone	Mean monthly max. temp.	Mean monthly relative humidity
Hot dry	Above 30°C	Below 55%
Warm humid	Above 30°C	Above 55%
	Above 25°C	Above 75%
Temperate	25-30°C	Below 75%
Cold	Below 25°C	All values
Composite	Does not have a predominant season for more than six months	



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Ministry of Power
Government of India
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File Help

ECBC-R Compliance

Project

Project Name: Trial Project

State: Select

City

Climate

Latitude

Total no. of Residential Blocks

Block Type for Compliance ...

No. of Blo...

Ad...

Project Re...

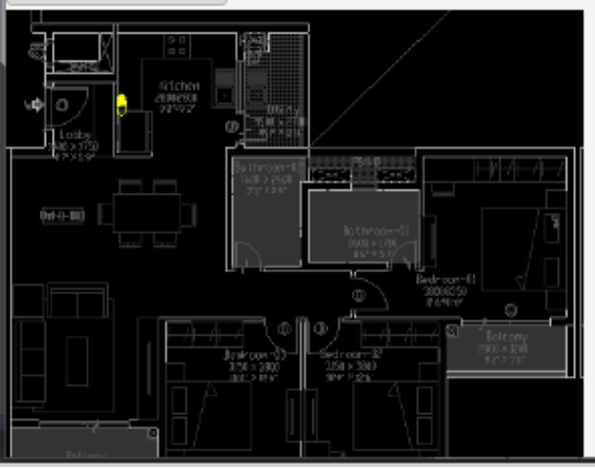
Block Type for Compliance Check | Number of Blocks

HELP !

- Climate zones of India
- Building block type for compliance check

Haryana
Himachal Pradesh
Jammu & Kashmir
Jharkhand
Karnataka
Kerala
Madhya Pradesh
Maharashtra
Manipur
Meghalaya

Upload Siteplan



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Ministry of Power
Government of India

File Help

ECBC-R Compliance

Project

Project Name: Trial Project

State: Karnataka

City: Select

Climate

Latitude

Total no. of Residential Blocks

Block Type for Compliance ...

No. of Blo...

Ad...

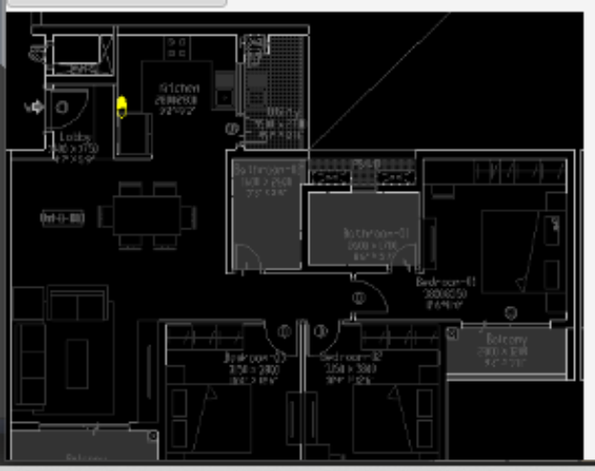
Project Re...

- Bangalore
- Belgaum
- Chitradurga
- Mangaluru
- Other

HELP !

- Climate zones of India
- Building block type for compliance check

Upload Siteplan



Block Type for Compliance Check	Number of Blocks

Eco-Niwas Samhita: Compliance Check Tool

Ministry of Power
Government of India
सत्यमेव जयते

File Help

ECBC-R Compliance

Project

Project Name: Trial Project

State: Karnataka

City: Bangalore

Climate: TEMPERATE

Latitude: < 23.5° N

Total no. of Residential Blocks:

Block Type for Compliance ...

No. of Blo...

Ad...

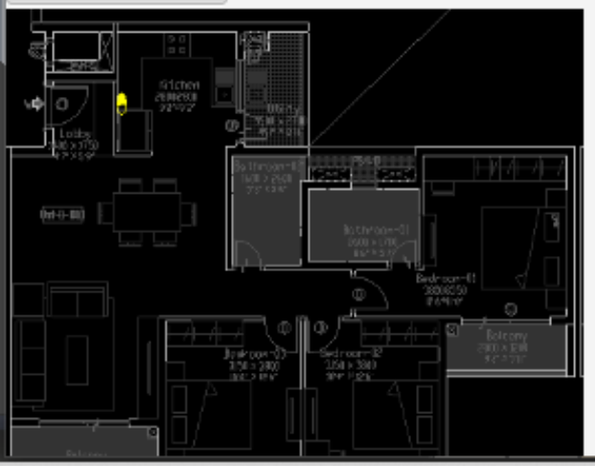
Project Re...

Block Type for Compliance Check	Number of Blocks

HELP !

