



**USER MANUAL**

**COMPLIANCE CHECK TOOL FOR  
ECO-NIWAS SAMHITA 2018 (*ENERGY  
CONSERVATION BUILDING CODE FOR  
RESIDENTIAL BUILDINGS*)**

Version 1.4

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## Contents

|     |  |    |
|-----|--|----|
| 1   | Introduction .....   | 4  |
| 1.1 | About ECBC-R compliance tool.....                          | 4  |
| 1.2 | Who Should Use It .....                                    | 4  |
| 1.3 | System Requirement.....                                    | 4  |
| 1.4 | Before Using the tool.....                                 | 5  |
| 2   | Using the ECBC-R Compliance Tool .....                     | 6  |
| 2.1 | Project Information level.....                             | 6  |
| 2.2 | Block Information level .....                              | 8  |
| 2.3 | Window/Ventilator/Door Construction Information Level..... | 9  |
| 2.4 | Window/Ventilator/Door Detailed Information level .....    | 13 |
| 2.5 | Wall Information level .....                               | 15 |
| 2.6 | Roof Information level .....                               | 18 |
| 2.7 | Compliance Results .....                                   | 20 |
| 2.8 | Saving & Opening a Project .....                           | 21 |



## List of Figures

|   |    |
|---|----|
| Figure 1: Project information level .....             | 6  |
| Figure 2: Block information level .....               | 8  |
| Figure 3: Window construction information level ..... | 9  |
| Figure 4: Window detailed information level .....     | 13 |
| Figure 5: Wall information level .....                | 15 |
| Figure 6: Roof information level .....                | 18 |
| Figure 7: Compliance result window .....              | 21 |
| Figure 8: Option for saving a file .....              | 22 |
| Figure 9: Saving a file in desired location .....     | 22 |
| Figure 10: Option for opening a file .....            | 23 |
| Figure 11: Opening a file from file location .....    | 23 |



# 1 Introduction

## 1.1 About ECBC-R compliance tool

With the advent of Energy Conservation Building Code – Residential in the Indian Real Estate sector, there emerged a need of an efficient and quick software mechanism for code compliance evaluation and reporting.

The Energy Conservation Building Code-Residential (ECBC-R) Compliance check tool has been designed to provide the project proponent complete virtual assistance in the form of an easy to use and interactive user interface for evaluating code compliance of the proposed residential building design. It takes the construction details of various building envelope elements such walls, roofs, windows, ventilators & doors as input in dedicated forms and based on the user inputs the code compliance is evaluated. The user has the liberty to check the compliance status of the whole project or an individual category of block based on the preference.

The generated ECBC-R compliance report provides a comprehensive summary of compliance status of all the mandatory compliance criteria of the code, for the proposed design, along with the detailed description of the user inputs for each criterion.

## 1.2 Who Should Use It

The ECBC-R compliance tool has been designed to keep it simple and easy to use; and does not require specific skill (e.g. energy simulation). Following individuals with little or no experience in the area of residential building sector can use this tool:

- Engineers
- Architects
- Consultants
- Residential project contractors

## 1.3 System Requirement

For smooth functioning of this tool, following system configuration is essential:

- Operating System – Windows 7, Windows 8, Windows 10 or Windows 10.1.
- Processor Speed – Pentium 4 (2.0 Ghz or More)
- Memory – RAM (4 GB at least)
- Hard Disk Space – 2 GB
- JAVA SDK v1.8 or latest



## 1.4 Before Using the tool

In order to provide the information required by the tool to check Energy Conservation Building Code- Residential (ECBC-R) compliance of a project, the user must have following details at hand:

- Soft copy/hard copy of the drawings (plans, sections and elevations) of the project to obtain/calculate the built-up area, roof area, orientation and dimensions of all walls, windows and all the shading elements
- Construction details (material layer with thickness) of wall, window, glazing, external door and other openings.



## 2 Using the ECBC-R Compliance Tool

### 2.1 Project Information level

This is the first level of the tool and contains the first-hand information about the project such as the project name, location, climate, total number of residential blocks in the project and their categories.

The screenshot shows the 'Project Information level' of the ECBC-R Compliance Tool. The interface includes a sidebar on the left with a project tree, a main form for project details, and a climate zone reference table and map on the right. Red dashed boxes and numbered callouts (1-16) highlight specific fields and features.

**Project Information Fields:**

- 1. Project Name: Example Project
- 2. State: Gujarat
- 3. City: Rajkot
- 4. Climate: COMPOSITE
- 5. Latitude: < 23.5° N
- 6. Total no. of Residential Blocks: 11
- 7. Block Type for Compliance Check: Block B
- 8. No. of Blocks: 9
- 9. Save
- 10. Save Info
- 11. Block Type for Compliance Check table
- 12. Block Type for Compliance Check table
- 13. Total No. of Block: 9
- 14. Project Name field
- 15. HELP button
- 16. Upload Siteplan button

**Climate zones of India table:**

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

**Map of India:** A map of India showing the five climate zones: Hot dry, Warm humid, Composite, Temperate, and Cold. A legend is provided below the map.

Figure 1: Project information level

**1 Project Name:** Enter the name of the project here.

*For Example: In our Example case, let's take "Example Project" as project name.*

**2 State:** Select the applicable state from the dropdown list.

*For Example: let's take "Gujarat" as project state.*

**3 City:** Select the applicable city from the dropdown list. Select "others", in case the applicable city is not given in the dropdown list and input city name in the appeared text box.

