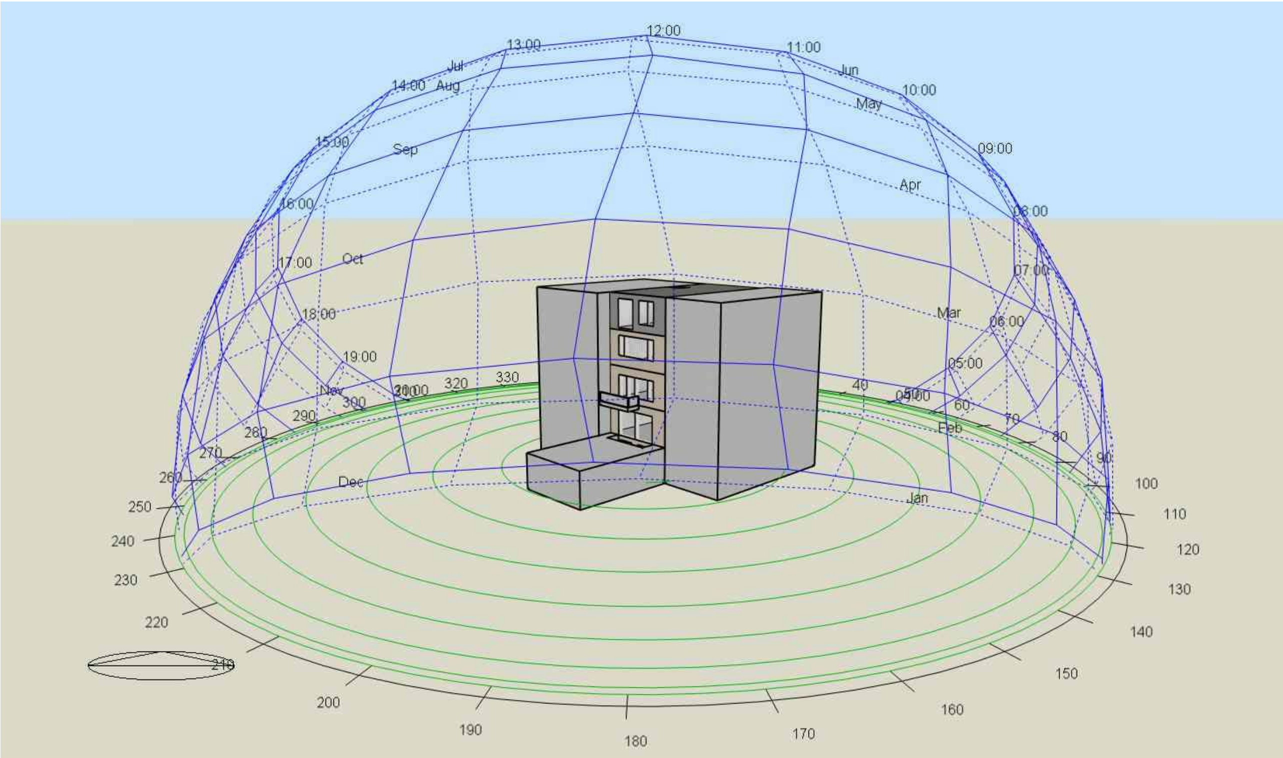

Domestic Overheating Assessment

CIBSE TM59

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17 November 2022

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Document Status

Client: GMS-ED Limited

Site: 23 Primrose Hill, NW3 3AY, London

Proposals: Re-development of a mid-terrace four-storey building to provide a dwellinghouse .

Contents:

Appendices:

Appendix A: Assessed Zones Internal Layouts
Appendix B: Extreme Weather DSY2, DSY3 Weather Scenarios
Appendix C: Detailed Occupancy Schedules – CIBSE TM 59 Heat gain Profile.

Document Control Record:

Prepared by	Checked by	Date	Job	Revision
Sergio Gomez	Allan Jones	17-11-2022	10402	2.0

1 Scope

This report and accompanying domestic overheating assessment have been prepared in support of the planning application for the re-development of a mid-terrace four-storey building to provide a dwellinghouse on the land at 23 Primrose Hill, NW3 3AY, London.

The intention is that this study helps inform and verify the design proposals, thereby providing the basis for mitigating overheating risk and producing a building that provides comfortable environmental conditions for occupants. This report assesses the overheating risk of all units and follows Policy CC2 Adapting to Climate Change of the London Borough of Camden Local Plan, which follows the requirements of the London Plan Policy SI 4: Managing heat risk.

It is important to note that with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions and approximations are supplied within the report. These were predominantly informed by William Deakins Architect and should be reviewed carefully.

All results are based on the output from computer modelling software and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

Moreover, this Overheating Assessment across the development supports the Planning Application and demonstrates that the proposed development complies with the relevant current guidance CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes (2017).

2 Executive Summary

An overheating assessment has been undertaken on all areas of the proposed residential development at 23 Primrose Hill, NW3 3AY, London.

The assessment for the residential units has been undertaken in accordance with CIBSE Technical Memorandum 59, which deals with overheating risk in domestic properties. The methodology stipulated in TM59 has been followed and all units assessed against the overheating criteria detailed.

3 London Plan Policy

The London Plan Policy SI 4 Managing heat risk states the following:

Development proposals should minimise adverse impacts on the urban heat island (UHI) through design, layout, orientation, materials, and the incorporation of green infrastructure.

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following **cooling hierarchy**:

1. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.
2. Minimise internal heat generation through energy efficient design.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
4. Provide passive ventilation.
5. Provide mechanical ventilation.
6. Provide active cooling systems.

Passive ventilation should be prioritised, taking into account external noise and air quality in determining the most appropriate solution. The increased use of air conditioning systems is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. If active cooling systems, such as air conditioning systems, are unavoidable, these should be designed to reuse the waste heat they produce. Future district heating networks are expected to be supplied with heat from waste heat sources such as building cooling systems.