- Climate zones of India
- Building block type for compliance check

Upload Siteplan



Eco-Niwas Samhita: Compliance Check Tool

File Help

ECBC-R Compliance

Ministry of Power
Government of India

Project

Project Name: Trial Project

State: Karnataka

City: Other — Enter City Name

Climate: Select / HOT & DRY / COMPOSITE / WARM & HUMID / TEMPERATE / COLD

Latitude: Select / >= 23.5° N / < 23.5° N

Total no. of Residential Blocks

Block Type for Compliance Check

No. of Blocks

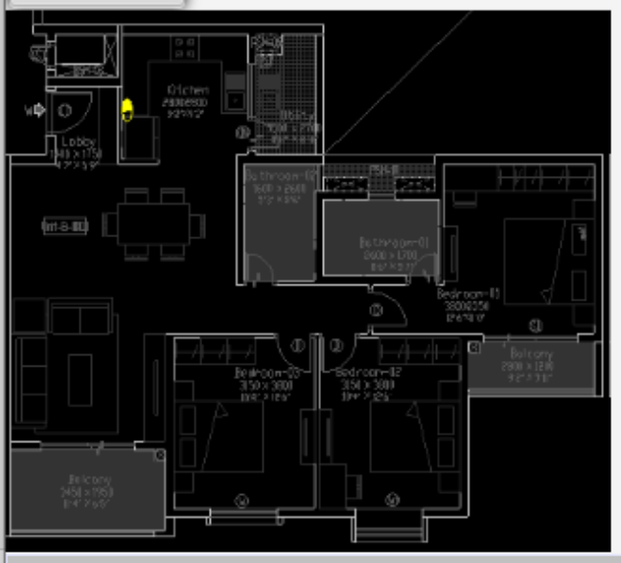
Add Block

Project Relocate

HELP !

- Climate zones of India
- Building block type for compliance check

Upload Siteplan



Block Type for Compliance Check	Number of Blocks
No content in table	

Total No. of Block

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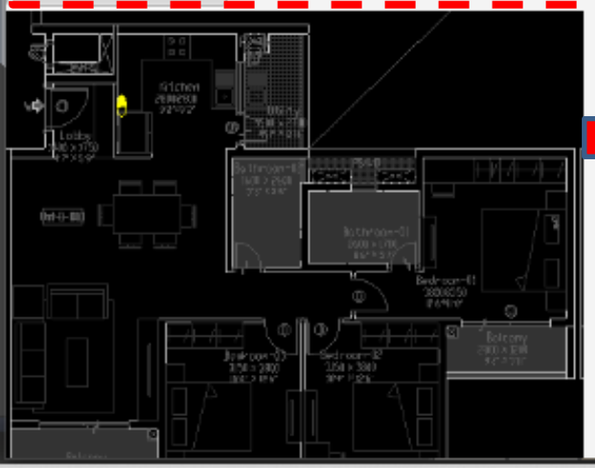
File Help

ECBC-R Compliance

Project

Upload Siteplan



Project Name: Trial Project

State: Karnataka

City: Bangalore

Climate: TEMPERATE

Latitude: < 23.5° N

Total no. of Residential Blocks:

Block Type for Compliance ...: BLOCK-A

No. of Blo...: 3

Ad...

Project Re...

Block Type for Compliance Check	Number of Blocks

HELP !

- Climate zones of India
- Building block type for compliance check

Eco-Niwas Samhita: Compliance Check Tool

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ECBC-R Compliance

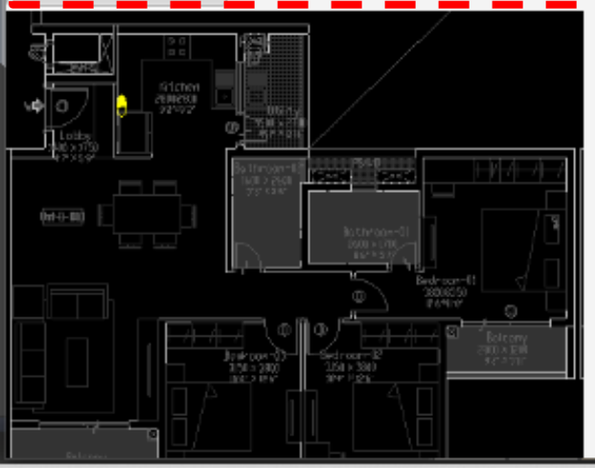
File Help

Trial Project | Check Compliance (Trial Project)

BLOCK-A | Check Compliance (BLOCK-A)

- Window
- Ventilator
- Door
- Wall
- Roof

Upload Siteplan



Project Name	Trial Project
State	Karnataka
City	Bangalore
Climate	TEMPERATE
Latitude	< 23.5° N
Total no. of Residential Blocks	56

Block Type for Compliance ... | No. of Blo... | Ad... | Project Re...

Block Type for Compliance Check	Number of Blocks		
BLOCK-A	3		

HELP !

- Climate zones of India
- Building block type for compliance check

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सत्यमेव जयते

File Help

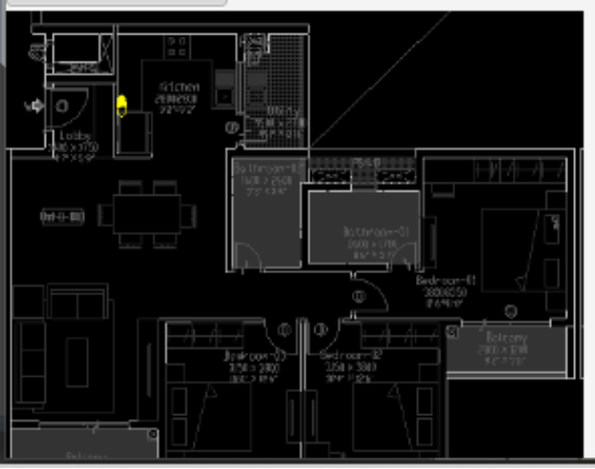
ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

BLOCK-A | Check Compliance (BLOCK-A)

- Window
- Ventilator
- Door
- Wall
- Roof

Upload Siteplan



Dwelling Unit Details :

Type of Dwelling Unit	No. of Units	Carpet Area/DU (m²)	
			Add

S.No.	Type of DU	No. of Units	Carpet Area/...	Total Area (m²)	
1	2-BHK	56	65.0	3640.0	

HELP !

