

# Overheating Analysis

## Wellington Road



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# Overheating Analysis

## Wellington Road

### Executive summary

#### Overview

This report has assessed the proposed scheme in accordance with CIBSE Guide A, CIBSE TM52 and TM59 requirements relating to overheating and Part O. Results are provided which show how the occupied spaces perform against the thermal comfort standards for overheating.

The scheme has implemented passive design measures and the modelling results indicate that the scheme is compliant with the overheating requirements.

The proposal maximises passive design measures by responding to the local context in the following ways:

- Energy efficient lighting and appliances have been recommended to reduce internal heat gains
- The building fabric will be insulated over and above the standards set out by Building Regulations and reduced solar gains from a glazing solar factor of 0.3 will help to keep heat out of the building
- Fixed overhangs as per architectural drawings
- Mechanical ventilation with heat recovery and summer bypass to provide fresh air and purging of heat
- Natural ventilation to supply fresh air to the building through openable windows and louvres (as per ventilation rates section of this report).

Note that the analysis was performed assuming that opening windows were controlled based on the level of occupancy and the operative indoor temperature of the space. To achieve the thermal comfort levels shown in this report the level of occupant control for the opening windows would need to be optimum i.e. fully responsive to indoor temperature.

# Overheating Analysis

## Wellington Road

### Introduction

Eight Versa has been appointed in order to undertake an overheating analysis of Wellington Road to provide design stage guidance and maximise occupant comfort levels. Consequently, thermal modelling has been undertaken to demonstrate compliance with Part O, CIBSE TM52 and TM59 requirements. The current proposal is to minimise overheating risk by following the Cooling Hierarchy.

### Building Summary

A full planning application to provide 21 no. Class C3 units, including related ancillary functions, amenity space, landscaping, car and cycle parking and refuse storage. The development is located in the Wokingham borough council with a total GIA of approx. 1,207 sqm.

### Planning Context

The current Wokingham District Local Plan does not set out any specific requirements for avoiding overheating. This report is aligned with national standards and regulations.

### Part O

The scheme is required to comply with Part O. Overheating mitigation:

1. Reasonable provision must be made in respect of a dwelling, institution or any other building containing one or more rooms for residential purposes, other than a room in a hotel ("residences") to:
  - a. limit unwanted solar gains in summer
  - b. provide an adequate means to remove heat from the indoor environment.
2. In meeting the obligations in paragraph (1)
  - a. account must be taken of the safety of any occupant, and their reasonable enjoyment of the residence, and
  - b. mechanical cooling may only be used where insufficient heat is capable of being removed from the indoor environment without it

In line with Part O, there are 2 possible approaches, the simplified method and the Dynamic thermal modelling. The Dynamic thermal modelling approach has been used in this assessment.

### Methodology

The methodology used within this report has been to establish the thermal comfort levels in the occupied spaces through using dynamic simulation modelling and respond with suitable passive design measures to mitigate solar gains, provide adequate ventilation and increase thermal mass. National regulations have set high standards and numerous iterations have been undertaken to determine suitable fabric improvements. All assumptions in the modelling are provided in the model inputs section of this report.

Please note that the climate change scenario has been excluded from this report. External temperatures are likely to increase because of climate change. The consequences of increased summer peak temperatures could be non-compliance with the thermal comfort recommendations unless further measures were implemented.

### Criteria for defining overheating

According to the CIBSE TM 52 - The limits of thermal comfort: avoiding overheating in European buildings (2013) and CIBSE Guide A - Environmental Design (2015), to reduce the risk of overheating the space has to comply with at least two of the following three criteria:

1. The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
2. The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperatures rise and its duration. This criterion sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

According to the CIBSE TM59: 2017 - Design methodology for the assessment of overheating risk in homes, to reduce the risk of overheating the space has to comply with the following criteria:

1. For living rooms, kitchen and bedrooms: the number of hours during which  $\Delta T$  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 (Same as Criterion 1 of TM52).
2. 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 the annual hours (1% of the annual hours between 22:00 and 07:00, equivalent to 32 hours).
3. For communal corridors, the operative temperature should not exceed 28 °C for more than 3% of the annual hours.