*For Example: let's take "Rajkot" city where the project is situated.*

**4 Climate:** Climate will be auto selected based on location selection. In case of "Other" locations, select the climate from the dropdown list.

**5 Latitude:** Latitude will be auto selected based on location selection. In case of "Other" locations, select the latitude from the dropdown list.



- 6 Total No. of Residential Blocks:** Enter the total number of blocks present in the residential campus.

*For Example: In our project, there are 11 different blocks having two different orientation categories. ECBC-R compliance for whole project can be checked by only checking compliance of any one block from each category, therefore, let's put "2" in the textbox.*

- 7 Block Type for Compliance Check:** Enter the category name of the blocks having same orientation and form factor. Blocks having different orientations should be considered as a separate category (refer ECBC-R).

*For Example: Let's put the block type as "Block B".*

- 8 No. of Blocks:** Enter the number of blocks that fall under the same category based on orientation and form factor.

*For Example: In our project, since there are 9 blocks (Block A to I) having same block category, let's put "9" here.*

- 9 Add Block:** After filling the block category information, press this button. This will add the block category in the table below and also populate the project navigator **13** based on the user inputs.

- 10 Relocate Project:** This feature can be used to relocate the project to a different climatic condition. The user can click on this button and select a different location from **2** and **3** and then double click at project level **13** to relocate the project.

- 11 Blocks Table:** This table lists the different block categories input by the user for compliance evaluation.

- 12 Delete/Edit:** These buttons can be used to delete/edit the block category from the list. Excessive care should be taken while deleting the blocks as this will erase all the relevant construction details from the tool.

- 13 Total No. of Blocks:** This textbox shows the total number of residential blocks added in the table above. The number of blocks in this box should always match with the total no. of residential blocks in **6**

- 14 Project Navigator:** This is the navigation pane where all the project construction level information is displayed. The project navigator is generated once all the project level information is filled by the user and the first block category is added in the table **10**

- 15 Help:** This section provides details about the fundamentals of ECBC-R and relevant help about various form entries.

- 16 Upload Site Plan:** With the help of this button, the user can upload the site plan of the of the proposed project. Please note that, although not mandatory but it is essential that the user uploads the site plan for ready reference.



## 2.2 Block Information level

At this level, the user is required to enter the block level details such as the type or category of dwelling units, number of dwelling units in each category and individual dwelling unit carpet area in square meters. These details are essential to be used for calculating the window to floor area ratio ( $WFR_{op}$ ) for assessing natural ventilation of the block type.

Figure 2: Block information level

- 1 Type of Dwelling Units:** Enter the name of the category of dwelling units present in the block (for example 1-BHK, 2-BHK, Villa, etc.). This should be categorized based on the carpet area per dwelling unit.

*For Example: Let's put the type as "1BHK" here. In other cases, if there are multiple category of dwelling units in the project, mention them separately here.*

- 2 No. of units:** Enter the total number of units present under the mentioned category.

*For Example: In our example, there are 112 dwelling units having same design configuration, therefore, let's put "112" here.*

- 3 Carpet Area/DU (m<sup>2</sup>):** Enter the total carpet area per dwelling unit in sq.m. for the mentioned category.

*For Example: In our example, all the 112 dwelling units have carpet area of 26.6 m<sup>2</sup> each, so let's put "26.6" here.*

- 4 Add:** This button adds the mentioned category of dwelling unit into the calculation as well as in the dwelling units table.





- 5 Block Table:** This table lists the various dwelling unit categories added by the user. The user can delete the entries anytime using the delete button.
- 6 Total Carpet Area (m<sup>2</sup>):** This box represents the total carpet area of the block in sq.m.
- 7 Help:** This section provides details about the fundamentals of ECBC-R and relevant help about various form entries.

## 2.3 Window/Ventilator/Door Construction Information Level

The Window/Ventilator/Door Construction Information level is the master level for defining window details, wherein, user is required to define window construction by entering the various details such as window/ventilator/door area, number of windows/ventilator/doors, glazing properties and opaque element properties. It is also essential to note that these are the criteria based on which the window/ventilator/door construction should be differentiated.

The screenshot shows the 'Window Construction Information Level' interface. It includes a sidebar with a tree view showing 'Window', 'Ventilator', 'Door', 'Wall', and 'Roof'. The main area is divided into sections for 'Window Construction Details', 'Glazing Details', and 'Opaque Elements Details'. Each section contains input fields for various parameters like name, shape, height, width, area, number of windows, type, open/fixed percentage, glazing percentage, material, U-value, SHGC, VLT, and thickness. A table at the bottom lists the details for three windows (W1, W2, W3). On the right, there are diagrams for different window shapes (rectangle, triangle, semi-circle, circle) with labels for height (HT) and width (W). A 'HELP!' button is also present.

| S.No. | Window Name | Window Shape | Height (m) | Width (m) | Area (m <sup>2</sup> ) | No. of Windows | Window Type | % Fixed | % Open |
|-------|-------------|--------------|------------|-----------|------------------------|----------------|-------------|---------|--------|
| 1     | W1          | Rectangle    | 1.6        | 1.2       | 1.92                   | 112            | Casement    | 10.0    | 90.0   |
| 2     | W2          | Rectangle    | 1.3        | 0.8       | 1.04                   | 112            | Casement    | 10.0    | 90.0   |
| 3     | W3          | Rectangle    | 1.6        | 0.8       | 1.28                   | 112            | Casement    | 10.0    | 90.0   |

Figure 3: Window construction information level

### Window Construction Details:

- 1 Window Name:** Enter the name of the window construction here.