- Dwelling unit and type
- Carpet area

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File Help

ECBC-R Compliance

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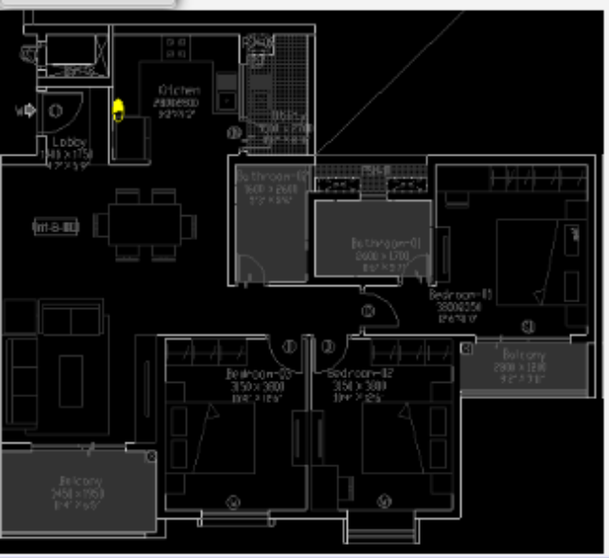
Government of India

- Trial Project — Check Compliance (Trial Project)
  - A — Check Compliance (A)
    - Wall
    - **Window**
    - Ventilator
    - Door
    - Roof

Upload Siteplan



Window Construction Details:

Window Name	Window Shape	Height (m)	Width (m)	Area (m²)	No. of Windows
W1	Rectangle	1.5	1.5	2.25	3

Window Type	Open %	Fixed %
Select	0	0

Glazing Details:

Glazing % | Height (m): Height | Width (m): Width

Define Glazing: Select

U-value(W/m².K): 0 | SHGC: 0 | VLT %: 0

Opaque Elements Details:

Opaque %	Definition Method	Material Type	Thickness (m)	U-value(W/m².K)	
	Select	Select	0		Add Window

		S.No.	Window ...	Window ...	Height(m)	Width(m)	Area(m²)	No.

No content in table

Total No. of Windows: 0

HELP!

- Window height and width
- Window openable %
- Glazed area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

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File Help

ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

A | Check Compliance (A)

Wall

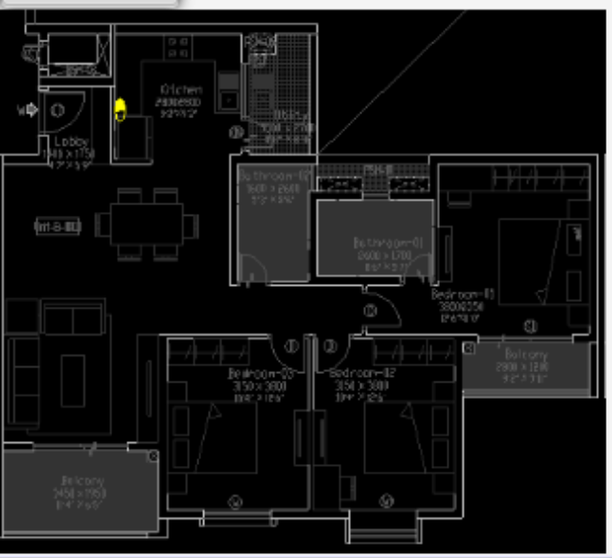
Window

Ventilator

Door

Roof

Upload Siteplan



Window Construction Details:

Window Name	Window Shape	Height (m)	Width (m)	Area (m²)	No. of Windows
W1	Rectangle	1.5	1.5	2.25	3

Window Type: Select / Casement / Sliding 2 door / Sliding 3 door / others

Open %: 50 | Fixed %: 50.0

Height (m): 1.5 | Width (m): 1.5

Single Glazing

U-value(W/m².K): 5.8 | SHGC: 0.8 | VLT %: 85.0

Opaque Elements Details:

Opaque %	Definition Method	Material Type	Thickness (m)	U-value(W/m².K)
50.0	Select	Select	0	

Add Window

S.No.	Window ...	Window ...	Height(m)	Width(m)	Area(m²)	No.

No content in table

Total No. of Windows: 0

HELP !

- Window height and width
- Window openable %
- Glazed area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

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File Help

ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

A | Check Compliance (A)

Wall

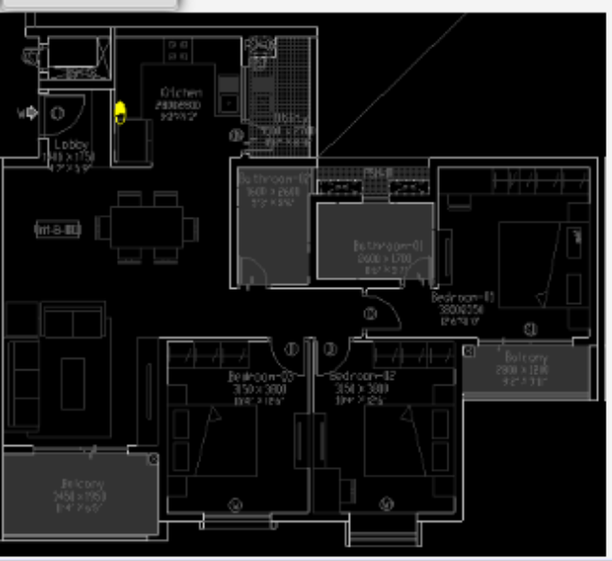
Window

Ventilator

Door

Roof

Upload Siteplan



Window Construction Details:

Window Name	Window Shape	Height (m)	Width (m)	Area (m²)	No. of Windows
W1	Rectangle	1.5	1.5	2.25	3

Window Type	Open %	Fixed %
Sliding 2 d...	50	50.0

Glazing Details:

Glazing % 50 | Height (m) 1.5 | Width (m) 1.5

Define Glazing: Material

U-value(W/m².K) 5.8 | VLT % 85.0

- Select Material
- Single Glazing
- Double Glazing
- Double Glazing(Low-e)

Opaque Elements Details:

Opaque %	Definition Method	Material Type	Thickness (m)	U-value(W/m².K)
50.0	Select	Select	0	

Add Window

		S.No.	Window ...	Window ...	Height(m)	Width(m)	Area(m²)	No.

