



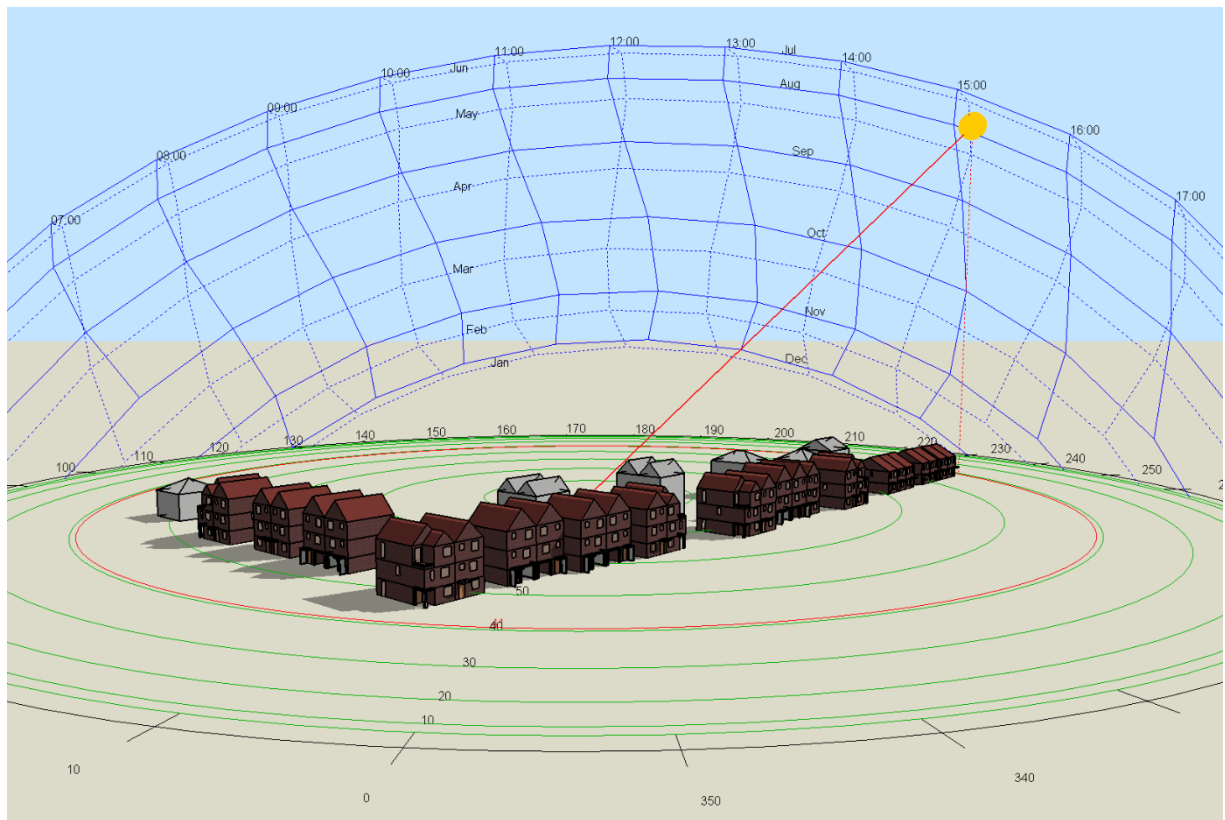
TM59 Overheating Study

Moss Hey Drive, Northenden

CIBSE TM59:2017

This report has been prepared by:	Will Howarth
Date of initial report:	22/05/2023
Revision:	A
Revised by:	Matthew Hurd
Date of revision	05/06/2023

DSM Model



Software

The building has been modelled using DesignBuilder Dynamic Simulation Modelling Software Version 7.1.4.005, using the EnergyPlus Simulation Engine.

