

## Tutorial and Troubleshooting Guide – TEMPERATURE CHECK AND THERMAL COMFORT REPORT PLUGIN

Please remember that the plugin is only a calculation tool. It is up to you to ensure that you are following all relevant NCC procedures, including setting up your building model correctly and verifying the calculated results produced by the plugin.

*You can also refer to the tutorial video available through the DesignBuilder Australia website.*

### Introduction

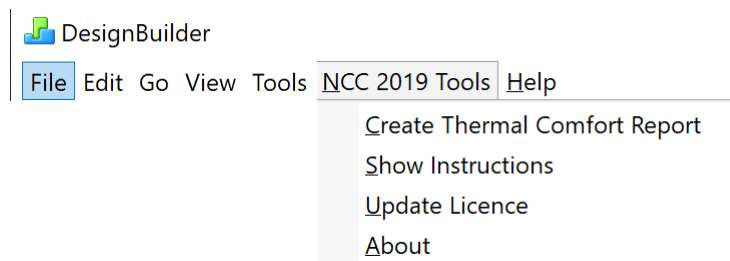
All verification methods in the 2019 NCC Section J include a check of thermal comfort levels during the hours of operation of the building. In addition, Specification JVb requires that when modelling a reference building, the air conditioning must be shown to meet target temperatures during hours of operation. The definition of *hours of operation* in the NCC is hours where the occupancy of the space is greater than 20% of the maximum. There are prescribed occupancy schedules for each building class listed in the NCC, and so there are prescribed hours of operation for each building class.

The temperature range check and thermal comfort report plugin for DesignBuilder will assist you in quickly and easily calculating the total number of hours each occupied space in your building model meets the target temperature and thermal comfort values, and whether or not the building as a whole meets the temperature and thermal comfort requirements in the NCC.

### Plugin installation

To install the plugin, download the plugin installer package from the DesignBuilder Software Australia website and extract the files. Make sure DesignBuilder is closed then run the setup.exe file.

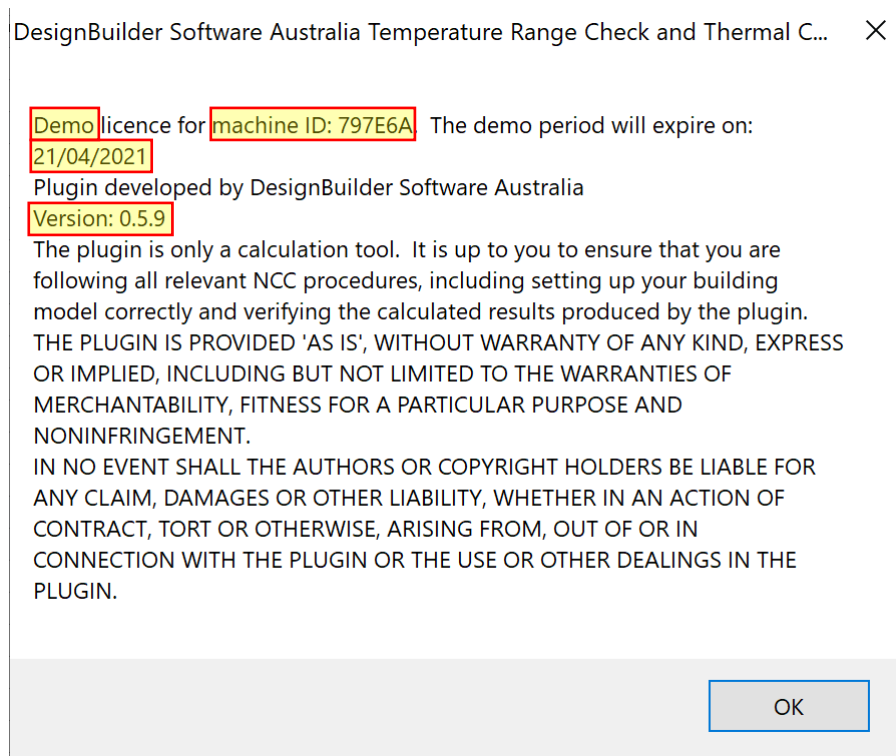
When you have installed the plugin, and restarted DesignBuilder, you will see a new item on the main DesignBuilder menu bar:



You use this menu to generate the temperature check and thermal comfort report, but before you can generate a report, you will need to set up your building model and simulation options to produce the data needed by the plugin. Detailed instructions on how to do this are in this document, and a short version is always available for reference by selecting Show Instructions on the menu. You can also refer to the tutorial video available through the DesignBuilder Australia website.

