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Trial Support
Material

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Natural Ventilation
(MacroFlo)

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MacroFlo is used for analysing natural ventilation in buildings, including mixed mode operation (with a direct link to ApacheHVAC air system modelling). It uses a zonal airflow model to calculate bulk air movement in and through the building, driven by wind and buoyancy induced pressures.

The preparation of input data consists of setting the airflow characteristics of openings in the building (windows, doors and holes).

This is similar to setting construction data for building elements, but it is considerably simpler, since its sole purpose is the setting of airflow data for openings.

The simulation program itself is run from within the **Apache** view.

Find out more at <https://help.iesve.com/ve2019/macroflo.htm>

Create Window Types and Use Profiles as Controllers



MACROFLO OPENINGS DATABASE MANAGER

This opens a window where new opening types can be created by working from the top down.

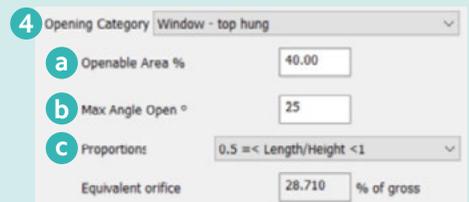
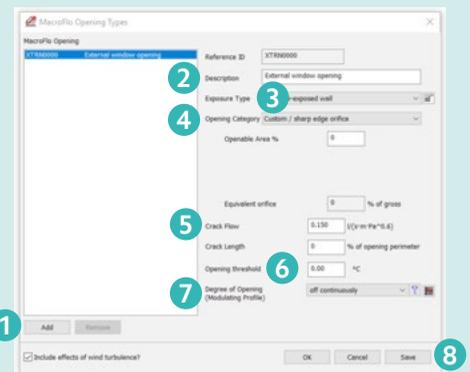
Opening categories can be used to specify information relevant to some standard opening types and have the performance data automatically included in the simulation or else custom/sharp edge orifice may be chosen to input these characteristics directly. The database is based on manufacturer data and wind tunnel tests.

To create a new opening type, the simplest option is:

1. Click on **add**, and a copy will be made of whichever opening type is highlighted in the left hand window. Make sure to select the new copy before you start to edit the opening.
2. Give it a new **description** that is a good reference for later reports. You may want to re-name the default opening as closed, because that is what the off continuously profile sets it to.
3. Select a suitable **Exposure Type** from the drop-down list to specify the exposure of the opening to wind pressures. The button to the right opens a window listing the wind pressure coefficients for each exposure type. Remember that the same window used at different places in the project will need different opening types assigned to it as the exposure varies across the project. The descriptors short and long in this instance refer to the overall footprint shape of a building – the short side versus the long side of the whole building.
4. Select the **Opening Category** of this window. To specify a realistic opening type in terms of real air resistance, complete the sub-categories too, for the software to calculate an equivalent orifice.
 - a. Set the **Openable Area %** of the window for the software to calculate the Equivalent Area as a % of the gross opening area as drawn in ModelIT.
 - b. Set the **Max Angle Open** in degrees.
 - c. Set the horizontal:vertical **proportions** of the opening.

Find out more at https://help.iesve.com/ve2019/macroflo_opening_types.htm

5. It is generally simplest to leave the **crack flow** default setting and the crack length set to zero, and then account for infiltration under the air exchange tab of the thermal template in the BTM.
6. The **opening threshold** sets an internal temperature threshold: when this is reached, the window will open. Once open, the profile for opening will take control, so if it switches off before midnight, then the window will close, but if not, the window will close at midnight for the start of the next daily cycle. As such, it is better to set this parameter as part of a formula driven profile, so leave it as zero.
7. Enter the opening profile under Degree of Opening. This can be a function driven profile, or one aligned to occupancy, or other hourly based **profile**, as set in Apache.
8. Remember to click on **Save**.