The DSM model can be used to provide:

- Overheating analysis (this report)
- Future weather energy-consumption predictions
- Heating and Cooling Load calculations
- Climate Based Daylight Modelling
- Thermal Fluid Dynamics Assessments
- Building Compliance Assessments (Building Regulations Part-L and EPC)
- Bespoke detailed HVAC analysis
- Digital Twin and Calibrated Modelling
- Uncertainty and Sensitivity Analysis
- Optimisation

Classification of Overheating

Currently overheating studies are based on BS EN 15251. This introduces the concept of 'adaptive comfort' (the relationship between outdoor conditions and comfortable indoor temperatures) into overheating tests. For naturally ventilated, non-domestic properties this standard, TM52, defines overheating as a failure of two of the three following criteria:

- Criterion 1: This is a limit on the number of hours the operative temperature is above the upper limit of the comfort temperature scale. $\nless 3\%$ Occupied hours May – September.
- Criterion 2: Daily weighted exceedance. This is a limit on the degree of overheating in any given one day of the simulation period. $\nless 6K$

Criterion 3: Absolute upper limit. This is an absolute temperature limit above the upper comfort temperature, beyond which normal adaptive actions will be insufficient to prevent discomfort. $\nless 4K$

TM59

TM59 is the design methodology for the assessment of overheating risk in homes. It is an extension of the BS EN 15251 standard described above. It contains standardised internal gains and occupancy profiles that must be included in all TM59 modelling and stipulates which weather files should be used. In order to pass the standard, both of the following criteria must pass the annual simulation test:

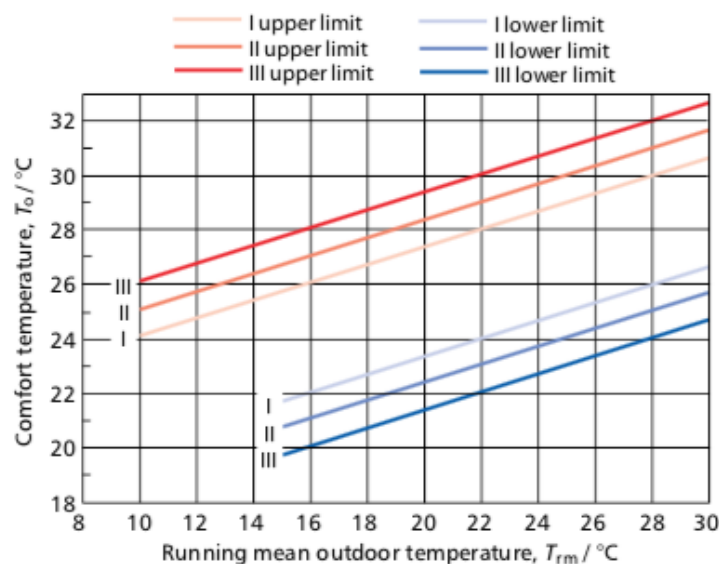
- Criterion A - For Living Rooms, Kitchens and Bedrooms - CIBSE TM52 Criterion 1: Hours of exceedance. < 3% indicates a fail.
- Criterion B - For Bedrooms Only – from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. This equals 32hrs - so 33hrs indicates a fail.

N.B. Whilst TM59 does not include a mandatory target for corridors, they suggest that $\approx 3\%$ of total annual hours at 28°C operative should be the target. See S4.5 from TM59 below. Research has shown that overheating corridors lead to overheating flats.

“4.5 Corridors: assessment criteria

The overheating test for corridors should be based on the number of annual hours for which an operative temperature of 28 °C is exceeded. Whilst there is no mandatory target, if an operative temperature of 28 °C is exceeded for more than 3% of total annual hours, this should be flagged as a significant risk within the report. “

Adaptive Comfort Category



Adaptive Comfort Category Description

Table 2 Suggested applicability of the categories and their associated acceptable temperature range for free-running buildings and of PMV for mechanically ventilated buildings (from BSI, 2007). The CIBSE suggestion is that designers should aim to remain within the Category II limits.