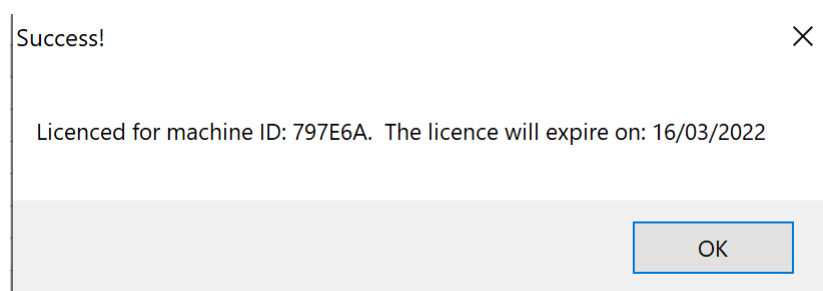
When you first install the plugin, it will be a demonstration version. You have 30 days to evaluate the plugin before you must start using a paid licence. You will need to send your unique machine ID to DesignBuilder

Software Australia when you are ready to purchase an licence – you can view your machine ID and the expiry date of the demo period using the ‘About’ plugin menu option:



The plugin will only be installed for the current user – if you want to use the plugin on multiple user accounts on the same computer, you must install the plugin in each account. Only one user needs to update the licence to a paid licence, however – the licence is shared between all users on the same computer.

When you have purchased a paid licence, select the menu option ‘Update Licence’ and browse to the file sent to you by DesignBuilder Software Australia. If the licence is installed successfully, you will see the following type of message:



## Plugin uninstallation

To uninstall the plugin, click on the Windows key, then select Settings|Apps. You will find the plugin listed under “Design Builder Software Australia Temperature Check and Thermal Comfort Report Plugin” in the list of installed applications. When you click on the plugin name, choose ‘Uninstall’. Your plugin licence is preserved when you uninstall, so you can reinstall the plugin later. Uninstalling the plugin on one user account will not affect other users on the same computer.

## Renewing your plugin licence or moving the licence to another computer

Please see the additional document: “Licence Renewal Guide” available on the DesignBuilder Software Australia website.

## Preparing to generate a report

Before you can generate a temperature check and thermal comfort report with the plugin, you must set up the building model and calculation options. These changes ensure that the simulation data output by DesignBuilder for an annual simulation contains all the information required by the plugin to generate the report. Once you have made these changes, you can continue to edit your building model and work in DesignBuilder as usual. If you need to generate another report, just make sure that you first run an annual simulation with the calculation options described below. You must do this to make sure that the data used by the plugin reflects the current state of the building model.

## Setting up the building model

To set up your building model so that the plugin can generate a report, you must identify all occupied spaces and their corresponding NCC building class. Each occupied space should have its activity and air conditioning schedules set up so that they are consistent with the assigned building class and use of the space (i.e matching the appropriate Section Jvc modelling profile). The hours of operation included in the temperature check and thermal comfort analysis for each building class are listed in the document ‘NCC 2019 Schedules used in the Thermal Comfort Report plugin’ available on the DesignBuilder Software Australia website.

The plugin needs to identify the NCC building class for each occupied zone to correctly analyse the temperature and thermal comfort values for the *hours of operation* of each space. This is done by including a fixed phrase in the occupancy schedule name for each space that identifies the building class.

