
KAMANI PROPERTY GROUP

CIBSE TM59 Thermal Comfort Report

New residential development, Ancoats Works, Manchester.

18th October 2021

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1. Executive Summary

Watt Energy & Consulting Engineers have been appointed to carry out a thermal comfort assessment for the new residential development at Ancoats Works, Manchester. The development consists of 195 residential dwellings, common circulation areas, refuse store, plant space and outdoor amenity areas. An image of the proposed development can be viewed below:



Image the ground floor layout of the proposed development

Following the DSM modelling, all apartments were found to comply with the overheating requirement of CIBSE TM59 on the basis that all assumptions outlined in the methodology section (regarding building fabric performance, G-values of glazing etc.) are incorporated into the design.

2. Introduction

The thermal comfort assessment has been carried out according to the guidelines in CIBSE guide TM59:2017 *“Design Methodology for the assessment of overheating risk in homes”* and the development has been modelled using the Dynamic Simulation Modelling (DSM) Software Integrated Environmental Solutions Limited, “Virtual Environment” (VE) version 2021.1.0.0. The software is fully compliant with the requirements of CIBSE guide AM11: *Building Performance modelling (2015b.)*

Following the DSM modelling, all apartments were found to comply with the overheating requirement of CIBSE TM59 on the basis that all assumptions outlined in the methodology section (regarding building fabric performance, G-values of glazing etc.) are incorporated into the design.

This report serves to predict the internal temperature within the occupied areas based on the parameters set from the IES thermal modelling.

The report should not be used as an actual measurement of internal temperature but as a report that uses the appropriate modelling software to demonstrate the potential internal air temperatures of the assessed areas.

3. Methodology

Geometry

The geometry of the model has been based on the drawings provided by BDP Architects.

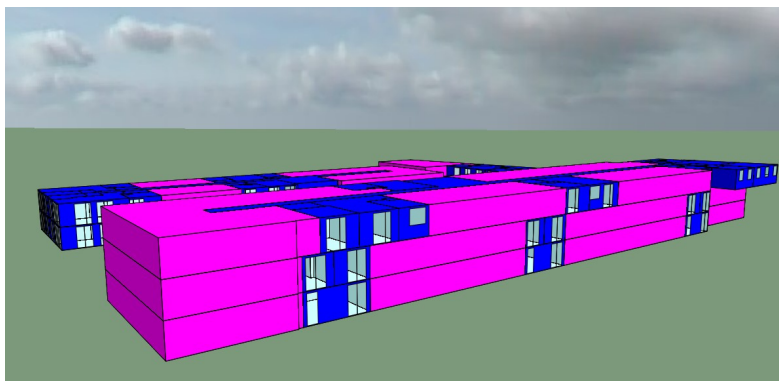


Figure 1 – image taken from the IES VE software

Floor to ceiling heights have been modelled as 2.5m. Generally, exposed concrete soffits were modelled in bedrooms & living/kitchen areas, with lowered ceilings in wet rooms and bulkheads for services distribution. The depth of the service zone was assumed to be 175mm.

Apartment types and samples

The apartment types listed below have been modelled as part of the overheating analysis. These apartment/ townhouse types were selected to provide a comprehensive representation of possible orientations, room sizes and layouts.

- Unit 01-00-01 – Southwest facing, Ground Floor apartment
- Unit 01-00-03 – Northwest facing, Ground Floor apartment
- Unit 01-00-04 – Northeast facing, Ground Floor apartment
- Unit 01-00-06 - Northeast facing, Ground Floor apartment
- Unit 01-01-01 – Southwest facing, first floor apartment
- Unit 01-01-04 - Northeast facing, First Floor apartment
- Unit 01-01-06 - Northeast facing, First Floor apartment
- Unit 02-00-015 - Northeast facing, Ground Floor apartment
- Unit 02-00-03 - Southwest facing, Ground Floor apartment
- Unit 02-00-04 - Southwest facing, Ground Floor apartment

- Unit 02-00-09 - Southwest facing, Ground Floor townhouse
- Unit 02-00-013 - Northeast facing, Second Floor apartment
- Unit 03-02-01 - Southwest facing, Second Floor apartment
- Unit 03-02-02 - Southeast facing, Second Floor apartment
- Unit 04-01-02 - Southeast facing, First Floor apartment
- Unit 04-01-03 - Northwest facing, First Floor apartment

All spaces within the apartment/houses have been zoned into separate rooms including kitchen, living rooms, bedrooms, bathrooms and hallways/landing. Images of a typical apartment and townhouse layouts can be seen below.