No content in table

Total No. of Windows 0

HELP !

- Window height and width
- Window openable %
- Glazed area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

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File Help

Trial Project | Check Compliance (Trial Project)

A | Check Compliance (A)

Wall

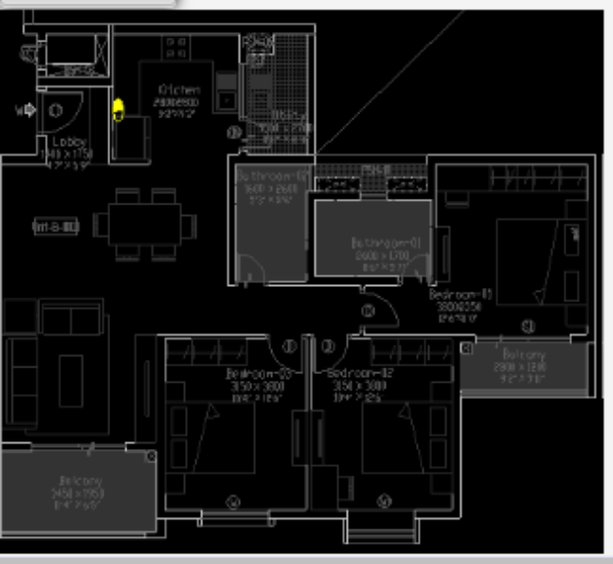
Window

Ventilator

Door

Roof

Upload Siteplan



Window Construction Details:

Window Name	Window Shape	Height (m)	Width (m)	Area (m²)	No. of Windows
W1	Rectangle	1.5	1.5	2.25	3

Window Type	Open %	Fixed %
Sliding 2 d...	50	50.0

Glazing Details:

Glazing % 50 | Height (m) 1.5 | Width (m) 1.5

Define Glazing: Material | Single Glazing

U-value(W/m².K) 5.8 | SHGC 0.8 | VLT % 85.0

Opaque Elements Details:

Opaque %	Definition Method	Material Type	Thickness (m)	U-value(W/m².K)
50.0	Properties	Select	0	

Add Window

Select

Properties

Window ...	Window ...	Height(m)	Width(m)	Area(m²)	No.

No content in table

Total No. of Windows 0

ECBC-R Compliance

HELP !

- Window height and width
- Window openable %
- Glazed area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

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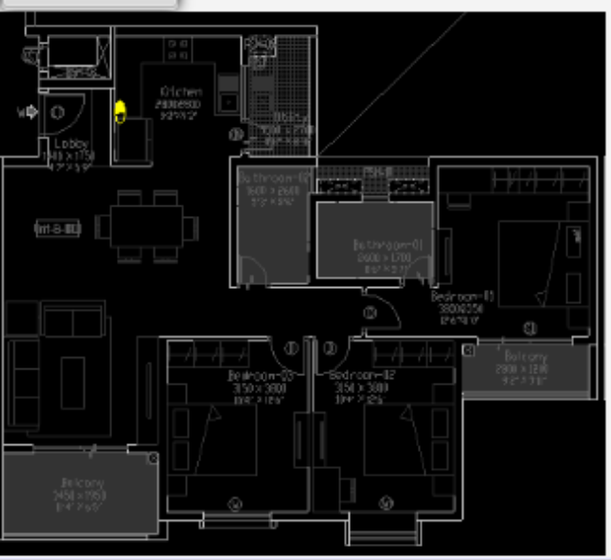
File Help

ECBC-R Compliance

- Trial Project — Check Compliance (Trial Project)
  - A — Check Compliance (A)
    - Wall
    - **Window**
      - W1
    - Ventilator
    - Door
    - Roof

Upload Siteplan



Window Construction Details:

Window Name	Window Shape	Height (m)	Width (m)	Area (m²)	No. of Windows
	Select	0	0	0.0	0

Window Type	Open %	Fixed %
Select	0	0

Glazing Details:

Glazing % | Height (m): Height | Width (m): Width

Define Glazing: Select

U-value(W/m².K): 0 | SHGC: 0 | VLT %: 0

Opaque Elements Details:

Opaque %	Definition Method	Material Type	Thickness (m)	U-value(W/m².K)
	Select	Select	0	0.0

Add Window

		S.No.	Window ...	Window ...	Height(m)	Width(m)	Area(m²)	No.
🗑	✎	Details	1	W1	Rectangle	1.5	1.5	2.25	

Total No. of Windows: 3

HELP !