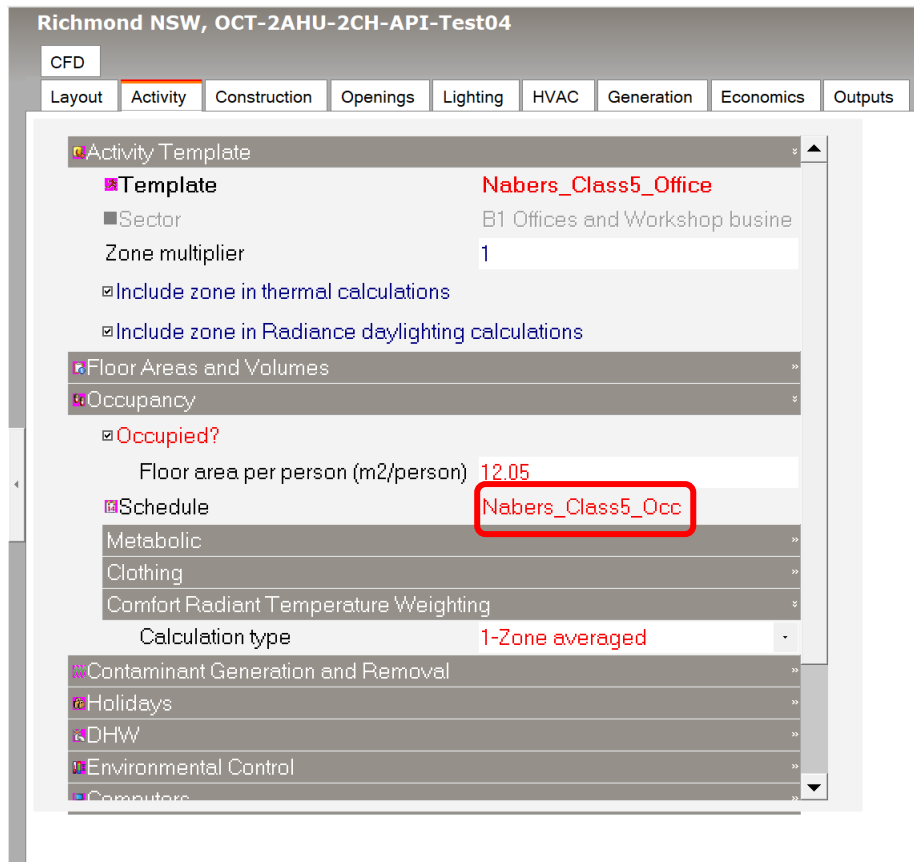
NCC Building Class	Schedules and Hours of Operation based on NCC Jvc	Text to include in Occupancy Schedule name
Class 2	Table 2a	CLASS2
Class 3	Table 2b	CLASS3
Class 5	Table 2c and 2d	CLASS5
Class 6 (shop)	Table 2e	CLASS6-SHOP
Class 6 (restaurant)	Table 2f	CLASS6-RESTAURANT
Class 7	Table 2c and 2d	CLASS7
Class 8	Table 2c and 2d	CLASS8
Class 9a (clinic)	Table 2c and 2d	CLASS9A-CLINIC
Class 9a (ward)	Table 2g	CLASS9A-WARD
Class 9b (conference)	Table 2i	CLASS9B-CONFERENCE
Class 9b (school)	Table 2j	CLASS9B-SCHOOL
Class 9c	Table 2k	CLASS9C
n/a	n/a	DONOTREPORT

You can quickly check these phrases while you are working by referring to the Instructions available via the plugin menu. Note that the phrase can appear anywhere in the occupancy schedule name. Use ‘DONOTREPORT’ to mark zones that have an occupancy schedule, but which should not be included in the temperature check and thermal comfort analysis. Zones marked ‘DONOTREPORT’ and any zones with unrecognised building class will be listed at the top of the report, but not included in the report tables or the pass/fail analysis (i.e they will not count towards total floor area).

The plugin does not read or check any of the schedules in your building model. **Make sure that activity (occupancy, lighting and equipment) schedules MATCH the building class indicated in the occupancy schedule name for each space.** If this is not the case, you may get unexpected results from the plugin – see the Troubleshooting section for an example. Please check this carefully.

### Example

In the following example, the zone is an office space and the corresponding NCC building class is Class 5. The name of the zone occupancy schedule must include the text “CLASS5”. The occupancy schedule name “NABERS\_Class5\_Occ” contains the text “CLASS5”, and so this zone will be analysed with the hours of operation corresponding to a NCC Class 5 space (NCC Jvc Table 2c and 2d).



#### **Zones with transitory occupancy (new in v.0.5.7)**

Some conditioned zones in the model may have transitory occupancy. These zones must meet different criteria to pass the temperature check during hours of occupation (NCC Jvb 2c (i) A). These zones are not analysed for thermal comfort. To indicate that a zone has transitory occupancy, include the text ‘TRANSITORY’ in the schedule name in addition to the text identifying the building class (the building class specifies which hours are hours of occupation). For example, a transitory zone in a Class 5 building could be indicated with an occupancy schedule name of ‘Nabers\_Class5\_Transitory\_Occ’. In the generated report, the building class will be shown as “Class 5 (TO)”.