Figure 2 –typical 1 bed apartment layout

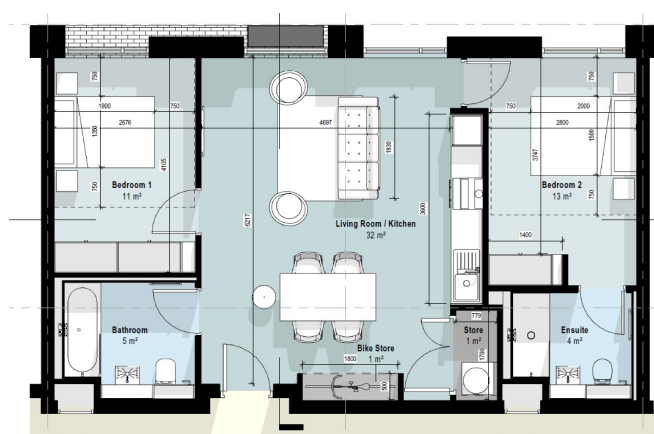


Figure 3 –typical 2 bed apartment layout

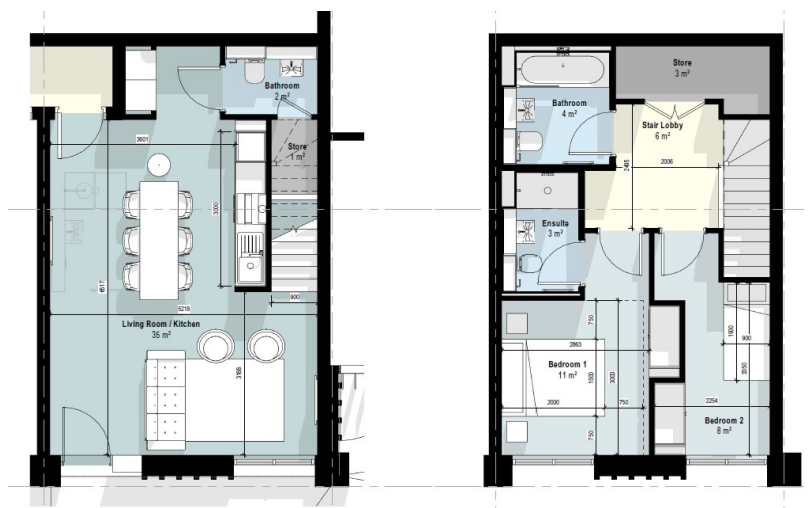


Figure 4 –typical townhouse layout

Weather File

The weather file used within the model was the CIBSE *Design Summer Year* (DSY1) for the Manchester area, for the 2020s, high emissions, 50% percentile scenario as the most appropriate data set for the location of the development and makes allowance for future elevated temperatures due to climate change.

Building fabric

Thermal transmittance values (U-values) of thermal elements have been based on the values provided in the Architectural specification and summarised in the table below:

Thermal Element	U-Value (W/m².K)
Wall	0.2
Floor	0.1
Doors	1.3
Windows	1.3
Roof	0.1

The glazing G-values was modelled as 0.72 with a light transmittance of 71 %.

Internal & external shading devices

Blinds were modelling in each habitable room with the following properties:

- Night time resistance – $1.0\text{m}^2\text{K/W}$
- Daytime resistance - $1.0\text{m}^2\text{K/W}$
- Shading Coefficient – 0.4
- Short Wave radiant Fraction – 0.3

Blinds were modelled to be fully lowered when solar irradiation reaches a threshold level of 200W/m^2 and raised when the radiation is less than this figure. Blinds were modelled to be controlled between 7am and 10pm (weekdays) and 10am and 10pm weekends/holidays.

Lighting Internal gains

Internal lighting gains have been based on 2W/m^2 throughout all spaces, between the hours of 6pm and 11pm, as outlined in CIBSE TM59, section 5.2. No daylight dimming has been assumed within the model.

Heating, Cooling & Ventilation (HVAC) system

The mechanical ventilation system was modelled as mechanical ventilation with heat recovery (MVHR), or system F in Building Regulations Approved Document F. This system extracts air from wet rooms and kitchens and supplies heat recovered air to habitable rooms (bedrooms/living rooms).