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments, which can also be applied to refurbishment projects. TM 59 should be used for domestic developments and TM 52 should be used for non-domestic developments. In addition, TM 49 guidance and datasets should also be used to ensure that all new development is designed for the climate it will experience over its design life. Further information will be provided in guidance on how these documents and datasets should be used.

Further details and guidance regarding overheating and cooling are outlined in the Energy Assessment Guidance (2022). Which in section 8 “Cooling and overheating” sets out the following recommendations to avoid overheating risks and reduce the impact of UHI effects in new developments:

1. The London Plan encourages developers to carry out overheating modelling against extreme weather scenarios, which will provide the necessary detail for developers to design developments with appropriate mitigation measures.

2. The London Plan requires developers to follow the cooling hierarchy to reduce the risk of developments overheating and reduce the impact on the UHI effect through avoiding mechanical cooling where possible and promoting passive cooling measures. Where mechanical cooling is proposed, developers will need to consider the use of low global warming potential refrigerants to reduce harmful emissions.

As stated above this report demonstrates how the scheme has been produced in line with the cooling hierarchy of London Plan Policy SI 4, and has identified the CIBSE TM 59 guidance, presented in chapter 4 of this report, as the most appropriate methodology for the assessment of overheating risk of homes.

4 CIBSE TM59 Assessment Criteria

CIBSE TM 59: Design methodology for the assessment of overheating risk in homes (2017):

The occupied spaces being assessed are to have their performance measured against the requirements of CIBSE Technical Memorandum 59 'Design methodology for the assessment of overheating risk in homes', which was published in 2017.

The guidance requires that both of the following criteria be met for predominantly natural ventilated homes:

Criterion A: For living rooms, kitchens, and bedrooms: the number of hours during which ∆T 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).

Criterion B: For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a failure).

Additionally, the following criteria is set for homes that are **predominantly mechanically ventilated:**

For homes with restricted window openings, all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied annual hours.

5 The Model

The building was modelled using Design Builder software (DSB) which is based on the Energy Plus engine. The software complies with CIBSE Application Manual AM11: 1998 Building Energy and Environmental Modelling and provides a full dynamic simulation of thermal conditions in the building.

Geometry

A three-dimensional analysis model has been generated for the proposed scheme. The model was developed using drawn information supplied by GSB Architectural.

As with any modelling exercise, some approximations have been made, but care has been taken to ensure the scale and internal dimensions of the model are as close as practicable to the design drawings, and that glazing areas are as accurately represented as the provided information allows.

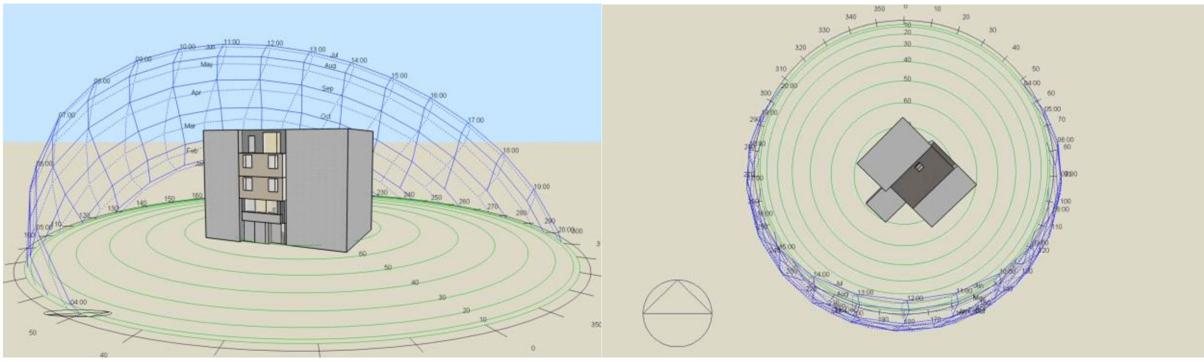


Figure 01.- Solar Path & Isometric view

Climate

The GLA Energy Assessments guidance (March 2021), refers to the CIBSE TM:49 weather files to be used on overheating assessments.

Overheating modelling for both domestic and non-domestic developments should be conducted using the following design weather file:

DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario

The most representative weather data set for the project location should be used as follows:

- London Weather Centre data: The Central Activity Zone (CAZ) and other high density urban areas (e.g., Canary Wharf).
- London Heathrow airport data: lower density urban and suburban areas.
- Gatwick Airport data: rural and peri-urban areas around the edge of London.

Additional testing should be undertaken using the 2020 versions of the following more extreme design weather years:

DSY2 – 2003: a year with a very intense single warm spell.
DSY3 – 1976: a year with a prolonged period of sustained warmth

It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2&3 weather files, although it is expected that in most cases a significant proportion of spaces will be able to achieve compliance if passive measures are fully exploited. Where the CIBSE compliance criteria is not met for a particular weather file the applicant must demonstrate that the risk of overheating has been reduced as far as practical and that all passive measures have been explored, including reduced glazing and increased external shading.

The weather data used in this study is based on 2020 weather data for Heathrow which is intended to be indicative of a low-rise urban location for London and it is closer to the building site, accounting for local microclimatic factors. The DSY1 weather file has been used, which represents a moderately warm summer with a return period of seven years.

The outputs for the extreme DSY2 and DSY3 weather files that were additionally tested are shown in Appendix B. As per the GLA Guidance for Energy assessments, adaptation measures for the more extreme weather scenarios are proposed to help occupants cope in the event of extreme weather conditions.

Solar

Solar gains are calculated automatically by the modelling software based on the orientation of the building, the transmission coefficients of the glazing and the solar angles.

Building Elements

The fabric performance listed in tables 02 and 03 has been extracted following the information provided by GMS-ED Limited and the U-value for band E of the SAP Appendix S.

A glazing specification was not proposed, however one that incorporates solar control has been assumed for the sake of the analysis as a means of helping to mitigate the amount of solar radiation being transmitted into the building.