- Window height and width
- Window openable %
- Glazed area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

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Window (W1)

No. of Internal Windows 0

No. of External Windows 3

External Shading Details

Select Orientation ☑ N ☐ S ☐ E ☐ W ☐ NW ☐ NE ☐ SE ☐ SW Save

N

Total Windows [North]: **1**

No. of W...	PARENT WALL	IS SHADE PRESENT ?	☑ OVERHANG Dimension		☑ SIDE FIN-LEFT Dimension		☑ SIDE FIN-RIGHT Dimension		
			Depth(m)	Distance(...	Depth(m)	Distance(...	Depth(m)	Distance(...	
1	Select	☑	0.3	1.5	0.15	1.5	0.15	1.5	+

HELP !

- Internal & external windows
- Orientation of external windows
- Shading dimension
- Side Fin-Right & Left

	S.No.	No. of W...	Wall Name	Shading ...	Overhang	Sidefin-L	sidefin-R	Depth (O...	Distance...	Depth (S...	Distance...	D
	1	1	WAll_North	☑	☑	☑	☑	0.3	1.5	0.3	1.5	

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File Help

ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

BLOCK-A | Check Compliance (BLOCK-A)

Window

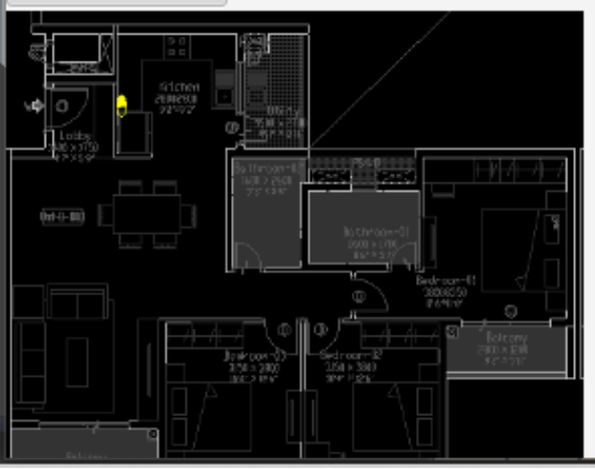
Ventilator

Door

Wall

Roof

Upload Siteplan



Ventilator Construction Details:

Ventilator N...	Ventilator Sh...	Height (m)	Width (m)	Area (m²)	No. of Ventil...
V1	Rectangle	0.6	0.9	0.54	1

Ventilator Type | Open % | Fixed %

Glazing Details:

Glazing % 40 | Height (m) 0.2 | Width (m) 0.8

Define Glazing: Material | Single Glazing

U-value(W/m²... 5.8 | SH... 0.8 | VLT % 85.0

Opaque Elements Details:

Opaque %	Definition Me...	Material Type	Thickness (m)	U-value(W/...
60.0	Propert...	Select	0	1.2

S.No.	Ventilato...	Ventilato...	Height(m)	Width(m)	Area(m²)

No content in table

HELP !

- Ventilator height and width
- Ventilator openable %
- Glazed area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

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Government of India
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File Help

ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

BLOCK-A | Check Compliance (BLOCK-A)

Window

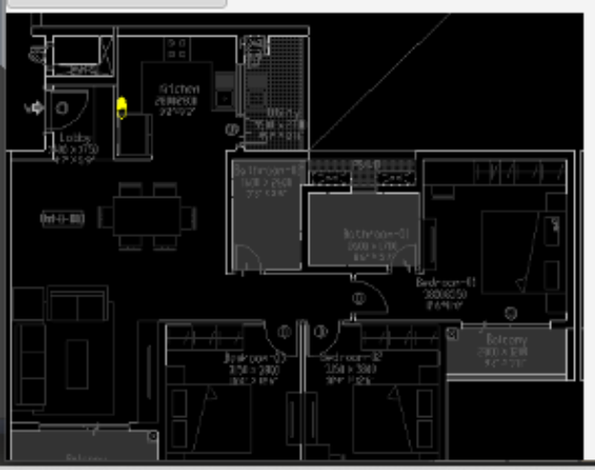
Ventilator

Door

Wall

Roof

Upload Siteplan



Door Construction Detials:

Door Name	Door Shape	Height (m)	Width (m)	Area (m²)	No. of Door
D1	Rectangle	2.100	0.900	1.89	1

Door Type | Open % | Fixed %

Glazing Details:

Glazing % 0 | Height (m) 0 | Width (m) 0

Define Glazing: Select

U-value(W/m²... 0 | SH... 0 | VLT % 0

Opaque Elements Details:

Opaque %	Definition Me...	Material Type	Thickness (m)	U-value(W/...
100.0	Propert...	Select	0	1.5

S.No.	Door Na...	Door Sh...	Height(m)	Width(m)	Area(m²)

No content in table

HELP !

- Door height and width
- Door openable %
- Door area % and Opaque area %
- Glass dimension
- Glazing details
- Opaque material properties

Eco-Niwas Samhita: Compliance Check Tool

Ministry of Power
Government of India
सत्यमेव जयते

File Help

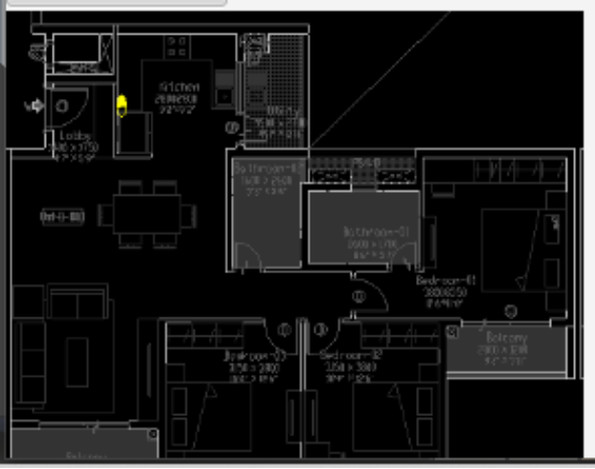
ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

BLOCK-A | Check Compliance (BLOCK-A)

Window
Ventilator
Door
Wall
Roof

Upload Siteplan



Wall Construction Details

Name	Define Wall	Wall Layers	Thickness(...	Uvalue(W/...	
W1	Material	Select	0	0	Ad...