*For Example: In our case, there are three different types of windows (W1, W2 & W3) present in each dwelling unit which are exposed to ambient, so let's put the first window name "W1" here.*



- 2 Window Shape:** Select the applicable window shape from the dropdown list.

*For Example: In our case, all the three external windows are rectangular in shape, so let's select "Rectangle" from the dropdown list.*

- 3 Height (m):** Enter the full height of the window construction from sill level to the window head height in meters.

*For Example: In our case, "W1" window height is 1.6 meters so let's put "1.6" in the height textbox.*

- 4 Width (m):** Enter the full horizontal width of the window construction from one end to the other end in meters.

*For Example: In our case, "W1" window width is 1.2 meters so let's put "1.2" in the width textbox.*

- 5 Area (m<sup>2</sup>):** The total area of the window is calculated based on the height & width input by the user. Please note that in case of "other" shape selection, the user needs to input height width and area of the window separately.

- 6 No. of Windows:** Enter the total number of windows present in the project of the mentioned construction.

*For Example: In our case, each dwelling unit has 1 number of "W1" window and there are 112 Dwelling units in the block so let's put "112" in this textbox.*

- 7 Window Type:** Select the applicable window type from the drop-down list (for more details refer ECBC-R).

*For Example: In our case, all three external windows (W1, W2 & W3) are of casement type. So, let's select "Casement" from the dropdown list.*

- 8 % Open:** Enter the percentage of window openable area to the total window area. Generally, the values for casement, sliding 2-doors and sliding 3-door windows are 90%, 66% & 33% respectively.

*For Example: In our case, all three external windows (W1, W2 & W3) are of casement type. So, let's put "90" in the textbox.*

- 9 % fixed:** This field shall be auto-calculated based on the percentage openable value input by the user.

### **Glazing Details:**

- 10 Glazing %:** Enter the net percentage of glazing area present in the window construction.

*For Example: In our case, "W1" window has glass height of 0.53 m and glass width of 1.20 m therefore total glazing area is  $1.20 \times 0.53 = 0.636$  m. Now, since total window*



area is  $1.60 \times 1.20 = 1.92$  m, therefore total glazing percentage is  $(0.636 / 1.92) \times 100 \approx 33\%$ . Let's put "33" here.

**11 Height (m):** Enter the glazing height in meters.

*For Example: In our case, "W1" window has glazing height of 0.53 m. Let's put "0.53" in this textbox.*

**12 Width(m):** Enter the glazing width in meters.

*For Example: In our case, "W1" window has glazing width of 1.20 m. Let's put "1.20" in this textbox.*

**13 Define Glazing method:** Select the glazing property definition method from the dropdown list. In case of "Material", select the appropriate material from the adjacent list and the corresponding thermal properties shall appear in the relevant boxes. In case of "Properties", the user is required to put glazing properties in the relevant boxes.

*For Example: In our case, window glazing is Single clear glass for all the windows. Therefore, we will select definition type as "Material" from the dropdown list. In other cases, if properties such as U value, SHGC & VLT for the glazing system are available to the user, then "properties" should be selected from the dropdown list and values shall be filled in **15**, **16** & **17***

**14 Glazing Material:** This dropdown list contains the different type of glazing materials available in the market. The user can select appropriate material applicable to the project design.

*For Example: In our case, window glazing is Single clear glass for all the windows. Therefore, we will select "Single Glazing" from the dropdown list.*

**15 U-value (W/m<sup>2</sup>.K):** U-value or thermal transmittance of a material indicates its ability to transfer heat through conduction. This field is auto-filled in case "Material" is selected in **13** and is user editable in case of "Properties".

**16 SHGC:** SHGC or Solar Heat Gain Coefficient is the fraction of incident solar radiation admitted through non-opaque component, both directly transmitted, and absorbed and subsequently released inward through conduction, convection and radiation. This field is auto-filled in case "Material" is selected in **13** and is user editable in case of "Properties".

**17 VLT %:** VLT or Visible Light Transmittance is the ratio of total transmitted light to total incident light. It is a measure of the transmitted light in the visible portion of the spectrum through a material. This field is auto-filled in case "Material" is selected in **13** and is user editable in case of "Properties".



### **Opaque Elements Details:**

**18 Opaque %:** This field represents the percentage opaque area of the window and is auto-filled based on the glazing area percentage input by the user.

*For Example: In our case, “W1” window has 33% glazing area, therefore net opaque area shall be  $100\% - 33\% = 66\%$ . Let’s put “66” in this textbox.*

**19 Definition Method:** Select definition method from the dropdown list to define the opaque element properties. The field **20** & **21** shall be disabled in case “Properties” is selected.