Heat transfer between assessed spaces and adjacent internal spaces is considered adiabatic (i.e., zero heat transfer).

Table 01: Thermal Transmittance of Building Elements for constructed elements

Building Element	Retained U-Value (W/M^2k)	G-Value	Notes
Retained Walls	0.25	n/a	Retained brick wall with internal insulation plasterboard lining internally
Roof	0.13	n/a	Pitched roof with insulation in rafters and internal plasterboard.
Internal Walls	1.60	n/a	Concrete blockwork lining plasterboard
Internal Floors	1.00	n/a	Timber joists
Glazing	1.60	0.63	Double glazed units
External Doors	1.80	n/a	Insulated external doors

Table 02: Thermal Transmittance of Building Elements for retained construction elements

Building Element	Retained U-Value (W/M^2k)	G-Value	Notes
Walls	0.25	n/a	Retained unfilled cavity wall with internal lining insulation and plasterboard
Roof	2.30	n/a	Retained Flat Roof
Ground Floor	1.50	n/a	Retained concrete floor
Internal Walls	1.50	n/a	Retained brickwork lining plasterboard
Internal Floors	1.00	n/a	Retained reinforced concrete

Solar Control

The glazing specification proposed is to meet a U-Value of 1.60W/m2K and have a g-value of 0.63 as per the SAP notional building values. However, for the sake of the analysis and as a mean of helping to mitigate the amount of solar radiation being transmitted into the building, the present assessment has proposed to include solar control glazing in all windows and glazed doors, the proposed g-values were 0.50 and 0.35.

All proposed design glazing g-values has been described in the following table:

Table 03: Glazing Orientation

Level	Opening	Glazing Orientation	G-Value
Ground Floor	0F.4-Bedroom 01	Southwest	0.35
First Floor	1F.9-Dining Room	Northeast	0.35
	1F.11-Kitchen	Southwest	0.35
Second Floor	1F.12-Sitting Room 01	Northeast	0.35
	1F.14-Sitting Room 02	Southwest	0.35
Third Floor	1F.15-Bedroom 02	Northeast	0.35
	1F.19-Bedroom 03	Southwest	0.35
Fourth Floor	1F.23-Bedroom 04	Southwest	0.35

The results of the iterations are reflected in options 03-05 of table 07.

It is important to note that external elements such as balconies can act as local shading devices, any alteration in the size of these elements will have a direct impact in the TM59.

Model Geometry and Local Shading

The Model has included the immediate surrounding elements (vegetation and building blocks) to account the overshadowing during simulations.

Environmental

Internal Gains

Internal conditions are attributed to each assessed zone. Within the internal conditions, heat gains attributable to lighting, occupancy, and equipment are detailed. The heat gains and occupancy patterns are based on figures outlined in TM59 for various types of residential space.

Internal Heat Gains

The internal gains assumptions (Table 05) stipulated by the TM 59 guidance have been included in the dynamic thermal model. Table 04 below provides details of the heat gains associated with lighting, meanwhile table 05 shows all equipment and occupancy load (Sensible and latent).

Table 04: Lighting gains (CIBSE TM 59)

	Occupancy	Lighting Load
All Rooms - Lighting	N/A	Lighting assumed 2 W/m^2 from 6pm to 11 pm, corridors: zero lighting gains assumed for PIR sensor activated lighting.

Table 05: Occupancy & Equipment gains (CIBSE TM 59)

Room Type	Occupancy	Equipment Load
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
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 gain 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	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

<u>Profiles</u>
Figures 03-08 below illustrate the profiles applied to the heat gains associated with occupancy, lighting and equipment. These profiles are defined by the methodology described in CIBSE TM59.

The vertical axis of the graphs represents the proportion of the full gains applied for each hour of the day, with maximum internal gain figures given in Table 5 above. Further information can be found in Appendix C.