Define Wall dropdown: Select / Material / Properties

S.No.	...ayer	Thickness (m...	R Value (K.m...
No content in table			

Add Construction

S.No.	Wall Name	Layer	U Value
No content in table			

Wall Area Details

Wall Construction	Orientation	Height (m)	Width (m)	Area (m²)
Select	Select			

Add Wall

S.No.	Wall Name	Orientation	Height(m)	Width(m)	Area(m²)	Dele
No content in table						

HELP !

- Wall definition
- Wall construction
- Wall orientation
- Wall dimensions

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Eco-Niwas Samhita: Compliance Check Tool

Ministry of Power
Government of India

File Help

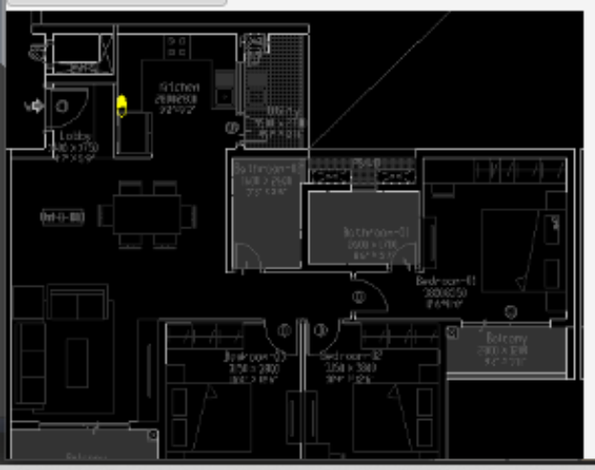
ECBC-R Compliance

Trial Project | Check Compliance (Trial Project)

BLOCK-A | Check Compliance (BLOCK-A)

Window
Ventilator
Door
Wall
Roof

Upload Siteplan



Wall Construction Details

Name	Define Wall	Wall Layers	Thickness(...	Uvalue(W/...	
W1	Material	Cement pl...	13	0	Ad...

S.No.	Wall Lay

No

S.No.	Wall Na

Value

- Dense concrete (2410 kg/m3)
- RCC (2288 kg/m3)
- Brick tile (1892 kg/m3)
- Lime concrete (1646 kg/m3)
- Mud Phuska (1622 kg/m3)
- Cement mortar (1648 kg/m3)
- Cement plaster (1762 kg/m3)
- Gypsum plaster (1120 kg/m3)
- Cellular concrete (704 kg/m3)
- AC sheet (1520 kg/m3)

Wall Area Details

Wall Construction	Orientation	Height (m)	Width (m)	Area (m²)	
Select	Select				Add Wall

S.No.	Wall Name	Orientation	Height(m)	Width(m)	Area(m²)	Dele

No content in table

HELP !

- Wall definition
- Wall construction
- Wall orientation
- Wall dimensions

75 Different Civil Material

Bureau of Energy Efficiency, Ministry of Power, Government of India

KREDL

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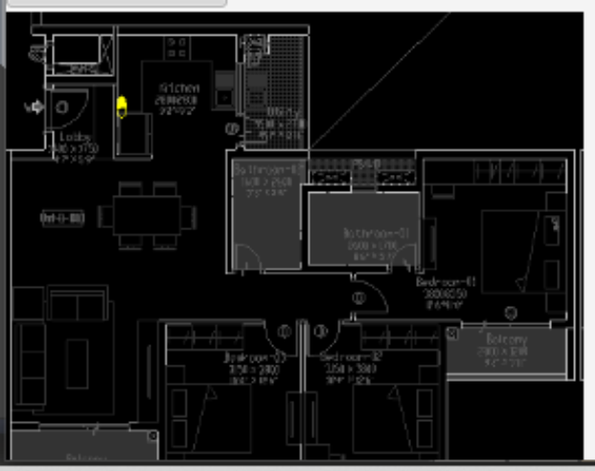

Wall Construction Details

Name	Define Wall	Wall Layers	Thickness(...	Uvalue(W/...	
W1	Material	Cement pl...	13	0	Ad...

S.No.	Wall Layer	Thickness (m...	R Value (K.m...
1	Cement plaster (1762 kg/m3)	13.0	0.018
2	Aerated autoclaved concrete (AAC) Block (...	230.0	1.25
3	Cement plaster (1762 kg/m3)	13.0	0.018

Add Construction

S.No.	Wall Name	Layer	U Value

No content in table

Wall Area Details

Wall Construction	Orientation	Height (m)	Width (m)	Area (m²)
Select	Select			

Add Wall

S.No.	Wall Name	Orientation	Height(m)	Width(m)	Area(m²)	Dele

No content in table

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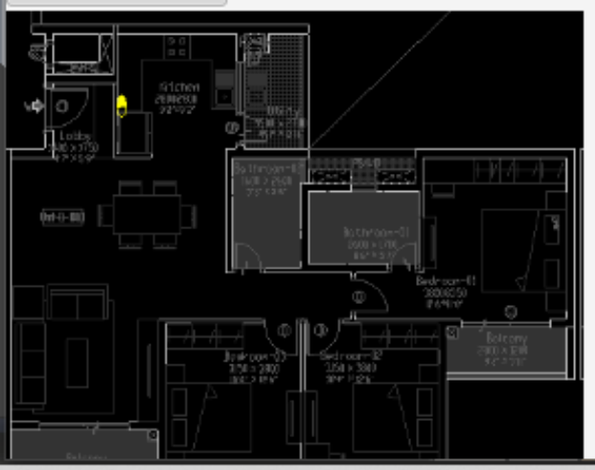

Wall Construction Details

Name	Define Wall	Wall Layers	Thickness(...	Uvalue(W/...	
W1	Material	Cement pl...	13	0	Ad...