## Setting calculation options

Before you run a simulation, you also need to set some options to make sure that DesignBuilder calculates and outputs the hourly temperature and thermal comfort values used in the report.

When you select Update to run a simulation, on the General tab of the Calculation Options screen, first make sure that you are running an annual simulation by checking the dates in the Simulation Period. Next, make sure that "Hourly" is selected under Output Intervals for Reporting. You can have other options selected as well.

Edit Calculation Options

**Calculation Options**

General Options Output Simulation Manager

Calculation Description

Simulation Period

From

Start day	1
Start month	Jan

To

End day	31
End month	Dec

Run simulation for multiple years

Output Intervals for Reporting

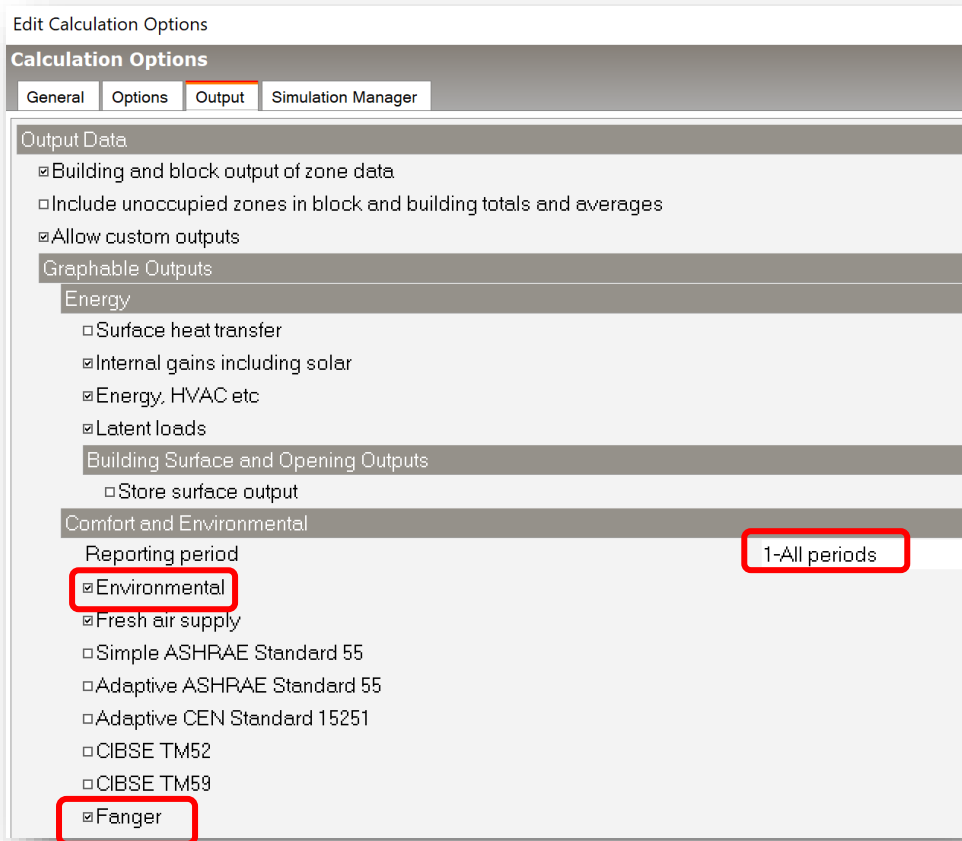
Monthly and Run period

Daily

Hourly

Sub-hourly

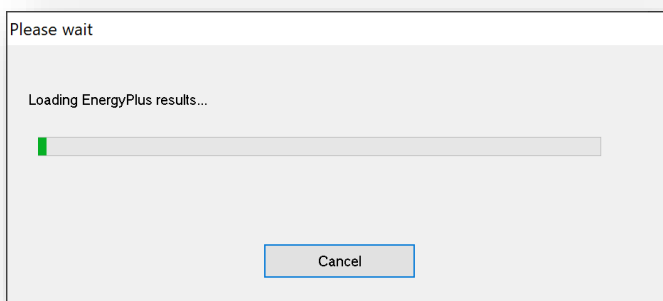
Now, select the 'Output' tab. On this tab, under Comfort and Environmental, make sure that the "Environmental" and "Fanger" option is selected – this ensures that the zone temperatures and thermal comfort values will be included in the simulation output. Also make sure the Reporting Period is set to "1-All periods" so that all hourly values are included in the output.