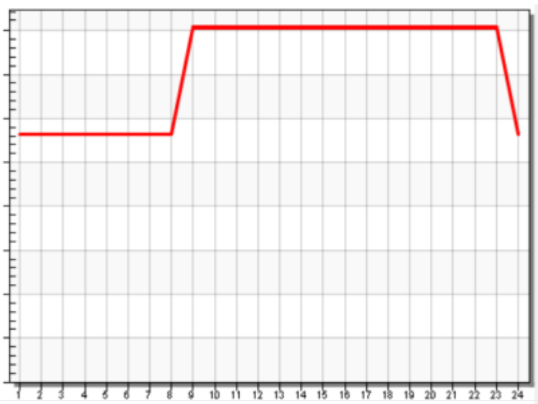


Figure 03: Occupancy of Single Bedrooms

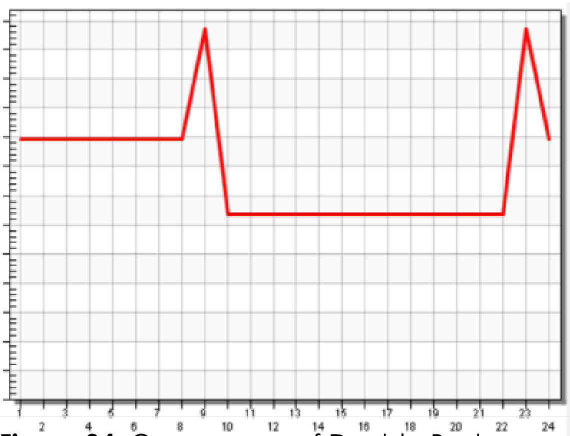


Figure 04: Occupancy of Double Bedrooms

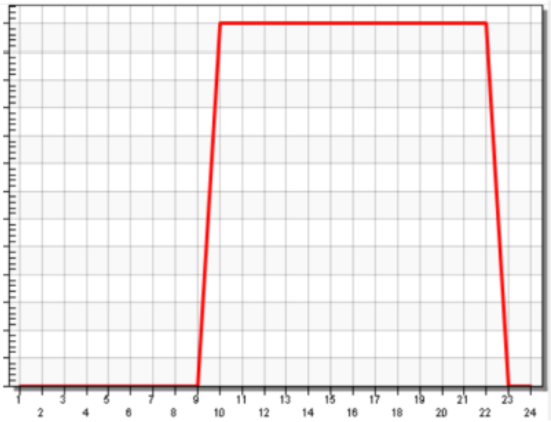


Figure 05.- Occupancy of Living/Kitchen

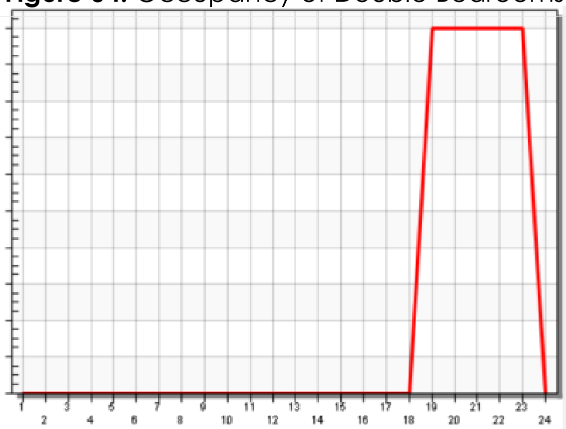


Figure 06: Lighting in all areas

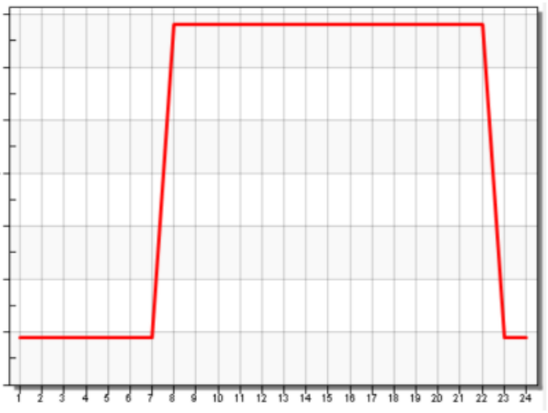


Figure 07: Equipment in Bedrooms

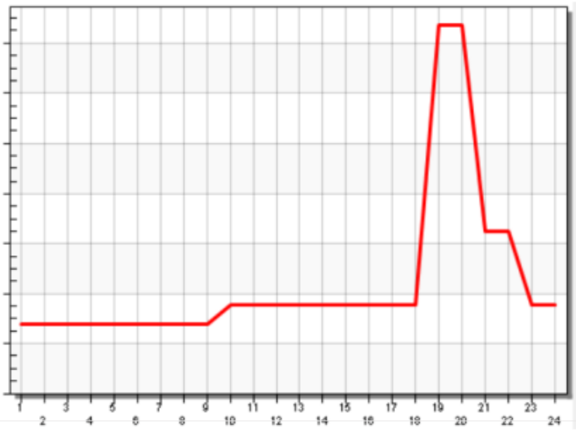


Figure 08: Equipment in Living/Kitchen

Heating, Cooling and Ventilation

Infiltration
An infiltration rate of 5 air changes per hour (ACH) has been assumed, based on the targeted air permeability rate of 15 m3/ (h.m2) at 50 Pa. This is based on empirical air permeability data published in CIBSE Guide A and the National Calculation Methodology.

Heating and Cooling

All Bedroom spaces are assumed to be heated to 18°C, Kitchen-Living spaces are assumed to be heated to 21°C.

Mechanical Ventilation

An additional iteration to include mechanical ventilation with heat recovery and summer bypass (MVHR) has been assessed (table 07 option 05). It has been assumed that the units will have the following flow rates:

1. Bedrooms: 30 l/s
2. Living-Kitchen: 50 l/s

Natural ventilation

All occupied spaces will have natural ventilation openings for purge ventilation. When temperatures begin to rise within the spaces, occupants will be able to open doors and windows in order to permit the flow of outside air into the relevant space. Openings have been modelled as indicated on the elevation drawings produced by William Deakins Architect.

As previously mentioned, the operability of the windows is managed by the CIBSE TM 59 occupancy templates, which indicates that the window opening is allowed only when the room is occupied

Openings have been set to be openable at any time of the day, taking into account the diverse occupancy of residential properties as per table 6.

Further detail regarding the occupancy schedules, stipulated by CIBSE TM 59 can be found in Appendix C. Table 7 summarizes the natural ventilation strategy adopted in each space.

Table 06: Proposed natural ventilation strategy in domestic areas.

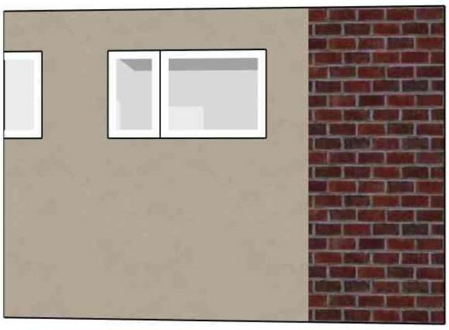
Room	Occupied Hours	Ventilation Strategy
Living Room	09:00 – 22:00	Windows and balcony doors open during unoccupied hours (22:00 - 09:00).
Bedroom	24/7 (sleeping hours 22:00-07:00)	Windows and balcony doors open outside sleeping hours (07:00-22:00).

Windows Operability

The equivalent free area of the windows has been defined under the concepts of the CIBSE 2016 article "Air of Credibility". Table 09-16 shows the opening details of all the windows/glazed doors in the development. The results include a security restriction of 100mm opening limits for all the windows that have low-cill heights (1100 mm), required by Part K of the building regulations and the BCA Technical Guidance Note 16 published by the building control alliance. Bedroom openings have been assumed to be closed over sleeping hours.