Category	Explanation	Suggested acceptable range (K)	Suggested acceptable limits PMV
I	High level of expectation only used for spaces occupied by very sensitive and fragile persons	± 2	± 0.2
II	Normal expectation (for new buildings and renovations)	± 3	± 0.5
III	A moderate expectation (used for existing buildings)	± 4	± 0.7
IV	Values outside the criteria for the above categories (only acceptable for a limited periods)	>4	> 0.7

This building has been tested under Category II limits, as per the table above.

Locations and Orientations Tested

Plots 104 – 110, 170 – 176, 184 - 197 were simulated using the Manchester Airport location template with the CIBSE Manchester DSY1 2020's HIGH 50% weather location file. This is approximately 4.2 miles from the site location of Moss Hey Drive, Northenden. Manchester is the closest of the 16 approved weather stations.

The Plots have been orientated as per Moss Hey Drive, Northenden– Planning Layout Rev N

Specification for Model

The following information has been used to produce the building models:

Drawings

Drawing pack – All types modelled using their respective drawing pack

Weather Data

Data File – CIBSE Manchester DSY1 2020's HIGH 50%

Constructions Properties

Main Pitched Roof – 0.16 U-value

Balcony Roof – 0.22 U-value

External Cavity Wall – 0.27 U-value

Exposed Floor – 0.11 U-value

External Ground Floor – 150mm 0.038 insulation

Entrance Door – 1.5 U-value

Rear Door – 1.5 U-value

Windows – 1.3 U-value, 0.41 G-Value

Thermal Bridging – Bespoke PSI Values

Thermal Mass – TMP Calculated from Drawings

Infiltration Rate – EnergyPlus Crack Template of Good – 5.0 m³/(h.m²) @ 50 Pa

HVAC

Boiler – As per Construction Specification Checklist (29/07/2022)

Ventilation – Natural Ventilation.

Ventilation Strategy

Natural (purge) ventilation is provided by opening windows. The windows are simulated to be opened when a room is occupied and the operative temperature in the room is above 22°C.

Windows closed as per Noise Assessment (June 2021).

Due to the limited Natural Ventilation in these rooms, it will be necessary to provide mechanical ventilation to suffice means of removing excess heat, this will be more apparent in rooms measured under criterion B.

Air infiltration through other openings, vents and cracks in the building structure is simulated and included in the infiltration rate.

Internal Conditions

Defined by dynamic simulation model as per TM59:2017, Section 6, Table 2:

Blinds and Shading Devices

The simulation model calculates the effect of beam and sky diffuse solar radiation and shading from exterior surfaces, other parts of the building itself. All external reflections and shading from ground reflected solar has also been modelled.

In accordance with the TM59 methodology the effect of internal blinds has not been included in the model.

“ 3.7 Blinds and shading devices

Blinds and shading devices can be used for the analysis only if specifically included in the design, provided in the base build and explained within associated home user guidance.

Blinds cannot be used properly if they clash with the opening of windows. “

Window & Door Schedule

Discharge coefficient – 0.65, which is of sufficient accuracy given other real-world uncertainties such as wind pressure coefficients.

Scheduling – TM59 protocols have been used to set opening schedules.

(Please see appendix 1)

Detailed Inputs

Input	Figure	Source
Metabolic Rates	130 w (sensible = 65W, latent = 65w)	TM59
Lighting	2 W/m ²	TM59 Default
Main zonal temperature setpoints	Various	TM59 Default
Equipment IHG & Schedules	Various	TM59 Defaults – see Appendix
Internal Air Speed	0.1m/s	TM59 Default
NatVent Summer Minimum Temp	19°C	

TM59 Calculation Results

Results produced from Base specification listed above.