S.No.	Wall Layer	Thickness (m...	R Value (K.m...
No content in table			

Add Construction

	S.No.	Wall Name	Layer	U Value
🗑	1	W1	1. Cement plaster (1762 kg/m3) [13.0 mm] 2. Aerated autoclaved concrete (AAC) Block (642 kg/m... 3. Cement plaster (1762 kg/m3) [13.0 mm]	0.687

Wall Area Details

Wall Construction	Orientation	Height (m)	Width (m)	Area (m²)	
Select	Select				Add Wall

S.No.	Wall Name	Orientation	Height(m)	Width(m)	Area(m²)	Dele
No content in table						

HELP !

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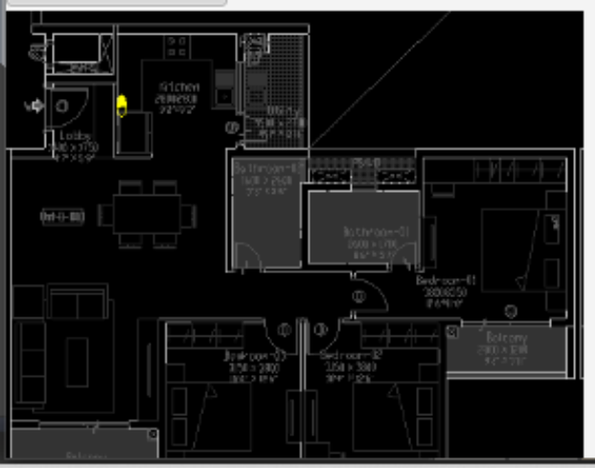

Wall Construction Details

Name	Define Wall	Wall Layers	Thickness(...	Uvalue(W/...	
W1	Material	Cement pl...	13	0	Ad...

S.No.	Wall Layer	Thickness (m...	R Value (K.m...
No content in table			

Add Construction

	S.No.	Wall Name	Layer	U Value
🗑	1	W1	1. Cement plaster (1762 kg/m3) [13.0 mm] 2. Aerated autoclaved concrete (AAC) Block (642 kg/m... 3. Cement plaster (1762 kg/m3) [13.0 mm]	0.687

Wall Area Details

Wall Construction	Orientation	Height (m)	Width (m)	Area (m²)	
W1	N (337.6° - 22...	3	15	45.0	Add Wall

S.No.	Wall Name	Orientation	Height(m)	Width(m)	Area(m²)	Dele
1	W1	N (337.6° - 22.5°)	3.0	15.0	45.0	🗑

HELP !

- Wall definition
- Wall construction
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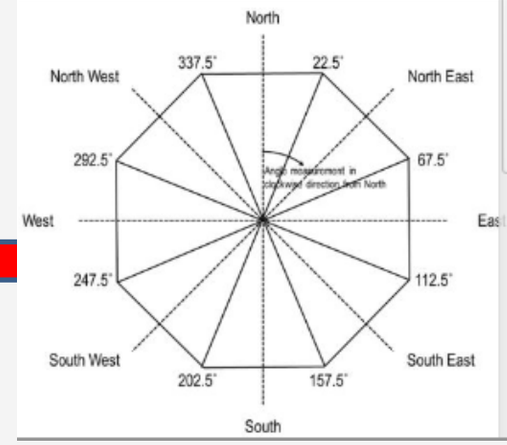
- Wall dimensions

North	337.6° – 22.5°
North-east	22.6° – 67.5°
East	67.6° – 112.5°
South-east	112.6° – 157.5°
South	157.6° – 202.5°
South-west	202.6° – 247.5°
West	247.6° – 292.5°
North-west	292.6° – 337.5°



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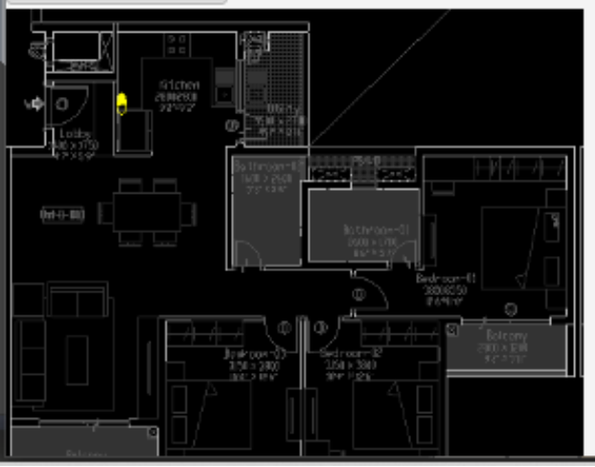

Roof Construction Details

Name	Define Roof	Roof Layers	Thickness(...	Uvalue(W/...	
Roof	Material	Cement pl...	13	0	Ad...