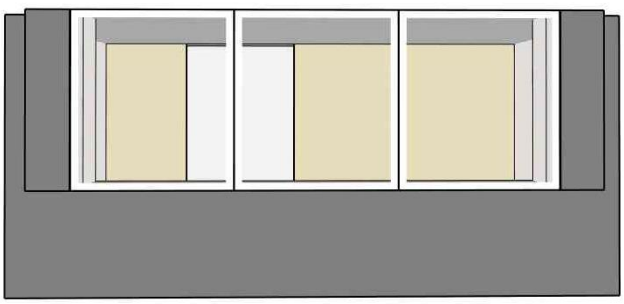
Internal domestic unit doors are assumed to have a free area equivalent to 50% and open 5% of the time, access doors to the apartments are assumed to be closed all the time.

Figure 09: 0F.4-Bedroom 01



Free area (%):	24.00
Discharge Coefficient	0.62

Figure 10: 1F.9-Dining Room



Free area (%):	Fixed
Discharge Coefficient	0.00

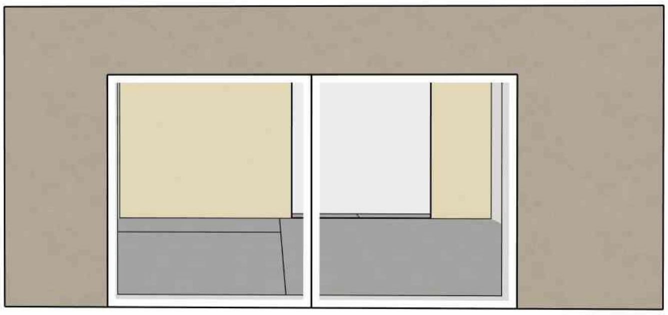
Figure 11: 1F.11-Kitchen	
	
Free area (%):	90.00
Discharge Coefficient	0.62

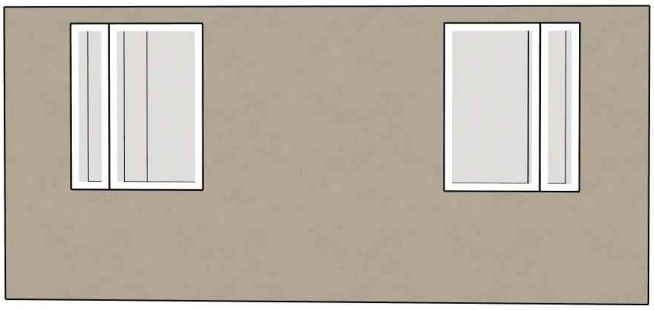
Figure 12: 2F12-Sitting Room 01	
	
Free area (%):	53.00
Discharge Coefficient	0.65

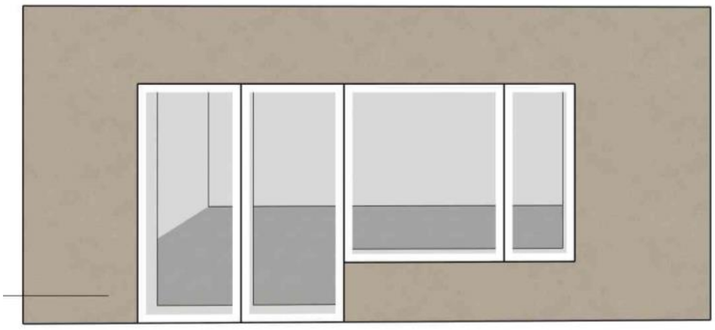
Figure 13: 2F.14-Sitting Room 02	
	
Free area (%):	Windows: 43.00/Door:90.00
Discharge Coefficient	0.62

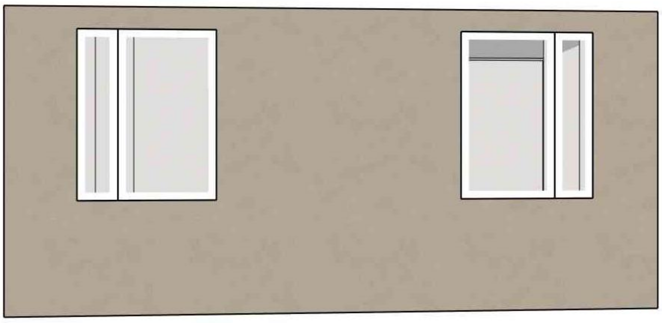
Figure 14: 3F.15-Bedroom 02	
	
Free area (%):	43.00
Discharge Coefficient	0.62

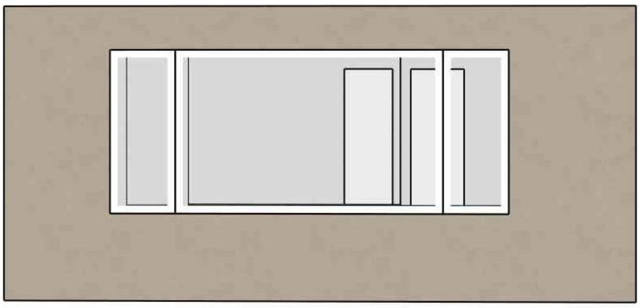
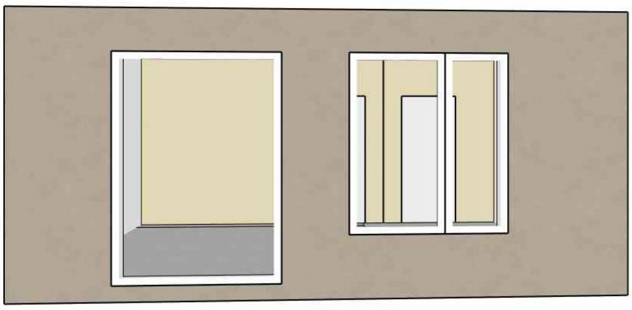
Figure 15: 3F.19-Bedroom 03	
	
Free area (%):	43.00
Discharge Coefficient	0.62

Figure 16: 4F.23-Bedroom	
	
Free area (%):	43.00
Discharge Coefficient	0.62

All of the openings are assumed to start being opened when the internal temperature of the adjacent zone reaches 22°C and to be open to their full extent by the time the internal temperature reaches 23°C. This is intended to simulate the likely behaviour of occupants.