*For Example: In our case, all the window and door framing are made up of 4mm thick PVC panel having U-Value of  $5.61 \text{ W/m}^2.\text{K}$ . Therefore, we will select definition type as “Properties” from the list.*

**20 Material Type:** Select the applicable opaque material type from the dropdown list.



**21 Thickness (m):** Enter the thickness of the opaque material in meters.

**22 U-value ( $\text{W/m}^2.\text{K}$ ):** U-value or thermal transmittance of a material indicates its ability to transfer heat through conduction. This field is auto-filled in case “Material” is selected in **20** and is user editable in case of “Properties”.

*For Example: In our case, all the window and door framing are made up of 4mm thick PVC panel having U-Value of  $5.23 \text{ W/m}^2.\text{K}$ . Therefore, let’s put “5.23” in this textbox.*

**23 Add Window:** Press this button to add the window construction in the table.

**24 Window Construction table:** This table lists all the window constructions added by the user. It is to be noted here that this table only shows the construction part details of the window and not shading details.

**25 Delete/Edit (  /  ):**  These buttons can be used to Delete/Edit the window construction. Special care should be taken while deleting a construction as it will also delete the shading components of that construction and the deleted information cannot be retrieved.

**26 Details:** This is one of the **most essential** components of the window Information level. Press this button and specify details of internal/external windows, orientation of window and shading details (*This section is further explained in section 3.4 “Window Detailed Information level”*).

**27 Total No. of Windows:** This textbox shows the total number of windows added in the table above.

**28 Help:** This section provides details about the fundamentals of ECBC-R and relevant help about various form entries.



## 2.4 Window/Ventilator/Door Detailed Information level

At this level, the user is required to input detailed construction level information of the fenestration elements such as windows, ventilators and doors. This form is a dedicated entry for an individual window/ventilator/door construction (*opened by clicking on “Details” button on Window/Ventilator/Door Construction Information Level*) wherein the details such as the opening placement, orientation and its shading details are filled.

| S.No. | No. of Wind. | Shading pres...                     | Overhang                            | Sidefin-L                           | sidefin-R                           | Depth (OH) | Distance (L) | Depth (S) | Distance (S) | Depth (SF) | Distance (S) | ESF-T... | Effective-S... |
|-------|--------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|------------|--------------|-----------|--------------|------------|--------------|----------|----------------|
| 1     | 56           | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | 0.4        | 0.53         | 0.4       | 1.2          | 0.4        | 1.2          | 0.654    | 0.523          |

Figure 4: Window detailed information level

**1 No. of Internal Windows:** Enter the total number of internal windows (windows which are not present on building envelope, but internally, which includes the shaft windows).

*For Example: In our scenario, all the windows are located externally and no internal windows are present. Therefore, let's put "0" in this textbox.*

**2 No. of External Windows:** Enter the total number of external windows which are present on the building envelope.

*For Example: In our case, each dwelling unit has one "W1" window, therefore, there are 112 number of "W1" in total located on the exterior façade of the project. So, let's put "112" in this textbox.*

**3 Select Orientation:** Select all the applicable orientations on which the window construction is present (refer **Internal & External Windows** tab in help section). After selection, a form is generated below for each orientation wherein the user can provide the shading details of the all the openings in that direction.



*For Example: In our case, “W1” window is installed only on the North and South façade of the project. So, let’s select “N” & “S” checkboxes.*

- 4 Total Windows [Orientation]:** This section shows the total number of windows added by the user in the table for a given orientation. The sum of total windows in each orientation should always be equal to the number of external windows in **2**

- 5 No. of Windows:** Enter the total number of windows in a particular orientation with same shading properties.

*For Example: In our case, there are 56 number of “W1” window installed on the North façade of the project having same type of overhang and side-fins. So, let’s put “56” in this textbox.*

- 6 Is Shade Present ☒**: Tick this box in case the window or group of windows have shading present.

*For Example: In our case, all the “W1” windows have shading installed on the North façade of the project. So, let’s select this checkbox.*

- 7 Overhang ☒**: Tick this option in case there is an overhang present above the opening. Enter the depth of overhang and distance from the window in the text boxes present below.

*For Example: In our case, all the “W1” windows have overhangs installed on the North façade of the project. So, let’s select this checkbox and enter the overhang depth/extrusion (0.4m) and distance between overhang lowest surface to bottom of glass (0.53m) in the textboxes below.*

- 8 Side Fin-Left ☒**: Tick this option in case there is a side-fin present on the left side of the opening. Enter the depth of fin and distance from the window in the text boxes present below.

*For Example: In our case, all the “W1” windows have left side-fin installed on the North façade of the project. So, let’s select this checkbox and enter the left side-fin’s depth/extrusion (0.4 m) and distance between left side fin’s inner surface to other end of glass (1.20 m) in the textboxes below.*

- 9 Side Fin-Right ☒**: Tick this option in case there is a side-fin present on the right side of the opening. Enter the depth of fin and distance from the window in the text boxes present below.