## Running an annual simulation

The next step is to run the annual simulation to generate the data required by the plugin.

When the simulation has finished, DesignBuilder will start loading the results back into the program for analysis. This can take a long time for a large model.

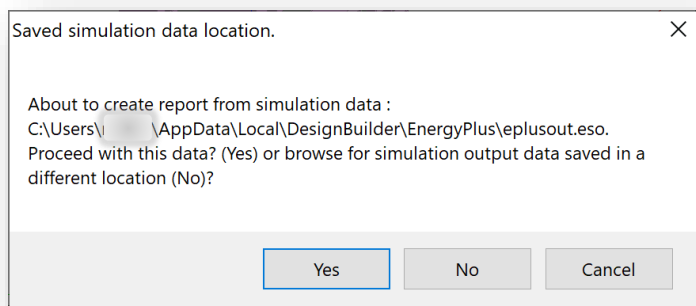


If you normally skip this loading step by hitting Cancel, you can still do so now – the plugin does not require the simulation results to be loaded into DesignBuilder in order to generate a report.

## Generating a report

Finally, we are ready to generate the report. Select the NCC 2019 Tools|Create Thermal Comfort Report option from the plugin menu.

You will be prompted to confirm that the plugin is analysing the correct simulation data output file. By default, DesignBuilder will save new simulation results in its EnergyPlus folder (you can check the location of this folder by selecting File|Folders|EnergyPlus in DesignBuilder. If you are not using SimulationManager or have not selected an option to save simulation data to a different location, then you can answer 'Yes' at this prompt to load data from the default location. If you have saved your simulation data to a different location, answer 'No' and you can browse to the simulation data file (.eso file) that matches the loaded model.



After it has read and analysed the output data, the plugin will ask you where you would like to save the generated report. At this point you can also rename the report.

If all went well, you should now have a temperature check and thermal comfort report for your building.

## Viewing the report

The report is a html file. After you have saved it, the plugin will attempt to open the report for viewing. This depends on your computer having a browser application associated with html file types. If the report does not open automatically, navigate to the saved file and open it manually. Your usual web browser will be able to display the file.

If you have long block or zone names, they might appear truncated in the table. Resizing the table will show the complete text – you can either resize your browser window or copy and paste the data into Word to adjust the column widths.

Hint: For best results, when pasting in Word, select Paste option 'Merge Formatting' from the drop-down list under Paste in the "Home" tab of the toolbar. Click inside the table, choose the blue table "Layout" tab on the far right of the toolbar and select Autofit | Autofit to Window. This will force all the columns to appear on the page – you can then alter the column widths as you require.

## Temperature Check and Thermal Comfort Report Format

The plugin produces a report with three tables:

- The first table shows the results of the temperature range check. For each occupied space or zone, the floor area, NCC building class and corresponding total number of operation hours are listed. The number of operation hours where the zone is within the target temperature range is shown. The NCC requires that all occupied spaces have more than 98% of total operation hours within the target temperature range. This is indicated as a pass/fail check for each zone, and also as a pass/fail for the building as a whole (all analysed zones must pass).

Zones with transitory occupancy are marked with “(TO)” in the building class column. These zones have a wider target temperature range, as noted above the table.

**Section J Temperature Range Check. Target temperature range: 21 - 24 degrees (occupied zones). 18 - 25 degrees (transitory zones).**

All zones pass temperature check - **Building : PASS**

Block	Zone	Floor Area (m <sup>2</sup> )	Fraction Total Floor Area	Building Class	Operation Hours	Operation Hours T below target	Operation Hours T in target range	Operation Hours T above target	Fraction Operation Hours T in target range	Zone temperature meets Section J target (T in target range ≥ 98 % Operation Hours)
00-GROUND...	EastNorth 1	41.9	0.02	Class 5	2610	0	2610	0	1.000	PASS
00-GROUND...	EastNorth	31.5	0.02	Class 5	2610	0	2610	0	1.000	PASS
00-GROUND...	EastSouth 1	26.9	0.01	Class 5	2610	0	2610	0	1.000	PASS
00-GROUND...	CENSouth	228.7	0.13	Class 5 (TO)	2610	0	2610	0	1.000	PASS
00-GROUND...	EastSouth	41.4	0.02	Class 5	2610	0	2610	0	1.000	PASS