Openings have been set to be openable at any time of the day, taking into account the diverse occupancy of residential properties. It is assumed that internal doors will be open during the day to encourage the flow of air within the property.

Solar Control Devices

A possible scenario to include 1.00 m brise soleil in the south facing windows has been explored, however, due to the planning constrains this solution has not been included in the final adopted measures.

5 Results

This section details the results obtained from the assessment of overheating risk.

All occupied spaces have been assessed against the requirements of Criterion A and all sleeping spaces against the requirements of Criterion B. These assessment criteria are described in detail earlier in the report.

Criterion A & B

The results presented below in table 08 demonstrate the performance of all occupied areas against Criterion A & B of TM59:

Table 07: Residential units CIBSE TM 59 overheating assessment results for DSY1 2020s weather file:

N.					Criterion A (%) *	Criterion B (Hrs)**
	G-value	Type of Ventilation	Window free area (%)	Shading Devices	No. of rooms meeting the criteria	No. of rooms meeting the criteria
01	0.63	Natural Ventilation	100mm opening limits	None	1 of 8	0 of 4
02	0.50	Natural Ventilation	100mm opening limits	None	1 of 8	0 of 4
03	0.35	Natural Ventilation	100mm opening limits	None	3 of 8	0 of 4
04	0.35	Natural Ventilation	100mm opening limits	1.0m Overhang	7 of 8	0 of 04
05	0.35	Natural Ventilation & MVHR	100mm opening limits	1.0m Overhang	7 of 8	1 of 04

*Criterion A accounts for both Bedroom & Living-Kitchen spaces (4 Living/Kitchen spaces and 4 bedrooms), 8 spaces in total.

**Criterion B accounts only for bedroom spaces (4 bedrooms in total)

Option 01 represents the results with the proposed 0.63 g-values in all windows, and only the underground floor bedroom has shown compliance with the criterion A. Option 02 integrates windows with a g-value of 0.50 and has no shown further improvements.

Option 03 has upgraded the solar control glazing integrating a 0.35 g-value in all windows. By doing this improvement the bedrooms at the ground and third floor levels have been shown to meet criterion A.

Option 04 has integrated a 1.0m overhang and 0.35 g-value in all windows. This has demonstrated significant reduction of overheating risk the majority of areas, as 7 out of 8 spaces will meet compliance with the criterion A of the CIBSE TM59 methodology.

Option 05 has incorporated all the elements of option 04 and integrated an MVHR with summer bypass. However, the only change was that the ground floor bedroom will meet Criterion B.

Finally, the above scenarios have demonstrated that the passive measures described by the cooling hierarchy will fail to meet the CIBSE TM59 criteria. Therefore, the incorporation of solar control and active cooling is advised.

6 Cooling Hierarchy Summary

In accordance with the CIBSE TM 59 guidance, the steps taken to avoid the risk of overheating on the dwellings are summarised in the following table:

Table 08: Cooling hierarchy

Cooling Hierarchy	Cooling Strategy
1. Minimise internal heat generation	1. Low energy lighting will be installed across the development to reduce internal heat gains and improve energy consumption.
2. Reduce the amount of heat entering a building in summer though orientation, shading, albedo fenestration, insulation and green roofs and walls.	2. The fabric of the building has been assessed in line with the heating requirements specified in the energy statement, which has adopted a "fabric first" approach to design the most suitable heating system. 3. Solar control glazing with low g-values was considered to be included in all facades to reduce unnecessary solar gains as per option 03 of table 07.
3. Manage the heat within the building though exposed internal thermal mass and high ceilings	4. Due to the existing nature of the building introducing further thermal mass to building elements has not been considered, the thickness and construction type the thermal mass in managing heat in the spaces is considered high.
4. Passive Ventilation	5. Natural ventilation is possible through outward/inward opening windows across all dwellings. 6. Due to the nature of the building, cross ventilation is facilitated by the double aspect in storeys 1 to 4.
5. Mechanical ventilation	7. Mechanical ventilation with heat recovery has been assessed, but not incorporated as it has a minor impact on the overheating risk.
6. Active Cooling Systems	8. Active cooling is proposed

6 Summary

An overheating assessment has been undertaken for re-development of a mid-terrace four-storey building to provide a dwellinghouse on the land at 23 Primrose Hill, NW3 3AY, London.

The present report has assessed all the relevant residential areas. A number of passive measures have been approached to help mitigate overheating risk:

- Natural ventilation openings have been provided to all occupied spaces, with cross-ventilation aspect and double ventilation employed wherever possible.
- The openings have assessed with solar control glazing to assist in mitigating the overheating risk at all areas.
- All openings have assessed with a 1.0m overhang in order to reduce the undesired solar gains in summer, however due to the planning constrains this solution has not been adopted.
- Mechanical Ventilation with Heat Recovery units has been assessed to enhance the ventilation rate but has not been included in the final proposal.

By following the GLA cooling hierarchy different passive measures have been considered in order to tackle overheating. However, the risk of overheating remains high as the development has failed to comply with the CIBSE TM 59 criteria, thus active cooling is being proposed.

In accordance with the assessment of the building under the DSY2 and DSY3 weather files (Appendix C), a minimal reduction can be observed in the overheating risk through the inclusion of solar control glazing. Nonetheless, the criteria cannot be met by the application of the aforementioned measures, hence there is still an overheating risk due to the onerous nature of the more severe weather scenarios, the inclusion of active cooling would be advisable to surpass the TM 59 requirements for these extreme weather files.