Ventilation rates have been calculated according to Building Regulations Approved Document Part F. Manually controlled “boost” ventilation rates were not modelled, as stated in CIBSE TM59.

The heating system was modelled as electric panel heaters in all spaces. The heating set-point was modelled as 21°C between 06.00 hrs and 22.00 hrs and 12°C between 22.00 hrs and 6.00 hrs

Natural Ventilation Openings

Within the model, natural ventilation was provided via openable windows. Details of windows dimensions, extent of opening etc. are provided in the Appendix at the end of this report. Natural ventilation openings were modelled to open when the internal dry resultant temperature exceeded 22°C . A full description of the natural ventilation openings, including opening profiles and free areas is

provided in the appendix. Internal doors & windows have been modelled as shut at all times throughout the model.

Infiltration Rates

Infiltration rates within each space assumed in the model are listed below.

Room	Infiltration Rate (ACH)
Lounge/Sitting Room/ Living Room	0.5
Dining Room	0.5
Kitchen	0.5
Bedroom	0.5
Bathroom/ Ensuite/WC	0.5
Hallway	0.5

Air speeds

An air speed of 0.1m/s has been modelled, as per the CIBSE TM59 guidance for rooms without a ceiling fan or other reliable means of reliable generating air movement. An elevated summer air speed of 0.8m/s was also modelled.

Thermal Comfort Category

The thermal comfort category was taken a Category. II (new build), as the most appropriate category according to CIBSE TM52 (2013) for a new development.

Communal Corridors

No heat gains from pipework in corridors was modelled, as heating will be via electric panel heaters.

4. Assessment criteria

Assessment criteria

To assess the risk of overheating within the occupied spaces, the methodology and compliance criteria have been based on *CIBSE Guide TM59: Design methodology for the assessment of overheating in homes*.

To demonstrate compliance, the apartments have been assessed as being predominately *naturally ventilated*. In this case both criteria (a) and (b) outlined below must be met.

(a) *For living rooms, kitchens, and bedrooms*: The number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours. (CIBSE TM52 Criterion 1; Hours of exceedance.)

Where ΔT is the difference between the actual operative temperature in the room at any time (T_{op}) and T_{max} the limiting maximum acceptable temperature.

(b) *For bedrooms only*: To guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of annual hours between 22:00 and 07:00 for bedrooms is 32 hours.)

Note that CIBSE TM52 criteria 2 and 3 may fail to be met, provided (a) and (b) above are satisfied.

There is no mandatory target for operative temperatures in corridors where community heating is provided. However, where an operative temperature of 28°C is exceeded for more than 3% of the annual total hours, this is identified a risk within this report.

5. Results and Conclusion

Table 1 below summarises the results for all spaces, based on CIBSE TM59 criteria (a) outlined in the methodology section. For completeness, the results for each room for CIBSE TM52 criteria 2 & 3 have also been included. A separate column for each set of results shows an overall Pass/ Fail for each space. The table demonstrates that all occupied spaces comply with the CIBSE TM59 criteria (a), provided the recommendations outlined in this report are incorporated into the design.

Room Name	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing	Overall Pass/ Fail
01-00-01 Living Kitchen	0.3	2	1	-	Pass
01-00-01-BEDROOM	0.8	8	2	2	Pass
01-00-03-BEDROOM	1.1	11	2	2	Pass
01-00-03-BEDROOM	0.9	6	2	-	Pass
01-00-03-LIVING/KITCHEN	1.2	7	2	2	Pass
01-00-04-BEDROOM	0	0	0	-	Pass
01-00-04-BEDROOM	0.8	6	2	-	Pass
01-00-04-LIVING/KITCHEN	0.3	2	1	-	Pass
01-00-06 Living Kitchen	0	0	0	-	Pass
01-00-06-BEDROOM	0	0	0	-	Pass
01-00-06-BEDROOM	0	0	0	-	Pass
01-01-01-BEDROOM	0.9	10	2	2	Pass
01-01-01-LIVING KITCHEN	0.7	4	2	-	Pass
01-01-03-BEDROOM	2.1	19	4	2	Pass
01-01-03-BEDROOM	0.8	6	2	-	Pass
01-01-03-LIVING/KITCHEN	1.1	7	2	2	Pass
01-01-04-BEDROOM	0	0	0	-	Pass
01-01-04-BEDROOM	0.8	6	2	-	Pass
01-01-04-LIVING/KITCHEN	0.1	2	1	-	Pass
01-01-06-BEDROOM	0	0	0	-	Pass
01-01-06-BEDROOM	0	0	0	-	Pass
01-01-06-LIVING KITCHEN	0	0	0	-	Pass
02-00-015-BEDROOM	0	0	0	-	Pass
02-00-015-BEDROOM	0	0	0	-	Pass
02-00-015-LIVING	0	0	0	-	Pass
02-00-015-LIVING	0	0	0	-	Pass
02-00-03-BEDROOM	1.3	12	3	2	Pass
02-00-03-BEDROOM	1.8	18	3	2	Pass
02-00-03-LIVING KITCHEN	1.8	8	2	2	Pass
02-00-03-STAIRS	0	0	0	-	Pass
02-00-04-BEDROOM	1.4	13	3	2	Pass
02-00-04-LIVING KITCHEN	0.8	4	1	-	Pass