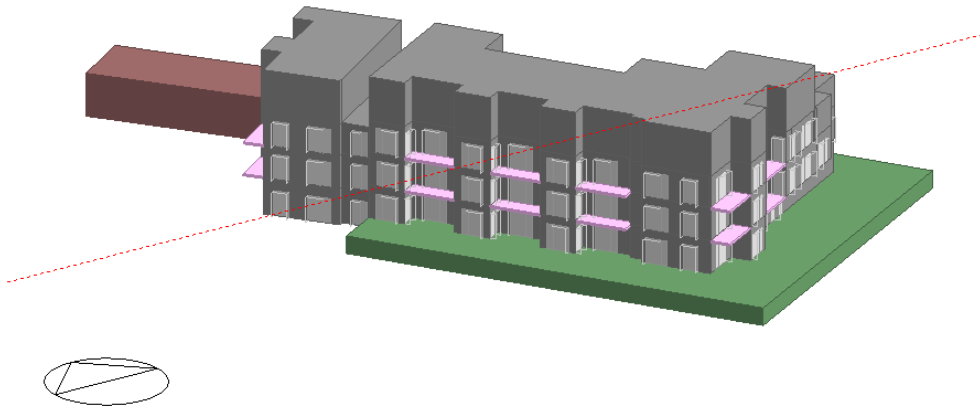
# Overheating Analysis

## Wellington Road

### Modelling Inputs

#### Simulation Software

An overheating analysis has been undertaken using Dynamic Simulation Modelling, Design Builder has been employed for this. Design Builder is a DCLG approved simulation environment that complies with the requirements of CIBSE Guide A. A screenshot of the model is shown below.



#### Weather File

The CIBSE Design Summer Year (DSY1), London Heathrow, for the 2020s, high emissions, 50% percentile scenario, has been used for the purposes of this report. DSY2 and DSY3 have also been investigated.

The three DSYs represent summers with different types of hot events.

- DSY1 - Moderately warm summer
- DSY2 - Short intense warm spell
- DSY3 - Long, less intense warm spell

#### Building Fabric U-Values

| Element      | Proposed U-value (W/m2K) |
|--------------|--------------------------|
| Flat roof    | 0.10                     |
| Pitched roof | 0.10                     |
| Wall         | 0.12                     |
| Ground floor | 0.09                     |
| Windows      | 0.90 (g-value 0.30)      |
| Doors        | 0.90                     |

#### Internal Gains

Typical hours based, according to CIBSE TM 59 and CIBSE Guide A on the relative activity for class use, on weekdays and weekends throughout the year have been specified for lighting, equipment and occupancy.

| Space                           | Occupancy people | Lighting W/m <sup>2</sup> | Small power W |
|---------------------------------|------------------|---------------------------|---------------|
| Double bedroom                  | 2                | 2                         | 80            |
| 1 Bedroom kitchen / Living room | 1                | 2                         | 450           |
| 2 Bedroom kitchen / Living room | 2                | 2                         | 450           |

Distribution losses from the communal heating pipework on primary side have been assumed and attributed to communal corridors (8W/m).

# Overheating Analysis

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### Passive Design

#### Cooling Hierarchy

Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. Minimise internal heat generation through energy efficient design;
2. Reduce the amount of heat entering a building in summer through shading, albedo, fenestration, insulation and green roofs and walls;
3. Manage the heat within the building through exposed internal thermal mass and high ceilings;
4. Passive ventilation;
5. Mechanical ventilation;
6. Active cooling systems (ensuring they are the lowest carbon options).

#### Cooling Strategy

The cooling strategy is to implement energy efficient lighting and appliances to reduce internal heat gains; create a super-insulated fabric with shading devices and solar control glazing to keep the heat out.

#### Windows

Glazing will be a crucial aspect to ensure thermal comfort of the occupied spaces. In order to minimise solar gains, and consequently cooling demand, windows with a solar factor of 0.3 have been modelled for every glazed area.

#### Shading

Overhangs (balconies) will reduce the solar heat gains.