*For Example: In our case, all the “W1” windows have right side-fins installed on the North façade of the project. So, let’s select this checkbox and enter the right side-fin’s depth/extrusion (0.4 m) and distance between right side fin’s inner surface to other end of glass (1.20 m) in the textboxes below.*





- 10 Add (+):** Click this button to add the shading properties for the group of windows in the shading table.
- 11 Shading Details Table:** This table lists all the shading details for a cluster of windows added by the user along with the computed effective SHGC and the external shading factor (ESF).
- 12 Delete/Edit (🗑️/✎):** Click this button to delete/edit the window shading group from the shading details table.
- 13 Save:** Click this button to save the form. Please note that the form could only be saved when the sum of total external and internal window number on the form matches with the total number of windows entered at window construction information level.
- 14 Help:** This section provides details about the fundamentals of ECBC-R and relevant help about various form entries.

## 2.5 Wall Information level

The wall information level contains the information related to the opaque wall construction details of the project. It has two main sections: **wall construction details** and **wall area details**. The **wall construction details** section allows the user to make different construction assemblies based on material layers as well as properties (U value). In the **wall area details** section, these wall construction assemblies created by the user can be used to define wall area in different orientations.

The screenshot displays the 'Wall Information level' interface. On the left, a sidebar shows a project tree with 'Block B' selected. The main area is divided into two sections: 'Wall Construction Details' and 'Wall Area Details'.

**Wall Construction Details:** This section includes a table for defining wall layers. The table has columns for S.No., Wall Layer, Thickness (mm), and U Value (W/m².K). A 'Define Wall' button is present. Below the table, there is a 'Wall Name' field and a 'U Value (W/m².K)' field. A 'Add Construction' button is also visible.

**Wall Area Details:** This section includes a table for defining wall areas. The table has columns for S.No., Wall Name, Orientation, Height (m), Width (m), and Area (m²). A 'Wall Construction' dropdown menu is present. Below the table, there is a 'Wall Name' field and a 'U Value (W/m².K)' field. A 'Add Wall' button is also visible.

On the right side, there is a 'Wall orientation' section with a table for defining orientations. The table has columns for Orientation and Range (0° being north and 90° being east). Below the table, there is a compass rose diagram showing the orientation of the walls.

Figure 5: Wall information level



### Wall Construction Details:

**1 Wall Name:** Enter the name of the wall construction here.

*For Example: In our case, Let's make a wall construction named "Wall1".*

**2 Define Wall:** Select definition method from the dropdown list to define the method of wall definition. The field **5** shall be disabled in case "Material" is selected and **3** & **4** shall be disabled in case of "Properties".

*For Example: In our case, all the external walls are made up of 200 mm AAC blocks with plaster on both sides. So, we will define our wall using materials and corresponding thickness, therefore, let's select "Material" from the list here.*

**3 Wall Layers:** Select the applicable material layer from the dropdown list.

*For Example: In our case, there is an AAC Block layer of 200 mm, so let's select "Aerated Autoclaved Concrete (AAC) block" from the layers list.*

**4 Thickness (mm):** Enter the thickness of the material layer in millimeters.

*For Example: In our case, the thickness of AAC Block layer is 200 mm, so let's put "200" in this textbox.*

**5 U-value (W/m<sup>2</sup>.K):** U-value or thermal transmittance of a material indicates its ability to transfer heat through conduction. In case the user selects "Properties" for wall definition method, it is required to enter the equivalent U-value in Watt-per-square-meter-Kelvin for the wall assembly here and directly click on the "Add Construction" button **8** to add the equivalent wall construction in the wall construction table, the "Add Layer" button **6** shall be disabled during wall definition through "Properties".

*For Example: In our case, U value shall be auto calculated based on the thermal conductivity of the material selected to define the wall layer and corresponding thickness. In case user selects "properties" from **2** then equivalent U-value of the wall construction needs to be given in this textbox.*

**6 Add Layer:** Click this button to add the current wall layer to the wall assembly table **7**

**7 Wall Assembly Table:** This table contains the details of all the layers used to define a particular wall assembly.

**8 Add Construction:** Clicking this button will add all the layers present in the wall assembly table as a unique wall construction along with calculated equivalent U-value in the wall construction table.

**9 Wall Construction Table:** This table contains the details of all the wall constructions created by the user along with their equivalent U values in W/m<sup>2</sup>K for defining project wall area.





**10 Delete (X):** Click this button to delete the wall construction element from the construction table. Please note that once the construction is deleted from the table, it cannot be further retrieved.

### **Wall Area Details:**

**11 Wall Construction<sup>1</sup>:** Select the applicable construction element from the dropdown list to define the wall area in a particular direction.

*For Example: In our case, we have made “Wall1” as wall construction with 200mm AAC block. Let’s select “Wall1” from the list and use this construction to define wall area for all the external walls of the project.*

**12 Orientation:** Select the applicable wall orientation from the dropdown list. Please note that currently only one wall can be added in one orientation.

*For Example: In our case, the project has four exterior walls in North, South, East and West direction. We will define each wall area one by one, therefore, let's select “North” first from the list.*

**13 Height (m):** Enter the height of the wall in the selected direction in meters.

*For Example: In our case, all the four exterior walls in North, South, East and West directions have a height of 21.06 m. Therefore, let's put “21.06” in this textbox.*

**14 Width (m)<sup>2</sup>:** Enter the height of the wall in the selected direction in meters.

*For Example: In our case, the exterior walls in North & South directions have a width of 51.58 m & in East and West directions have a width of 31 m. Therefore, let's put “51.58” in this textbox.*

**15 Area (m<sup>2</sup>):** The area of the wall shall be auto calculated based on the height and width input by the user.