Room Name	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing	Overall Pass/Fail
02-00-04-STAIRS	0	0	0	-	Pass
02-00-09-BEDROOM	1.8	18	3	2	Pass
02-00-09-BEDROOM	1.3	12	3	2	Pass
02-00-09-LIVING KITCHEN	1.8	8	2	2	Pass
02-00-09-STAIRS	0	0	0	-	Pass
02-02-013-BEDROOM	0	0	0	-	Pass
02-02-013-LIVING/KITCHEN	0	0	0	-	Pass
02-02-06-BEDROOM	1.3	12	3	2	Pass
02-02-06-LIVING/KITCHEN	0.2	2	1	-	Pass
02-02-09-BED	1.3	12	2	2	Pass
02-02-09-BED	0	1	1	-	Pass
02-02-09-LIVING	0.2	2	1	-	Pass
03-02-01-BEDROOM	0.7	8	2	2	Pass
03-02-01-BEDROOM	0	0	0	-	Pass
03-02-01-LIVING/KITCHEN	0	0	0	-	Pass
03-02-02-BEDROOM	0	0	0	-	Pass
03-02-02-LIVING/KITCHEN	0	0	0	-	Pass
04-01-02-BEDROOM	0	0	0	-	Pass
04-01-02-BEDROOM	0	0	0	-	Pass
04-01-02-LIVING/KITCHEN	0	0	0	-	Pass
04-01-03-BEDROOM	0.2	2	1	-	Pass
04-01-03-KITCHEN/LIVING	0	0	0	-	Pass

Table 1 – CIBSE TM59 Criteria a) results for all spaces.

Table 2 below summarises the results for all spaces, based on CIBSE TM59 criteria (b) outlined in the methodology section. A separate column for each set of results shows an overall Pass/ Fail for each space. The table demonstrates that all spaces comply with the CIBSE TM59 criteria (b), provided the recommendations outlined in this report are incorporated into the design.

Location	Dry resultant temperature (°C) – % hours in range > 26.00	Overall Pass/ Fail
01-00-01-BEDROOM	0.3	Pass
01-00-03-BEDROOM	0.4	Pass
01-00-03-BEDROOM	0.3	Pass
01-00-04-BEDROOM	0	Pass
01-00-04-BEDROOM	0.3	Pass
01-00-06-BEDROOM	0	Pass
01-00-06-BEDROOM	0	Pass



Location	Dry resultant temperature (°C) – % hours in range > 26.00	Overall Pass/ Fail
01-01-01-BEDROOM	0.3	Pass
01-01-03-BEDROOM	0.7	Pass
01-01-03-BEDROOM	0.3	Pass
01-01-04-BEDROOM	0	Pass
01-01-04-BEDROOM	0.3	Pass
01-01-06-BEDROOM	0	Pass
01-01-06-BEDROOM	0	Pass
02-00-015-BEDROOM	0	Pass
02-00-015-BEDROOM	0	Pass
02-00-03-BEDROOM	0.7	Pass
02-00-03-BEDROOM	0.4	Pass
02-00-04-BEDROOM	0.4	Pass
02-00-09-BEDROOM	0.4	Pass
02-00-09-BEDROOM	0.5	Pass
02-02-013-BEDROOM	0	Pass
02-02-06-BEDROOM	0.8	Pass
03-02-01-BEDROOM	0	Pass
03-02-01-BEDROOM	0	Pass
03-02-02-BEDROOM	0	Pass
04-01-02-BEDROOM	0	Pass
04-01-02-BEDROOM	0	Pass
04-01-03-BEDROOM	0	Pass

Table 2 – CIBSE TM59 Criteria b) results for bedrooms only.