Plot	Type	Criterion A	Criterion B
104	Gaskell	✓	✗
105	Gaskell	✓	✗
106	Gaskell	✓	✗
107	Gaskell	✓	✗
108	Gaskell	✓	✗
109	Gaskell	✓	✗
110	Gaskell	✓	✗
170	Burgess	✓	✗
171	Burnett	✓	✗
172	Wilson	✓	✗
173	Wilson	✓	✗
174	Burnett	✓	✗
175	Burnett	✓	✗
176	Burgess	✓	✗
184	Burgess	✓	✗
185	Burnett	✓	✗
186	Wilson	✓	✗
187	Wilson	✓	✗
188	Wilson	✓	✗
189	Wilson	✓	✗
190	Burnett	✓	✗
191	Burgess	✓	✗
192	Wilson	✓	✗
193	Wilson	✓	✗
194	Burnett	✓	✗
195	Burnett	✓	✗
196	Burnett	✓	✗
197	Burgess	✓	✗

*Please see Appendix 2 for full results.

Mitigation Sample

From the Base results we can identify the following:

- Burnett – Plot 175 is the most at risk of overheating.
- Burgess – Plot 191 is the most at risk of overheating.
- Gaskell – Plot 104 is the most at risk of overheating.
- Wilson – Plot 189 is the most at risk of overheating.

Therefore, these plots will make up the sample used to calculate the required mitigation for their respective types.

Remedial Measures

Type	Method*	Example Fan**
Burnett	Mechanical Ventilation achieving 45l/s in Bedroom 2.	Bedroom 2 – Vent Axia NBR CoolBox 50 412260
	Mechanical Ventilation achieving 45l/s in Bedroom 3.	Bedroom 3 - Vent Axia NBR CoolBox 50 412260
	Landing replacement air as total higher than 60 l/s but less than 200l/s	Vent Axia NBR Passive Duct Kit Passive Duct Kit 412261
Burgess	Mechanical Ventilation achieving 50l/s in Bedroom 2.	Bedroom 2 - Vent Axia NBR CoolBox 50 412260
	Mechanical Ventilation achieving 60l/s in Bedroom 3.	Bedroom 3 – Vent Axia NBR CoolBox 50 412260
	Landing replacement air as total higher than 60 l/s but less than 200l/s	Vent Axia NBR Passive Duct Kit Passive Duct Kit 412261
Gaskell	Mechanical Ventilation achieving 40l/s in Bedroom 2.	Vent Axia – NBR CoolBox 50 412260
Wilson	Mechanical Ventilation achieving 30l/s in Bedroom 2.	Vent Axia – NBR CoolBox 30 412259

*We recommend seeking further advice on the sufficiency of background ventilation due to the remedial mechanical ventilation listed above.

** Please note that other fans can be used, but the flow rates required are achieved, and noise levels are acceptable.

Results with Remedial Measures

CIBSE TM59 - Mitigation Results						
Plot	Type	Block	Zone	Criterion A (%)	Criterion B (hr)	Pass/Fail
175	Burnett	FF	Bed2	0	28.17	Pass
		FF	Lounge	0.43	N/A	Pass
		GF	KitchenDining	0.42	N/A	Pass
		SF	Bed1	0.1	14	Pass
		SF	Bed3	0	30.83	Pass
191	Burgess	FF	Bed2	0.03	30.83	Pass
		FF	Lounge	0.83	N/A	Pass
		GF	Family	0.51	N/A	Pass
		GF	KitchenDining	1.6	N/A	Pass
		SF	Bed1	0.3	30.67	Pass
		SF	Bed3	0.08	27.33	Pass
104	Gaskell	FF	Bed1	0.03	13.5	Pass
		FF	Bed2	0	27	Pass
		GF	KitchenDining	0	N/A	Pass
		GF	Lounge	0	N/A	Pass
189	Wilson	FF	LoungeDiningKitchen	0.68	N/A	Pass
		SF	Bed1	0.11	24.83	Pass
		SF	Bed2	0	30.33	Pass
		SF	Bed3	0.07	21.5	Pass

Conclusion

From the base specification all plots failed under criterion B.

To mitigate the failure; mechanical ventilation was implemented into each plot – notably bedrooms facing Princess Parkway, please see table under Remedial Measures.