**16 Add Wall:** Click this button to add the defined wall to the wall area table **17**

**17 Wall Area Table:** This table lists down wall area details of the project in every orientation as input by the user.

**18 Help:** This section provides details about the fundamentals of ECBC-R and relevant help about various form entries.

-----  
**Note:**

<sup>1</sup>Currently, the ECBC-R compliance tool facilitates definition of only one wall type per orientation. This has been restricted, keeping in view, the complications that may arise in calculation of the Residential Envelope Transmittance Value (RETV) with multiple wall types on a single orientation. Nevertheless, this restriction will be removed in the later versions of this tool.

<sup>2</sup>In cases where there are different wall areas for different floors, equivalent width needs to be considered for defining wall area.



For example, if a 5-floor project is having following wall dimensions in any orientation:

|                        | Wall Height (m) | Wall Width (m) | Wall Area (m <sup>2</sup> ) |
|------------------------|-----------------|----------------|-----------------------------|
| <b>Floor 1</b>         | 3.5             | 25             | 87.5                        |
| <b>Floor 2</b>         | 3               | 25             | 75                          |
| <b>Floor 3</b>         | 3.7             | 20             | 74                          |
| <b>Floor 4</b>         | 4               | 22             | 88                          |
| <b>Floor 5</b>         | 3.5             | 21             | 73.5                        |
| <b>Total Wall Area</b> |                 |                | <b>398</b>                  |

Then, Total Height of the wall = 3.5m + 3m + 3.7m + 4m + 3.5m = **17.7 m**

And **equivalent width** is = Total Area / Total Height = 398 / 17.70 = **22.48 m**

## 2.6 Roof Information level

The Roof information level contains the information related to the roof construction details of the project. It also has two main sections: **roof construction details** and **roof area details**. The **roof construction details** section allows the user to make different roof construction assemblies based on material layers as well as properties (U value). In the **roof area details table**, these roof construction assemblies created by the user can be used to define Roof Area of the project.

Figure 6: Roof information level

### Roof Construction Details:

**1 Roof Name:** Enter the name of the roof construction here.

For Example: In our case, Let's make a wall construction named "Roof1".



- 2 Define Roof:** Select definition method from the dropdown list to define the method of roof definition. The field **5** shall be disabled in case “Material” is selected and **3** & **4** in case of “Properties”.

*For Example: In our case, the roof is made up of seven different layers. So, we will define each layer one by one along with its corresponding thickness, therefore, let's select “Material” from the list here.*

- 3 Roof Layers:** Select the applicable material layer from the dropdown list.

*For Example: In our case, the first roof layer is “China Mosaic Tiles”. Therefore, let's select “China Mosaic Tiles” from the list.*

- 4 Thickness (mm):** Enter the thickness of the material layer in millimeters.

*For Example: In our case, the first roof layer of “China Mosaic Tiles” is 7mm thick. Therefore, let's put “7” in this textbox.*

- 5 U-value (W/m<sup>2</sup>.K):** U-value or thermal transmittance of a material indicates its ability to transfer heat through conduction. In case the user selects “Properties” for roof definition method, it is required to enter the equivalent U-value in Watt-per-square-meter-Kelvin for the roof assembly here and directly click on the “Add Construction” button **8** to add the equivalent roof construction in the roof construction table, the “Add Layer” button **6** shall be disabled during roof definition through “Properties”.

*For Example: In our case, U value shall be auto calculated based on the thermal conductivity of the material selected to define the roof layers and corresponding thickness. In case user selects “properties” from **2** then equivalent U-value of the wall construction needs to be given in this textbox.*

- 6 Add Layer:** Click this button to add the current roof layer to the roof assembly table **7**

- 7 Roof Assembly Table:** This table contains the details of all the layers being used to define a particular roof assembly.

- 8 Add Construction:** Clicking this button will add all the layers present in the roof assembly table as a unique roof construction object along with calculated equivalent U-value in the roof construction table.

- 9 Roof Construction Table:** This table contains the details of all the roof constructions created by the user along with their equivalent U values in W/m<sup>2</sup>K for defining project roof area.

- 10 Delete (■):** Click this button to delete the roof construction element from the construction table. Please note that once the construction is deleted from the table, it cannot be further retrieved.



### Roof Area Details:

- 11 Roof Construction:** Select the applicable roof construction type from the dropdown list to define the roof area.

*For Example: In our case, we have made “Roof1” as roof construction with 7 different layers. Let’s select “Roof1” from the list and use this construction to define roof area for the project.*

- 12 Length (m):** Enter the length of the roof in the selected direction in meters.

*For Example: In our case, the project has roof length of 31 m. Therefore, let’s put “31” in this textbox.*

- 13 Width (m):** Enter the height of the roof in the selected direction in meters.

*For Example: In our case, the project has roof width of 51.58 m. Therefore, let’s put “51.58” in this textbox.*

- 14 Area (m<sup>2</sup>):** The area of the roof shall be auto calculated based on the length and width input by the user.

- 15 Add Roof:** Click this button to add the defined roof to the roof area table.

- 16 Roof Area Table:** This table lists all the roof area details of the project as input by the user.

- 17 Help:** This section provides details about the fundamentals of ECBC-R and relevant help about various form entries.