Table 3 summarises the dry resultant temperatures within the communal corridor, expressed as a percentage of annual hours. The table demonstrates that the percentage of annual hours that the dry resultant temperature exceeds 28°C is less than the 3% maximum stated in CIBSE TM59 and therefore is not deemed as a significant risk.

Location	Dry resultant temperature (°C) - % hours in range			
	> 25.00	> 26.00	> 27.00	> 28.00
CIRCULATION	2.5	0.6	0	0
CIRCULATION	3.4	0.7	0	0
CIRCULATION	2.5	0.4	0	0
CIRCULATION	1.5	0.1	0	0
CIRCULATION	3.3	0.9	0	0
CIRCULATION	2.6	0.4	0	0

Table 3 – Dry resultant temperatures within communal corridors.



Appendix A – key modelling inputs

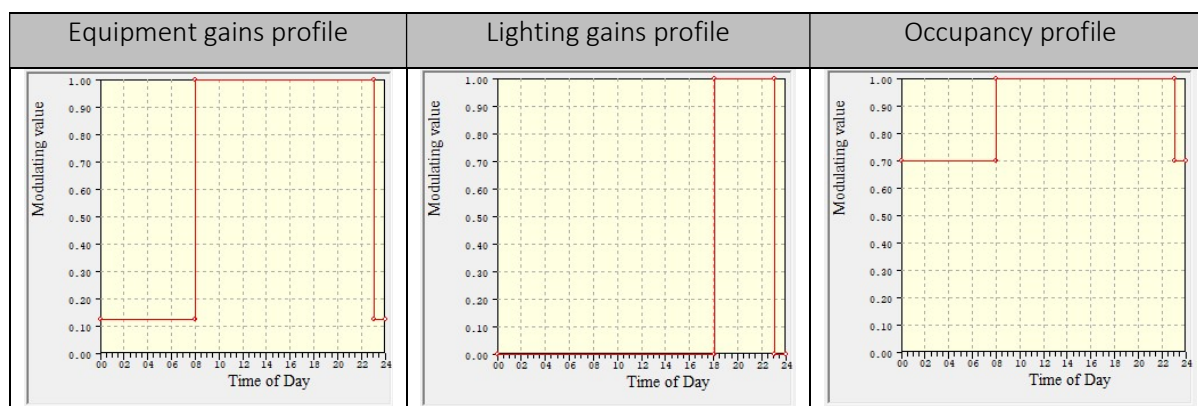
The key modelling inputs assumed within the overheating model are provided below.

The occupancy and equipment gains for each space in the model have been based on the figures provided in CIBSE Guide TM59, as below.

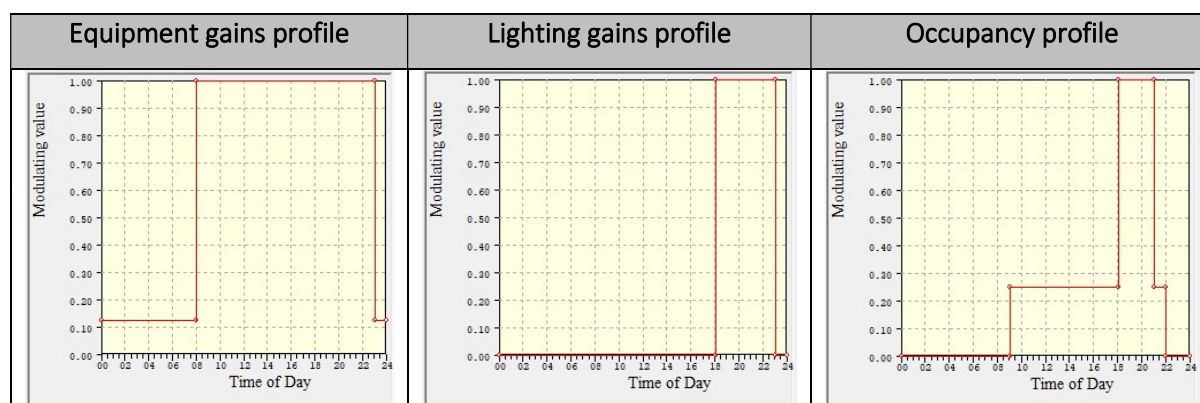
Room	Lighting Gain (W/m ²)	Peak equipment gain (W)	People gain-sensible (W)	People gain-latent (W)	Number of people
Bedroom	2	450	75	55	2
Living Room/ kitchen	2	450	75	55	1-3 (dependent on number of bedrooms)

Table 4 – internal gains within each space according to CIBSE TM59

Profiles for gains in each space are shown in the graphs below.