Disclaimer

The data used in this report has been provided by the developer, it has been used in good faith and is assumed to be correct at the time of writing. Different weather conditions and altered usage of the building will produce different results. Alterations to the assumptions listed in this report could result in a different set of results, therefore, the conclusion that the building will not overheat may no longer hold true.

Appendix 1

Table 2 Occupancy and equipment gain descriptions

Unit/ room type	Occupancy	Equipment load
Studio	2 people at 70% gains from 11 pm to 8 am 2 people at 100% gains from 8 am to 11 pm	Peak load of 450 W from 6 pm to 8 pm*. 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room/kitchen	1 person from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-bedroom apartment: living room	1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
1-bedroom apartment: kitchen	1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
2-bedroom apartment: living room/kitchen	2 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
2-bedroom apartment: kitchen	2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm Base load of 50 W for the rest of the day
3-bedroom apartment: living room/kitchen	3 people from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-bedroom apartment: living room	3 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150 W from 6 pm to 10 pm 60 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 35 W for the rest of the day
3-bedroom apartment: kitchen	3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 300 W from 6 pm to 8 pm base load of 50 W for the rest of the day
Double bedroom	2 people at 70% gains from 11 pm to 8 am 2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm 1 person at full gains in the bedroom from 9 am to 10 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during the sleeping hours
Single bedroom (too small to accommodate double bed)	1 person at 70% gains from 11 pm to 8 am 1 person at full gains from 8 am to 11 pm	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours
Communal corridors	Assumed to be zero	Pipework heat loss only; see section 3.1 above

Figure 1: TM59 Occupancy and equipment gain descriptions

Figure 2: TM59 Schedules and Heat Gain Profiles

Number of people	Description	Peak load (W)		Period																								
		Sensible	Latent	Hour ending																								
				00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	
				1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00	
1	Single bedroom occupancy	75	55	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7	
2	Double bedroom occupancy	150	110	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio occupancy	150	110	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7	
1	1-bedroom living/kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1-bedroom living occupancy	75	55	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1-bedroom kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bedroom living/kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2-bedroom living occupancy	150	110	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2-bedroom kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3-bedroom living/kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3-bedroom living occupancy	225	165	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3-bedroom kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
	Single bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13	
	Double bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13	
	Studio equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living/kitchen equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living equipment	150		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	1	1	1	0.4	0.4	
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17	
	Lighting profile	2 (W/m ²)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	