S.No.	Roof Layer	Thickness(...	R-Value (K.m...
No content in table			

Add Construction

	S.No.	Roof Name	Layer	U-Value (...
🗑	1	Roof	1. Cement plaster (1762 kg/m3) [13.0 mm] 2. RCC slab[200.0 mm] 3. Cement plaster (1762 kg/m3)[13.0 mm]	2.681

Roof Area Details

Roof Construction	Length (m)	Width (m)	Area (m²)	
Select				Add Roof

S.No.	Roof Name	Length(m)	Width(m)	Area(m²)	Dele
No content in table					

HELP !

- Roof definition
- Roof construction

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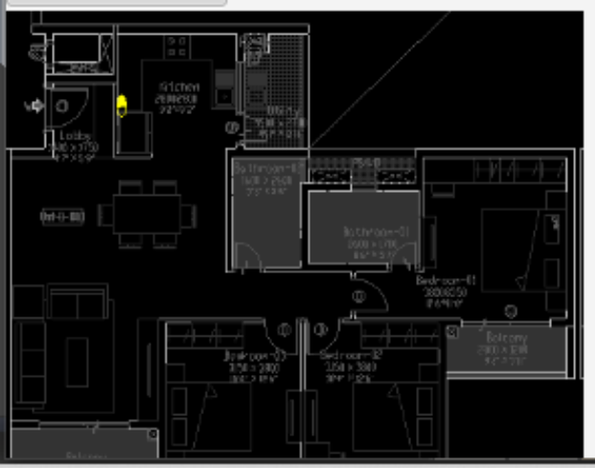

Roof Construction Details

Name	Define Roof	Roof Layers	Thickness(...	Uvalue(W/...	
Roof	Material	Cement pl...	13	0	Ad...

S.No.	Roof Layer	Thickness(...	R-Value (K.m...
No content in table			

Add Construction

	S.No.	Roof Name	Layer	U-Value (...
🗑	1	Roof	1. Cement plaster (1762 kg/m3) [13.0 mm] 2. RCC slab[200.0 mm] 3. Cement plaster (1762 kg/m3)[13.0 mm]	2.681

Roof Area Details

Roof Construction	Length (m)	Width (m)	Area (m²)
Roof	15	15	225.0

Add Roof

S.No.	Roof Name	Length(m)	Width(m)	Area(m²)	Dele
1	Roof	15.0	15.0	225.0	🗑

HELP !

- Roof definition
- Roof construction

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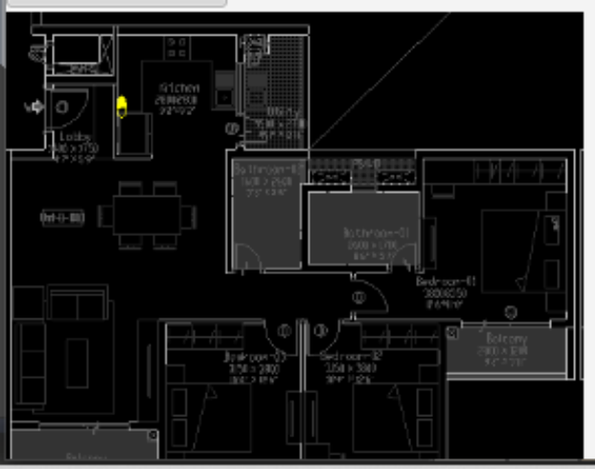

Roof Construction Details

Name	Define Roof	Roof Layers	Thickness(...	Uvalue(W/...	
Roof	Material	Cement pl...	13	0	Ad...

S.No.	Roof Layer	Thickness(...	R-Value (K.m...
No content in table			

Add Construction

	S.No.	Roof Name	Layer	U-Value (...
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Roof Area Details

Roof Construction	Length (m)	Width (m)	Area (m²)	
Roof	15	15	225.0	Add Roof

S.No.	Roof Name	Length(m)	Width(m)	Area(m²)	Dele
1	Roof	15.0	15.0	225.0	🗑

HELP !

- Roof definition
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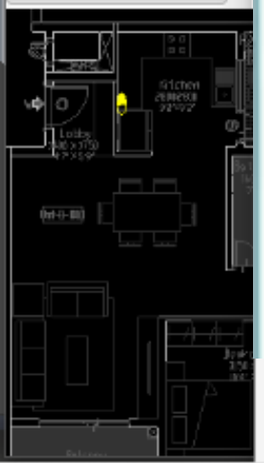

Compliance Result

ECBC-R Compliance Result

Mandatory

	Calculated	Criteria	Status
WFRop (Window to Floor Area Ratio)	22.47	12.5	Compliant
VLT (%) (Visible Light Transmittance)	85.0	27.0	Compliant
Uroof ($W/m^2.K$) (Thermal Transmittance -Roof)	0.47	1.2	Compliant
RETV (W/m^2) (Residential Envelope Transmittance Value)	9.46	15	Compliant

Generate Report

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Compliance

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Trial Project

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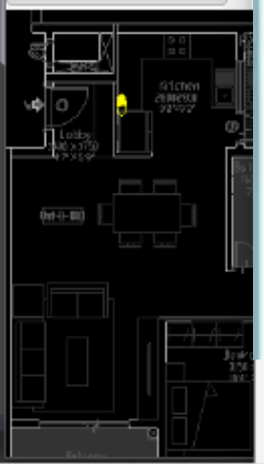

Compliance Result

ECBC-R Compliance Result

Mandatory

WFRop
(Window to Floor Area

VLT (%)
(Visible Light Transmitta

Uroof (W/m².K)
(Thermal Transmittance -

RETV (W/m²)
(Residential Envelope Transmittance Value)

9.46

15

Compliant

Compliant

Compliant

Compliant

Generate Report

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