- The second table in the report shows the results of the thermal comfort check. In this case, to achieve a pass at the building level, the NCC requires that 95% of the occupied floor area achieves a zone level pass condition. A zone achieves a pass where 98% of the operation hours have a thermal comfort PMV value in the target range. The table shows how many of the operation hours each zone is below, within and above the thermal comfort target range and shows a pass/fail for each zone and the whole building based on the NCC conditions. The plugin checks the total floor area of analysed zones, and the floor area of zones marked with a pass to determine the building pass condition. Zones with transitory occupancy are marked with “(TO)” in the building class column. These zones are not included in the thermal comfort check and do not count toward the total floor area in the building level pass/fail test.

**Section J PMV Thermal Comfort Check. Target PMV range: -1.0 to +1.0**

Less than 95% (0.0%) of floor area passes PMV check - **Building : FAIL**

Block	Zone	Floor Area (m <sup>2</sup> )	Fraction Total Floor Area	Building Class	Operation Hours	Operation Hours PMV below -1	Operation Hours PMV between -1 and 1	Operation Hours PMV above 1	Fraction Operation Hours PMV between -1 and 1	Zone PMV meets Section J target (greater than 98 % Operation Hours between -1 and 1)
00-GROUND...	EastNorth 1	41.9	0.02	Class 5	2610	621	1700	289	0.651	FAIL
00-GROUND...	EastNorth	31.5	0.02	Class 5	2610	960	1298	352	0.497	FAIL
00-GROUND...	EastSouth 1	26.9	0.01	Class 5	2610	963	1293	354	0.495	FAIL
00-GROUND...	CENSouth	228.7	N/A	Class 5 (TO)	2610	N/A	N/A	N/A	N/A	N/A
00-GROUND...	EastSouth	41.4	0.02	Class 5	2610	1125	1352	133	0.518	FAIL

- The final table in the report is not required for the NCC, but can be used to refine a building design to achieve enhanced thermal comfort. It shows the same information as the previous table, but for a tighter target range of thermal comfort PMV values. No pass/fail information is shown here as these results are not required.

**PMV Thermal Comfort Check. Target PMV range: -0.5 to +0.5**

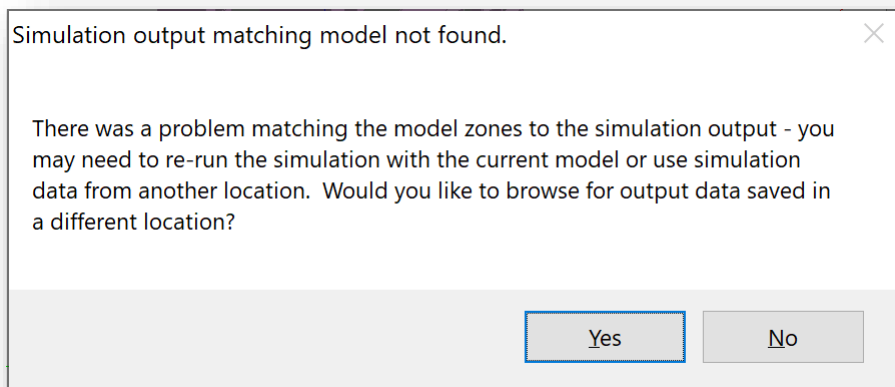
Block	Zone	Floor Area (m <sup>2</sup> )	Fraction Total Floor Area	Building Class	Operation Hours (≥ 0.2 fractional occupancy)	Operation Hours PMV below -0.5	Operation Hours PMV between -0.5 and 0.5	Operation Hours PMV above 0.5	Fraction Operation Hours PMV between -0.5 and 0.5
00-GROUNDFlo...	00XGROUNDFloor01:CENNo...	257.5	0.11	Class 5	2610	33	1267	1310	0.485
00-GROUNDFlo...	00XGROUNDFloor01:EastNo...	41.9	0.02	Class 5	2610	137	782	1691	0.300
00-GROUNDFlo...	00XGROUNDFloor01:EastNorth	31.5	0.01	Class 5	2610	125	604	1381	0.208

## TROUBLESHOOTING

This section describes some common problems you may encounter while running the Temperature Check and Thermal Comfort Plugin from Design Builder Software Australia.