The report demonstrates that the approach taken has failed to avoid an overheating risk in all the spaces if only passive measures are considered. Therefore, the proposed scheme it is advised to incorporate active cooling. It is also recommended that the development integrates solar control glazing with g-value of 0.35 in order to reduce the cooling demand.

It is incumbent on the local planning authority to approve the present assessment.

Appendices

Appendix A: Assessed Zones Internal Layouts

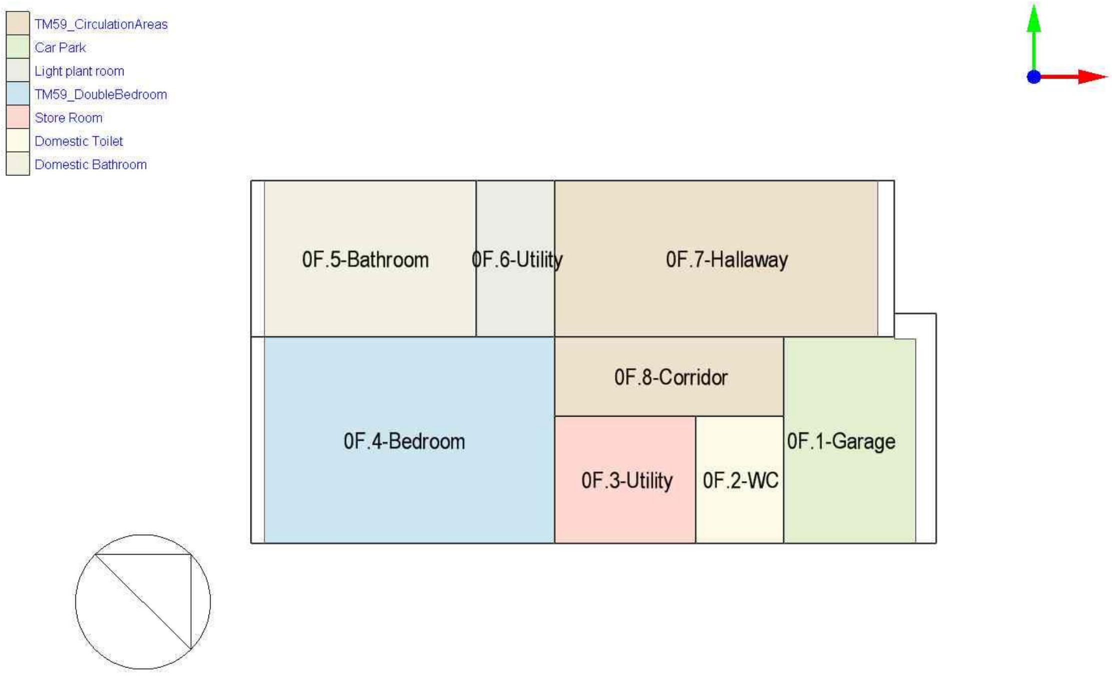


Figure 17: Ground Floor

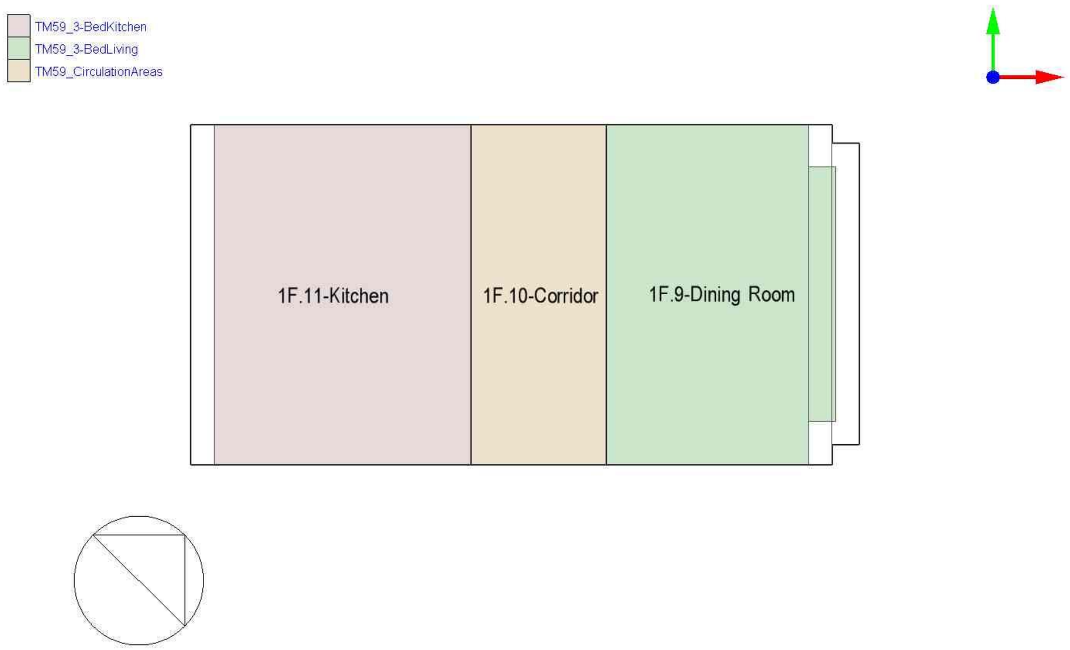


Figure 18: First Floor

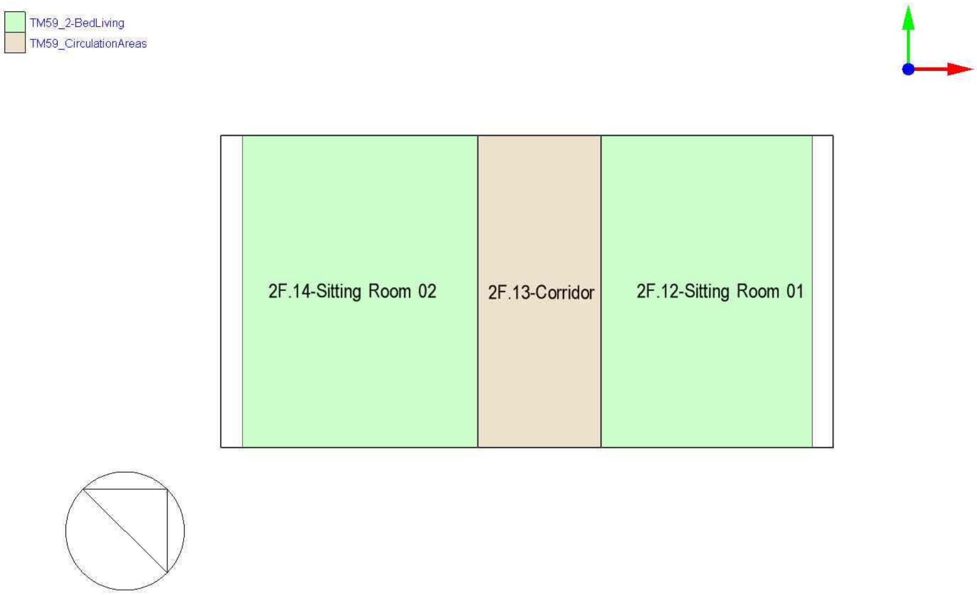


Figure 19: Second Floor

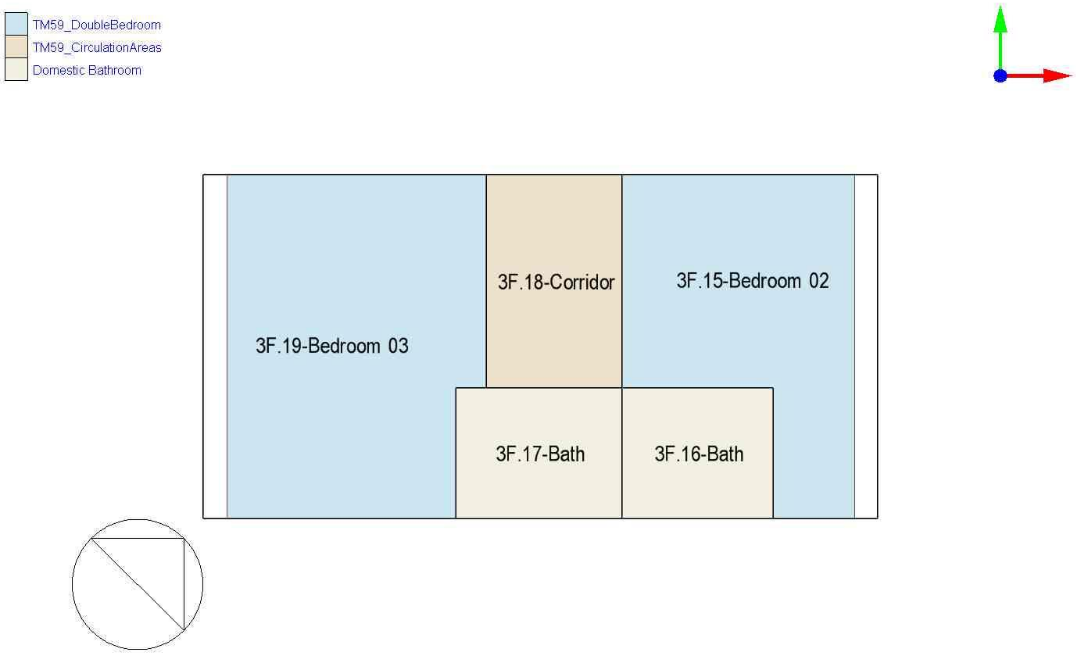


Figure 20: Third Floor

Figure 21: Forth Floor

Appendix B: Assessed Zones Internal Layouts

Table 08: CIBSE TM59 results for residential units – DSY-2.

N.					Criterion A (%) *	Criterion B (Hrs)**
	G-value	Type of Ventilation	Window free area (%)	Shading Devices	No. of rooms meeting the criteria	No. of rooms meeting the criteria
01	0.63	Natural Ventilation	100mm opening limits	None	1 of 8	0 of 4
02	0.50	Natural Ventilation	100mm opening limits	None	1 of 8	0 of 4
03	0.35	Natural Ventilation	100mm opening limits	None	2 of 8	0 of 4
04	0.35	Natural Ventilation	100mm opening limits	1.0m Overhang	4 of 8	0 of 04
05	0.35	Natural Ventilation & MVHR	100mm opening limits	1.0m Overhang	4 of 8	0 of 04

Table 08: CIBSE TM59 results for residential units – DSY-3.

N.					Criterion A (%) *	Criterion B (Hrs)**
	G-value	Type of Ventilation	Window free area (%)	Shading Devices	No. of rooms meeting the criteria	No. of rooms meeting the criteria
01	0.63	Natural Ventilation	100mm opening limits	None	1 of 8	0 of 4
02	0.50	Natural Ventilation	100mm opening limits	None	1 of 8	0 of 4
03	0.35	Natural Ventilation	100mm opening limits	None	2 of 8	0 of 4
04	0.35	Natural Ventilation	100mm opening limits	1.0m Overhang	4 of 8	0 of 04
05	0.35	Natural Ventilation & MVHR	100mm opening limits	1.0m Overhang	4 of 8	0 of 04

BASEENERGY
Building Assessments for a Sustainable Environment

Appendix D: Detailed Occupancy Schedules – CIBSE TM 59 Heat gain Profile

Number of People	Description /Occupancy	Period																							
		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
		Hour ending																							
		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	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	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	1	0.7
2	Studio	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	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1 - bedroom /living	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	0
1	1 - bedroom Kitchen	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	0
2	2-bedroom /living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2 - bedroom /living	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	0
2	2 - bedroom Kitchen	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	0
3	3 - bedroom/living/Kitchen	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3 - bedroom /living	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	0
3	3 - bedroom Kitchen	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	0