Figure 2: TM59 Schedules and Heat Gain Profiles

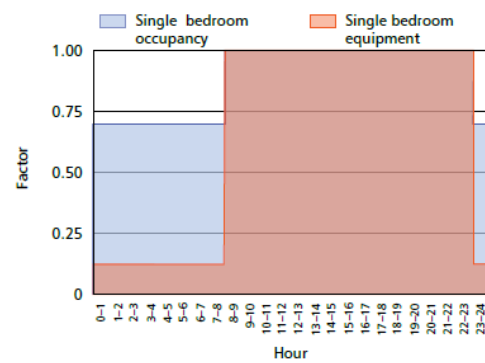


Figure 3: TM59 Single Bedroom

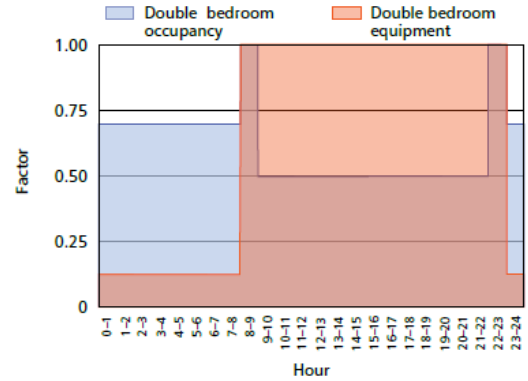


Figure 4: TM59 Bedroom Occupancy

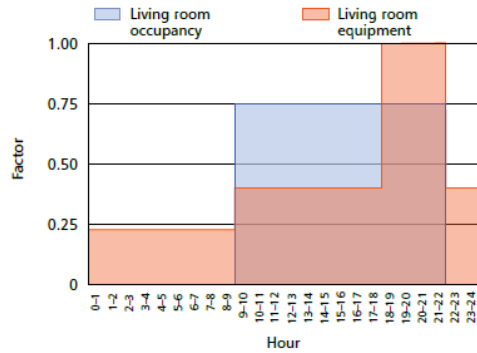


Figure 5: TM59 Living Room Occupancy

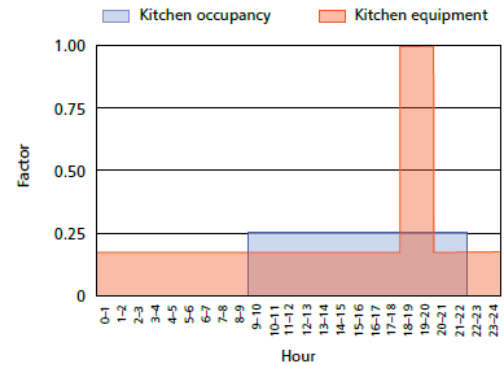


Figure 6: TM59 Kitchen Occupancy



Figure 7: TM59 Living Room/Kitchen Occupancy

Appendix 2

CIBSE TM59 - Base Results					
Burnett					
Plot	Block	Zone	Criterion A (%)	Criterion B (hr)	Pass/Fail
171	FF	Bed2	0.17	222.67	Fail
	FF	Lounge	0.28	N/A	Pass
	GF	KitchenDining	0.37	N/A	Pass
	SF	Bed1	0.1	16.5	Pass
	SF	Bed3	0.15	217.33	Fail
174	FF	Bed2	0.33	227.83	Fail
	FF	Lounge	0.87	N/A	Pass
	GF	KitchenDining	1.25	N/A	Pass
	SF	Bed1	0.26	21.17	Pass
	SF	Bed3	0.23	225.5	Fail
175	FF	Bed2	0.44	242.83	Fail
	FF	Lounge	0.65	N/A	Pass
	GF	KitchenDining	0.42	N/A	Pass
	SF	Bed1	0.23	21.33	Pass
	SF	Bed3	0.36	242.33	Fail
185	FF	Bed2	0.18	222.33	Fail
	FF	Lounge	0.31	N/A	Pass
	GF	KitchenDining	0.21	N/A	Pass
	SF	Bed1	0.13	18.83	Pass
	SF	Bed3	0.18	228.17	Fail
190	FF	Bed2	0.13	215	Fail
	FF	Lounge	0.34	N/A	Pass
	GF	KitchenDining	0.43	N/A	Pass
	SF	Bed1	0.11	17.67	Pass
	SF	Bed3	0.15	216.17	Fail
194	FF	Bed2	0.23	183.17	Fail
	FF	Lounge	0	N/A	Pass
	GF	KitchenDining	0	N/A	Pass
	SF	Bed1	0	10.67	Pass
	SF	Bed3	0.22	207.33	Fail
195	FF	Bed2	0.27	194.83	Fail
	FF	Lounge	0	N/A	Pass
	GF	KitchenDining	0	N/A	Pass
	SF	Bed1	0	12.5	Pass
	SF	Bed3	0.27	208.33	Fail
196	FF	Bed2	0.28	189.67	Fail
	FF	Lounge	0	N/A	Pass
	GF	KitchenDining	0	N/A	Pass