### Mismatched simulation data and model

The loaded building model must match the simulation output data. If you have loaded a building model but have not run an annual simulation before you try to generate a report, you can have a mismatch since the plugin will read the output of the last simulation run, which may be from a different model. The plugin can detect this problem if the current building model has different zone names to those in the simulation output and will display this message when you try to generate a report.

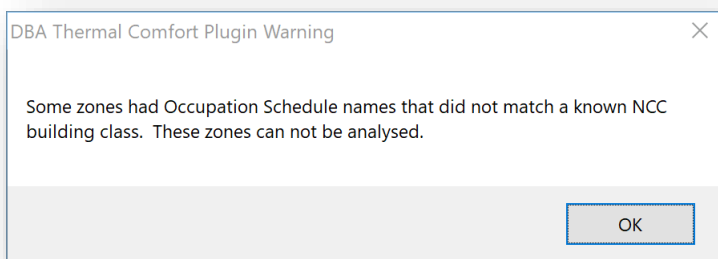


If you did not select the correct file when the plugin first started, you can choose 'Yes' to browse to the correct location now and reload the simulation data. If you need to re-run the simulation to generate new simulation data, select 'No' to cancel the report building operation. Re-run your simulation and then try to generate a report with the plugin again.

If the model has the same zone names as the last simulation output produced by DesignBuilder, but you have made changes to the model since you last ran a simulation, the plugin won't be able to detect that the simulation data doesn't match the model. To be sure that the report reflects the current building model, run an annual simulation so that the simulation output is up to date before generating a report.

### Missing or mistyped building class label

All occupied spaces must have their NCC building class identified with a special label in the occupancy schedule name. If you missed some occupied zones when adding labels, or made an error adding the label, you will get a warning that not all spaces could be analysed.



The report will list all the occupied zones where the building class could not be identified from the schedule name. Check that the Occupation Schedule name contains one of the labels shown in the table above.

**Warning:** Some zones had Occupation Schedule names that did not match a known NCC building class. These zones can not be analysed.  
Block1:Office1:NCC2019\_Class-Shop

### Misaligned schedules and operation hours

If the report shows an unexpectedly large number of occupied hours outside the target temperate range, it is worth double-checking that the activity (occupancy, equipment, lighting) and air conditioning schedules for your building model match the assigned NCC building class of the space – Consult Section JvC Table 2 for reference. If these schedules are out of alignment, the plugin could be analysing hours where the mechanical systems are not working, or the building loads could be misaligned with the expected hours of operation. The hours of operation analysed by the plugin are available as a separate document from the DesignBuilder Software Australia website.

In the following example, the occupancy schedule name of “NABERS\_Class5\_Office” indicates to the plugin that the space is a Class 5 office space, but the actual occupancy schedule as entered does not match JvC Table 2c/d for Class 5 spaces– this will not be detected by the plugin, and may cause unexpected results – the schedule should be corrected.