#### Thermal Mass

The development consists of a brick and block structure which will provide thermal mass. This will absorb heat energy during the day and release it at night, keeping spaces at a steadier temperature.

#### Mechanical Ventilation Rates

Mechanical ventilation with heat recovery has been specified. The system has to provide at least an air flow of 0.3 l/s/m<sup>2</sup> and 10 l/s/person as per Part F.

#### Natural Ventilation Rates

Natural ventilation through openable windows has been adopted for this scheme. The ventilation rate has been calculated by the software according to the percentage of openable windows for each space and the varying environmental conditions throughout the year. This percentage is detailed for each window in Appendix D.

In accordance with TM59 all windows are assumed to be fully opened when all the following conditions are satisfied:

1. Internal temperatures exceed 22 °C.
2. During occupied and non-occupied periods if any security issues were not identified

In accordance with Part O:

- When a room is occupied during the day (8am to 11 pm), openings are modelled to:
  - Start to open when the internal temperature exceeds 22 °C
  - Be fully open when the internal temperature exceeds 26 °C
  - Start to close when the internal temperature falls below 26 °C
  - Be fully closed when the internal temperature falls below 22 °C
- At night (11pm to 8am), openings are modelled as fully open if both of the following apply:
  - The opening is on the first floor or above and not easily accessible
  - The internal temperature exceeds 23 °C at 11pm
- When a ground floor or easily accessible room is unoccupied
  - In the day windows and doors should be modelled as open if this can be done securely
  - At night, windows and doors should be modelled as closes

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# Overheating Analysis

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### Natural Ventilation Rates (continued)

In line with requirement O1(2)(a), the building's overheating mitigation strategy for use by occupants should account for the following:

- a. Noise at night: As external noise was not considered to be an issue for this scheme, windows are not likely to remain closed at night allowing night-time ventilation to take place.
- b. Pollution: The scheme isn't located near any significant local pollution source.
- c. Security: Secure night-time vents have been specified for the project apartments allowing night-time ventilation to take place securely during the sleeping hours.
- d. Protection from falling: Openings intended to be opened for long periods to reduce overheating risk have been designed to prevent occupants from falling and therefore meet requirements O1(2)(a).
- e. Protection from entrapment: The night-time vents have been designed not to allow body parts to become trapped and therefore meet requirement O1(2)(a).

Moreover, the scheme has been modelled with a discharge coefficient rate of 0.65 and a wind factor of 1.

# Overheating Analysis

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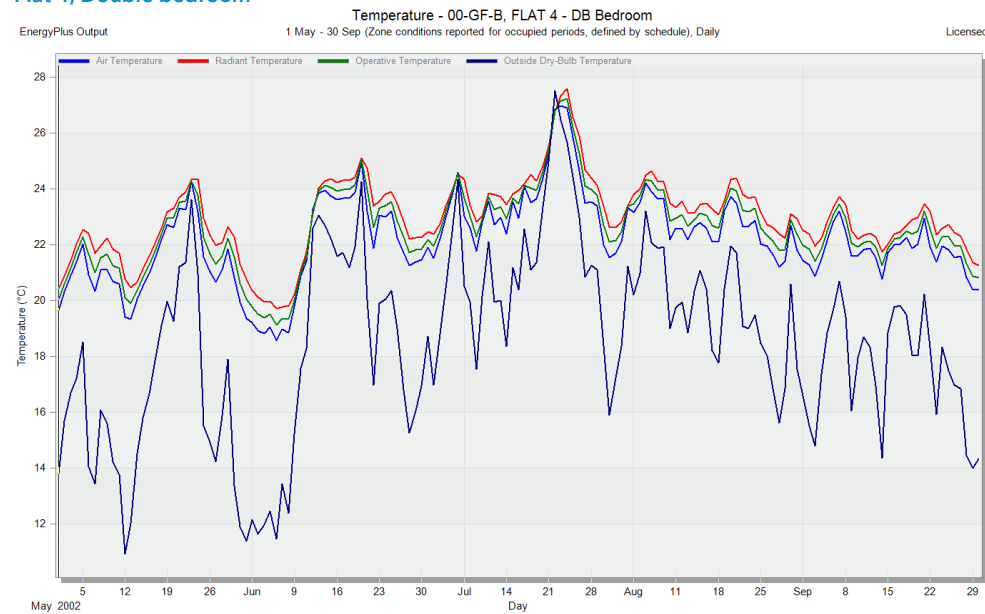
### Summary of Results