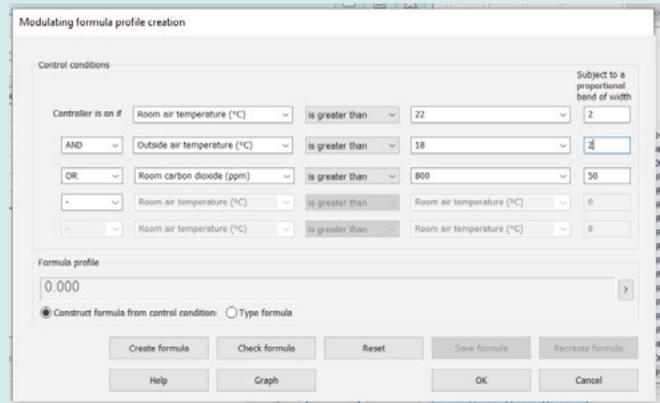


APACHE PROFILE DATABASE MANAGER

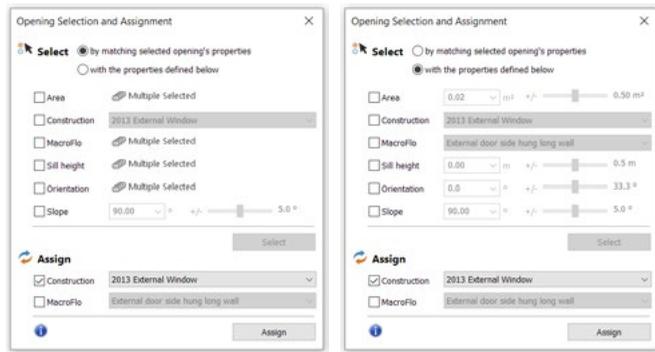
This is a quick access button to create or edit the **apache profiles** in the project.

Windows are a good place to use formula profiles as controllers, for example opening the window if the inside air temperature is above a set limit, and the outside air temperature is too, or the internal CO₂ is too high.

It is important to apply a bandwidth to the controllers so that the window does not open/close too many times in a given time period as the temperature changes.



Select and Assign Windows



If you return to the ModelIt application, you can make use of this icon to select opening by criteria and assign MacroFlo opening and construction types. This icon will be visible even if you have not selected the model, as, by default, it references all spaces in the model.

It will open a table, where you can choose from 2 methods of selection: either, by matching the properties of selected openings, or by defining the properties to use to make the selection. If you choose to match the properties, you need to select an opening, then choose which of that opening's properties you are wanting to apply as selection criteria.

Once you are happy with the selection set, which will be reflected in your model, you go into the bottom half of the window to assign properties, and select which construction property and which MacroFlo opening type you would like to apply to the selected openings.

Assign Window Types

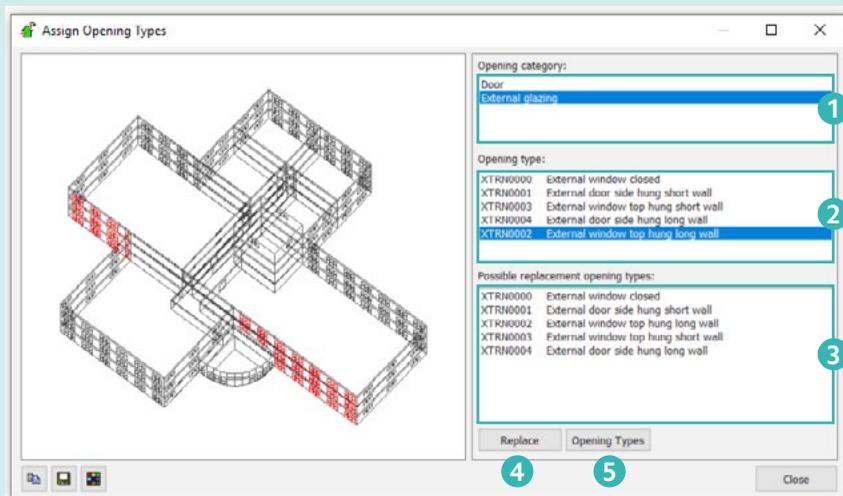


TABULAR MACROFLO DATABASE

The tabular database displays all the information on the different opening types used in the model.

- The data can be easily compared across openings and edited within the database.
- All information can be copied to or from a spreadsheet for record keeping and to aid model creation.