Bedrooms



Living room/ Kitchen

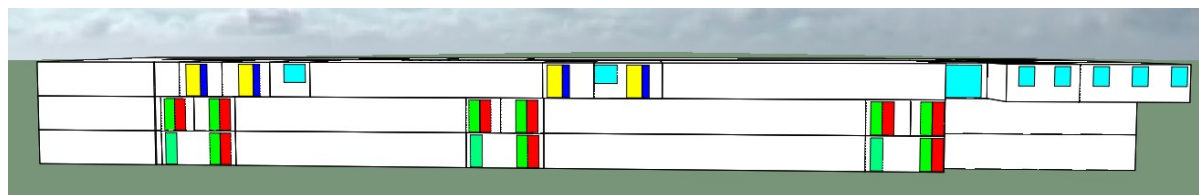
Mechanical ventilation rates.

The table below summarises the mechanical ventilation rate modelled for each space.

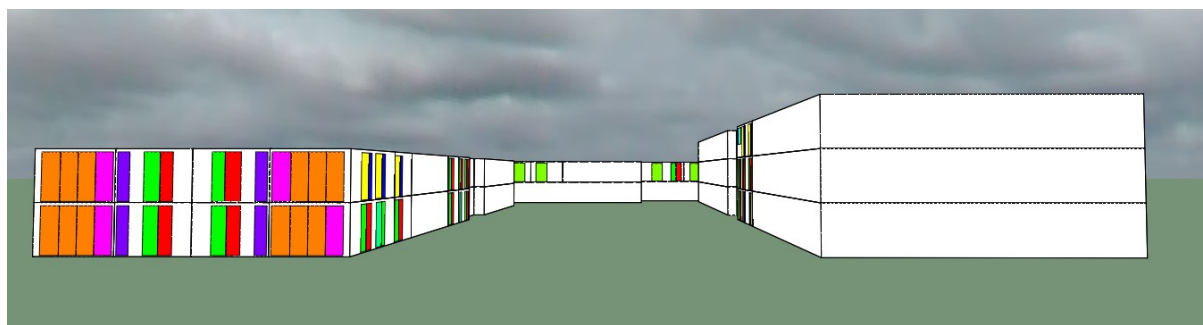
Room	Trickle ventilation rate (L/s)
Double Bedroom	5
1 bedroom communal kitchen/living	10.5
2 bedroom communal kitchen/living	14
3 bedroom communal kitchen/living	16

Natural Ventilation openings.

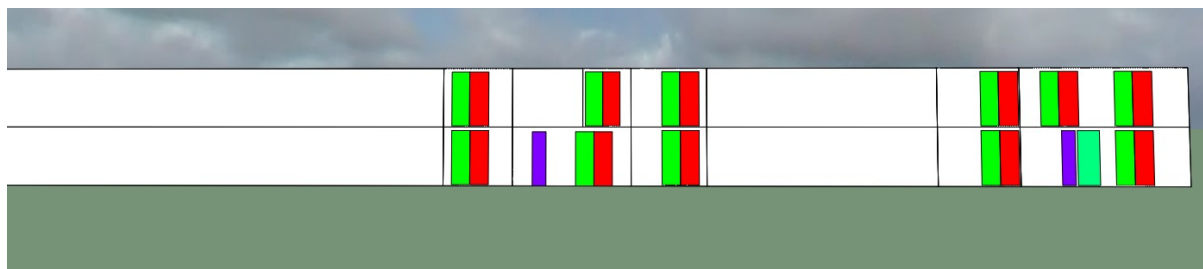
Natural ventilation openings have been modelled based on the elevations provided by the Architect. The image below shows the windows which have been modelled as fixed/openable within the IES simulation. A key to the window opening types can be found at the end of the table.