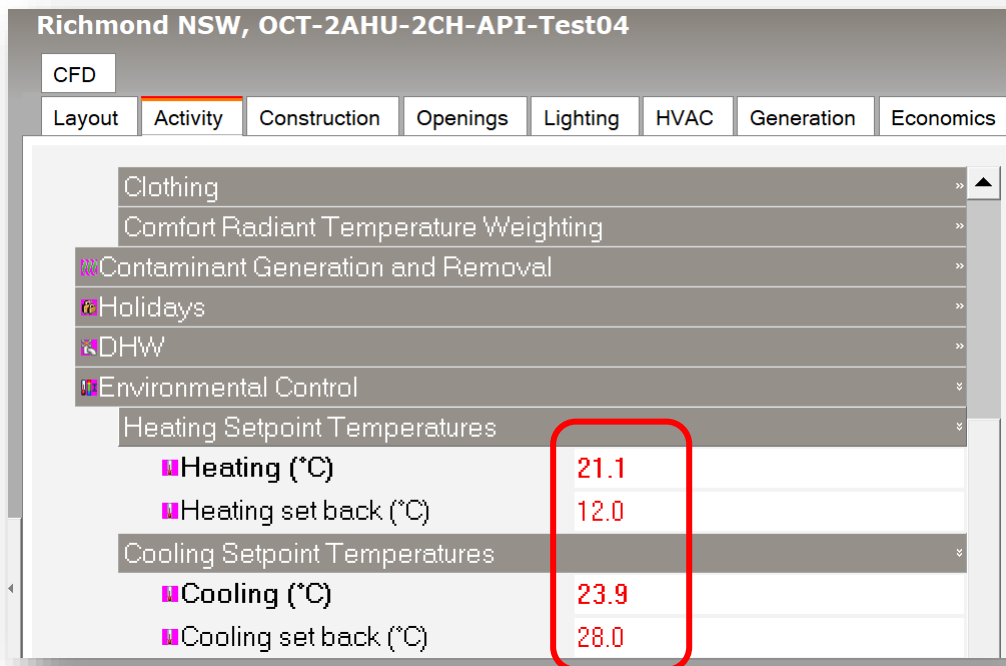
Day	Occupancy			Artificial Lighting			Appliances
	Monday to Friday	Saturday	Sunday	Monday to Friday	Saturday	Sunday	
12:00 AM to 01:00 AM	0	0	0	0.15	0.15	0.15	0.25
01:00 AM to 02:00 AM	0	0	0	0.15	0.15	0.15	0.25
02:00 AM to 03:00 AM	0	0	0	0	0	0	0
03:00 AM to 04:00 AM	0	0	0	0	0	0	0
04:00 AM to 05:00 AM	0	0	0	0	0	0	0
05:00 AM to 06:00 AM	0	0	0	0	0	0	0
06:00 AM to 07:00 AM	0	0	0	0	0	0	0
07:00 AM to 08:00 AM	0.1	0	0	0	0	0	0
08:00 AM to 09:00 AM	0.2	0.05	0.05	0	0	0	0
09:00 AM to 10:00 AM	0.7	0.05	0.05	0	0	0	0
10:00 AM to 11:00 AM	0.7	0.05	0.05	0	0	0	0
11:00 AM to 12:00 PM	0.7	0.05	0.05	0	0	0	0
12:00 PM to 01:00 PM	0.7	0.05	0.05	0	0	0	0
01:00 PM to 02:00 PM	0.7	0.05	0.05	0	0	0	0
02:00 PM to 03:00 PM	0.7	0.05	0.05	0	0	0	0
03:00 PM to 04:00 PM	0.7	0.05	0.05	0	0	0	0
04:00 PM to 05:00 PM	0.7	0.05	0.05	0	0	0	0
05:00 PM to 06:00 PM	0.35	0	0	0.8	0.15	0.15	0.8
06:00 PM to 07:00 PM	0.1	0	0	0.6	0.15	0.15	0.65
07:00 PM to 08:00 PM	0.05	0	0	0.6	0.15	0.15	0.55
08:00 PM to 09:00 PM	0.05	0	0	0.5	0.15	0.15	0.25
09:00 PM to 10:00 PM	0	0	0	0.15	0.15	0.15	0.25
10:00 PM to 11:00 PM	0	0	0	0.15	0.15	0.15	0.25
11:00 PM to 12:00 AM	0	0	0	0.15	0.15	0.15	0.25

**Problem!**  
Occupancy schedule name indicates Class 5 space, but entered schedule does not match corresponding part of JvC Table 2 – this must be corrected for the plugin to produce reasonable results

### Hard limits of temperature range check

Note that the temperature target range has hard limits. A zone temperature of 24.01 degrees for example, will be counted as out of range if the upper limit of the target temperature range is 24 degrees. It may be necessary to alter the environmental control set points slightly so that the zone temperature stays completely within the target range during occupied hours.

In the example below, the heating and cooling set points have been adjusted to keep the air temperature within the target range of 21-24 degrees for all hours of operation.



### Thermal comfort check includes radiant temperature

The comfort check is quite stringent. If the report shows an unexpectedly large number of occupied hours where the thermal comfort values are outside the target range even though the temperature is controlled, you may be seeing a large contribution from the radiant temperature of the space. This is most likely in highly glazed spaces. Design modifications may be required.