	SF	Bed1	0	10.83	Pass
	SF	Bed3	0.24	208.5	Fail
Burgess					
170	FF	Bed2	1.15	256.17	Fail
	FF	Lounge	0.92	N/A	Pass
	GF	Family	0.52	N/A	Pass
	GF	KitchenDining	1.46	N/A	Pass
	SF	Bed1	0.49	42.5	Fail
	SF	Bed3	1.56	248.17	Fail
176	FF	Bed2	0.75	246.5	Fail
	FF	Lounge	0.93	N/A	Pass
	GF	Family	0.34	N/A	Pass
	GF	KitchenDining	1.38	N/A	Pass
	SF	Bed1	0.3	39.5	Fail
	SF	Bed3	0.97	241.5	Fail
184	FF	Bed2	0.71	241.17	Fail
	FF	Lounge	0.86	N/A	Pass
	GF	Family	0.33	N/A	Pass
	GF	KitchenDining	1.23	N/A	Pass
	SF	Bed1	0.27	38.33	Fail
	SF	Bed3	0.91	240	Fail
191	FF	Bed2	1.23	261.17	Fail
	FF	Lounge	0.97	N/A	Pass
	GF	Family	0.53	N/A	Pass
	GF	KitchenDining	1.55	N/A	Pass
	SF	Bed1	0.54	44	Fail
	SF	Bed3	1.62	251.17	Fail
197	FF	Bed2	0.5	177.67	Fail
	FF	Lounge	0.05	N/A	Pass
	GF	Family	0.4	N/A	Pass
	GF	KitchenDining	0.27	N/A	Pass
	SF	Bed1	0.22	34.83	Fail
	SF	Bed3	1.04	209.67	Fail
Gaskell					
104	FF	Bed1	0.09	18	Pass
	FF	Bed2	0.23	177.33	Fail
	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
105	FF	Bed1	0	9.33	Pass
	FF	Bed2	0.04	135.17	Fail
	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
106	FF	Bed1	0.02	12.33	Pass
	FF	Bed2	0.09	150	Fail

	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
107	FF	Bed1	0.06	11.67	Pass
	FF	Bed2	0.16	163.33	Fail
	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
108	FF	Bed1	0.01	10.67	Pass
	FF	Bed2	0.09	138	Fail
	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
109	FF	Bed1	0.01	8.67	Pass
	FF	Bed2	0.09	140.83	Fail
	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
110	FF	Bed1	0.06	17.33	Pass
	FF	Bed2	0.17	176	Fail
	GF	KitchenDining	0	N/A	Pass
	GF	Lounge	0	N/A	Pass
Wilson					
172	FF	LoungeDiningKitchen	0.68	N/A	Pass
	SF	Bed1	0.16	28.5	Pass
	SF	Bed2	0.09	143.33	Fail
	SF	Bed3	0.1	24.17	Pass
173	FF	LoungeDiningKitchen	0.58	N/A	Pass
	SF	Bed1	0.1	25.33	Pass
	SF	Bed2	0.05	126.33	Fail
	SF	Bed3	0.01	18	Pass
186	FF	LoungeDiningKitchen	0.51	N/A	Pass
	SF	Bed1	0.09	23.83	Pass
	SF	Bed2	0.07	132.17	Fail
	SF	Bed3	0.02	18.67	Pass
187	FF	LoungeDiningKitchen	0.62	N/A	Pass
	SF	Bed1	0.14	26.83	Pass
	SF	Bed2	0.09	139.67	Fail
	SF	Bed3	0.07	22.17	Pass
188	FF	LoungeDiningKitchen	0.63	N/A	Pass
	SF	Bed1	0.13	27.33	Pass
	SF	Bed2	0.08	135.17	Fail
	SF	Bed3	0.04	21.67	Pass
189	FF	LoungeDiningKitchen	0.71	N/A	Pass
	SF	Bed1	0.17	28.5	Pass
	SF	Bed2	0.1	143.67	Fail
	SF	Bed3	0.1	24.33	Pass
192	FF	LoungeDiningKitchen	0.04	N/A	Pass

193	SF	Bed1	0	14.67	Pass
	SF	Bed2	0.14	115.5	Fail
	SF	Bed3	0	13.17	Pass
	FF	LoungeDiningKitchen	0	N/A	Pass
	SF	Bed1	0	14.33	Pass
	SF	Bed2	0.13	113.67	Fail
	SF	Bed3	0	12.33	Pass