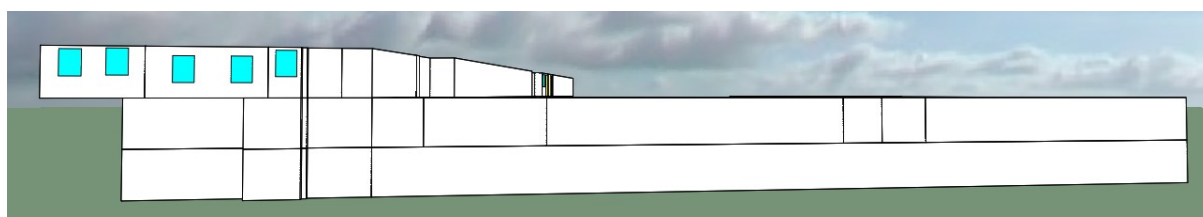
Southwest Elevation



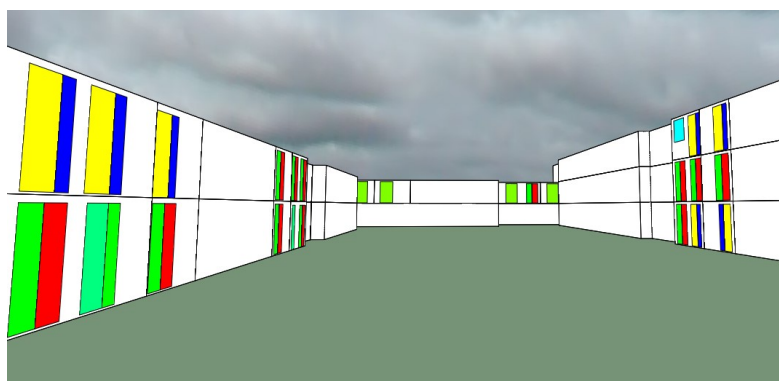
Northwest Elevation



Northeast elevation



Southeast elevation

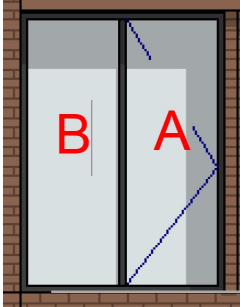
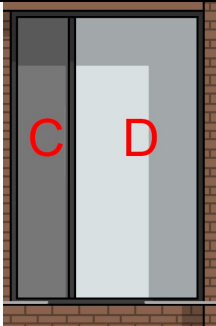
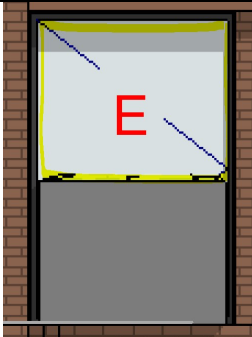


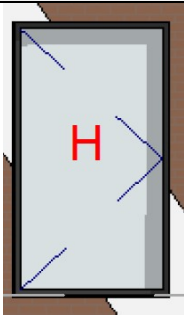
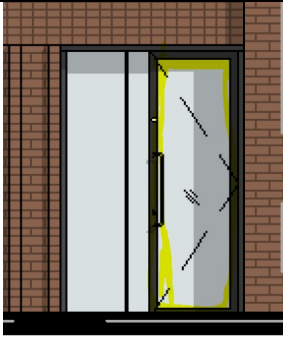
Courtyard elevations

Opening Type	
■	XTRN0000 (Type A)
■	XTRN0001 (Type B)
■	XTRN0002 (Type C)
■	XTRN0003 (Type D)
■	XTRN0004 (Type E)
■	XTRN0005 (Type F)
■	XTRN0006 (Type G)
■	XTRN0007 (Door)
■	XTRN0008 (FIXED)
■	XTRN0014 (Type H)

Key to window opening types

The table below summarises the assumed window opening with the simulation, including the equivalent opening area of the window, expressed as a percentage of the overall window frame area.

Window Reference	Image	Opening Percentage
Type A & B		A = 50% I.e. the upper half is openable, the lower half fixed (for fall protection). B = 0% not openable.
Types C & D		C = 60% Louvre/mesh assumed behind the window which is 60% "open." D = 0% not openable.
Type E – windows with planter boxes.		100% - yellow section only.
Balcony doors – F and G		F - 100% - fully openable. G- Fixed – not openable.

Window Reference	Image	Opening Percentage
H		A = 50% I.e. the upper half is openable, the lower half fixed (for fall protection).
Door – ground floor only.		100% - fully openable. Pane adjacent to the door assumed to be fixed.