## 2.7 Compliance Results

After filling up the required entries in the tool, the user can check the ECBC-R compliance status of the project by clicking on the “**Check Compliance**” button available at the project information level as well as the block level. The compliance results window shows the compliance status of all the four mandatory components of the ECBC-R i.e., **Window-to-floor area ratio ( $WFR_{op}$ )**, **Visible light transmittance (VLT)**, **Roof Thermal Transmittance ( $U_{roof}$ )** and **Residential Envelope Transmittance Value (RETV) / Thermal Transmittance Envelope ( $U_{envelope,cold}$ )** (In case of cold climate).

A comprehensive report depicting the construction details of the project as well as the compliance status of each block can be generated in portable document format by clicking on the “**Generate Report**” button located on the results panel.

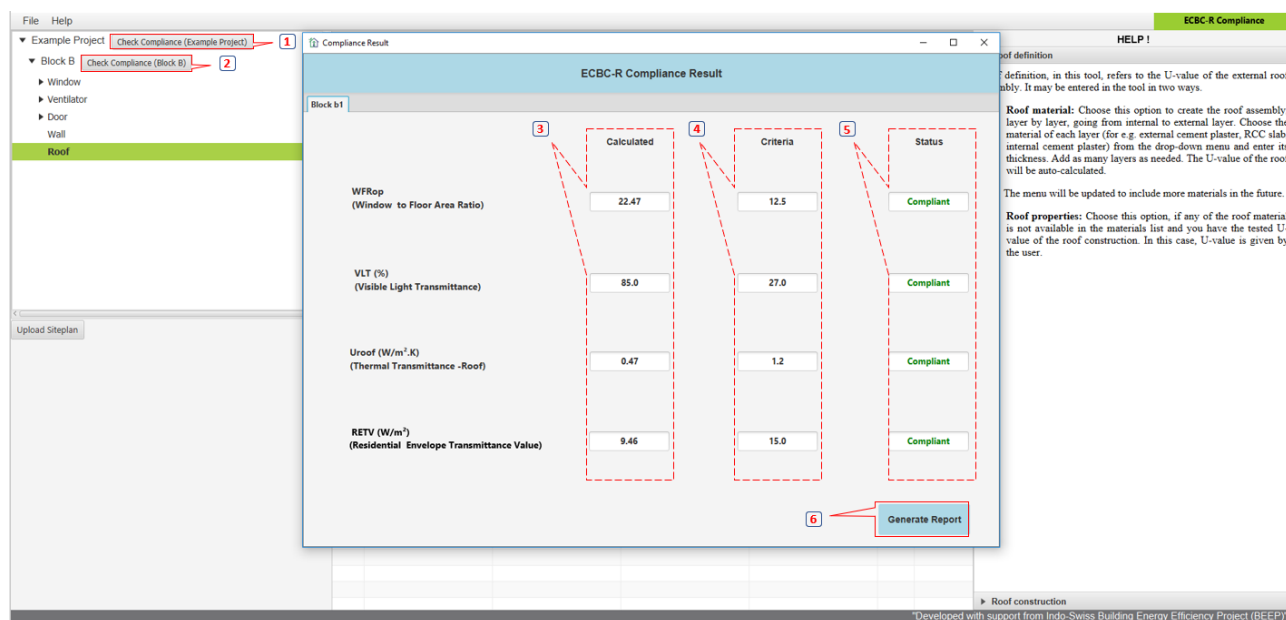


Figure 7: Compliance result window

- 1 Check compliance (Project Level):** Click this button to check the ECBC-R compliance status of the whole project.
- 2 Check compliance (Block Level):** Click this to check the ECBC-R compliance status of individual block.
- 3 Calculated Value:** This column shows the tool calculated values of all the mandatory components of ECBC-R.
- 4 Criteria:** This column shows the prescribed limiting value of all the mandatory components of the ECBC-R.
- 5 Status:** This column shows the compliance status of each component of the ECBC-R.
- 6 Generate Report:** Click this button to generate the ECBC-R compliance report in portable document format. After the click, a pop-up window for saving the file shall appear where user can select the desired location to save the file. This generated report contains all the required information related to user input data during the ECBC-R compliance check (including construction level information) along with the compliance status at project as well as block level.

## 2.8 Saving & Opening a Project

After filling up the required entries in the tool, in case the user wants to save the project details for later use and reference, there are provisions in the tool to save the current project



as well as open a previously saved file. The files are saved with the “**ecbcr**” extension for easy identification. There procedure for saving and opening a file is given below:

### Saving a file:

- 1- To save a project, click on the file menu at the top left corner of the tool and select **Save**.

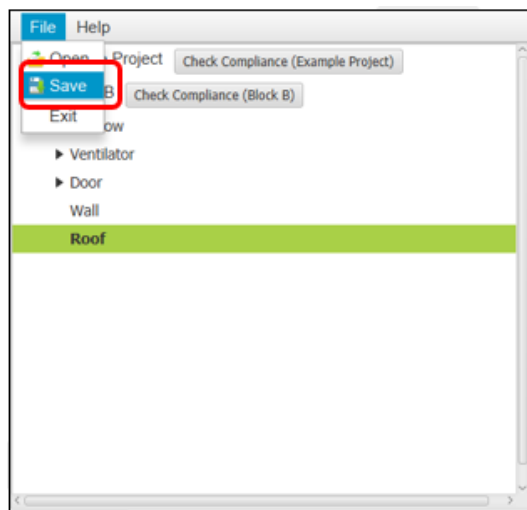


Figure 8: Option for saving a file

- 2- A pop-up window will ask for the required location to save the project file. Navigate to the desired location, give the project file a name and click on **Save**.