Ref ID	Description	Exposure Type	Opening	Openable Area %	Max Angle Open	Proportions	Equivalent Opaque Area (% of Gross)	Crack Flow Co-efficient (W/mPa ^{0.5})	Crack Length (% of Opening Perimeter)	Opening Threshold (°C)	Degree of C
XTRN0004	External door side hung long wall	18 semi-exp long wall	Window / door - side hung	95.00	90.000	Length/Height < 0.5	90.065	0.15	0.000	0.00	Window opening
XTRN0001	External door side hung short wall	18 semi-exp short wall	Window / door - side hung	95.00	90.000	Length/Height < 0.5	90.065	0.15	0.000	0.00	Window opening
XTRN0000	External window closed	05 semi-exposed wall	Custom / sharp edge ovf.	0.00	-	-	0.000	0.15	0.000	0.00	off continuously
XTRN0002	External window top hung long wall	18 semi-exp long wall	Window - top hung	40.00	25.000	0.5 → Length/Height...	20.710	0.15	0.000	0.00	Window opening
XTRN0003	External window top hung short wall	18 semi-exp short wall	Window - top hung	40.00	25.000	0.5 → Length/Height...	20.710	0.15	0.000	0.00	Window opening



EDIT SELECTION SET OPENING TYPES

This window lets you graphically assign opening types within the project.

On the left of the dialogue a graphic of the selection set is shown. At model and space level, the graphic uses the same view rotation as the active model window, so it is usually easier to see the various elements if you select an Axonometric view in the active model window before using this tool.

- If more than one element category is represented in the selection set, it is first necessary to select one of these categories from the list headed **Opening category (1)**. Any edits will be applied only to elements (openings) in the selected category.
- Under the heading **Opening Type (2)** you will see a list of the opening types currently assigned to the selected openings. By clicking on each opening type in turn, you will be able to identify the openings where the opening type is used. These openings are highlighted red on the wireframe preview model.
- At any stage in this inspection process, you may replace all the highlighted instances of the selected opening type with another opening type. To do this, click on the desired replacement opening type in the list headed **Possible replacement opening types (3)**, and then click on **Replace (4)**.
- If you need to create or modify opening types during this process, you can open the MacroFlo Opening Types dialogue by clicking on the **Opening Types (5)** button.

Check Window Assignment



INPUT DATA VISUALISATION

This data visualisation is useful for checking assigned data in the model.

Choose the variable you would like to check,

eg. opening category, under openings.

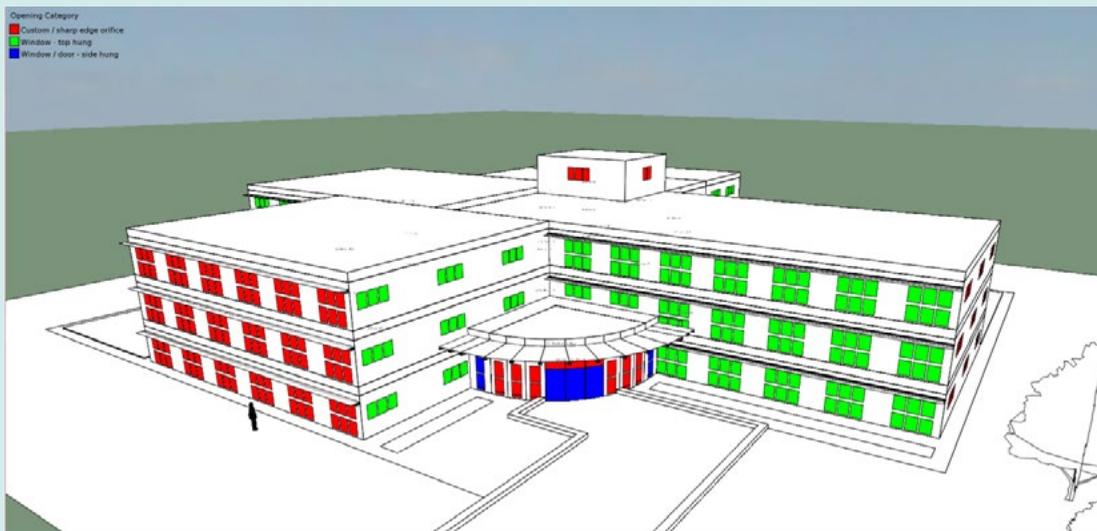
If desired choose an exploded view of the model.

It is generally best to set the windows to opaque, so that you don't see through them to the internal surfaces.

When you click **Apply**, model viewer will automatically open, so that you can review your model in 3D.

Find out more at https://help.iesve.com/ve2019/macroflo_modelviewer_ii.htm#

Remember that you can also check the construction applied to each window by using the input data visualisation tool in Apache.



Wind Driven Airflow

If your building will rely primarily on natural ventilation, it is useful to view the wind rose and MacroFlo results in Vista to review the design. This will let you see the combined effect of wind-driven and buoyancy driven ventilation.