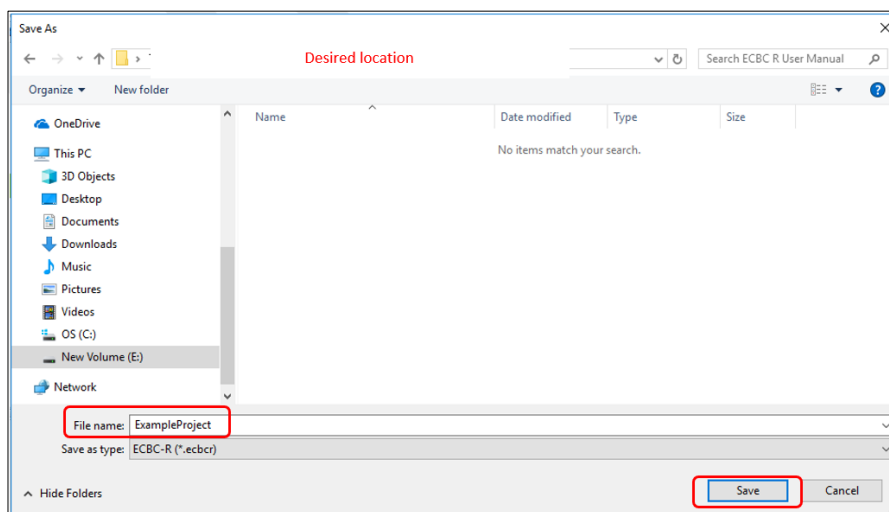


Figure 9: Saving a file in desired location

### Opening a file:

- 1- To Open a project, click on the file menu at the top left corner of the tool and select **Open**.

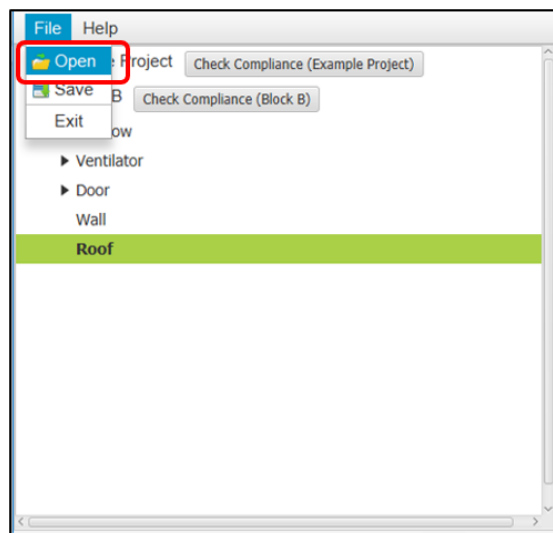


Figure 10: Option for opening a file

- 2- A pop-up window will ask for the file location. Navigate to the desired location, select the project file name and click on **Open**.

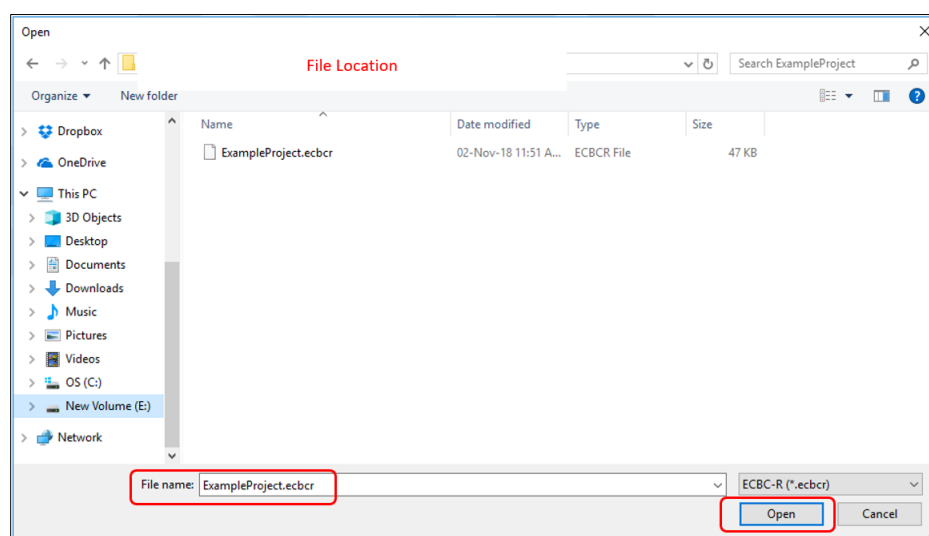


Figure 11: Opening a file from file location

**\*\*Important Note:** While opening a previously saved file, make sure to double click at the project level in the tool after clicking on “**Open**” to successfully load the selected file in the ECBC-R compliance tool, failing which the information of the opened file shall not be visible to the user.

For any question and suggestion on this tool please send an email to [pmtu@beepindia.org](mailto:pmtu@beepindia.org)