#### Results

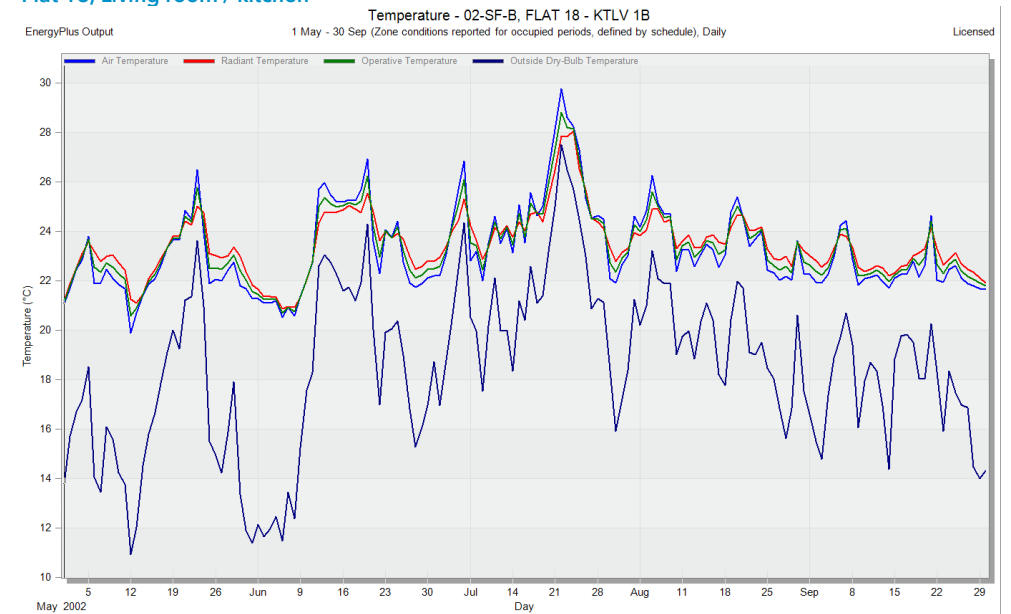
The graphs below present the outdoor, indoor mean air, indoor mean radiant and operative temperature for a sample of the worst performing rooms. A table confirming the results for all rooms is shown in Appendix A.

In summary, all rooms meet TM52 and TM59 requirements.

#### Flat 4, Double bedroom



#### Flat 18, Living room / kitchen



# Overheating Analysis

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### Conclusions

The proposal has responded to CIBSE TM52, CIBSE TM59 and Part O requirements relating to overheating. The report has set out how the occupied spaces perform against strict thermal comfort standards for overheating. The scheme has implemented passive design measures and the modelling results indicate that the scheme is compliant with the overheating requirements as set out in CIBSE TM52, CIBSE TM59 and Part O.

The proposal maximises passive design measures by responding to the local context in the following ways:

- Energy efficient lighting and appliances have been recommended to reduce internal heat gains
- The building fabric will be insulated over and above the standards set out by Building Regulations and reduced solar gains from a glazing solar factor of 0.3 will help to keep heat out of the building
- Fixed overhangs as per architectural drawings
- Mechanical ventilation with heat recovery and summer bypass to provide fresh air and purging of heat
- Natural ventilation to supply fresh air to the building through openable windows and louvres (as per ventilation rates section of this report).

The overheating risk has also been investigated for DSY2 and DSY3. DSY2 includes a short and intense warm spell. DSY3 includes a long and less intense warm spell. All living rooms and four communal corridors (out of 6) meet TM59 or TM52 requirements for DSY2 while the concierge office and two communal corridors (out of 6) fail to meet TM52 or TM59 requirements. All bedrooms meet the day-time criterion but fail to meet the night-time criterion.

All rooms except for the living rooms fail to meet the TM59 or TM52 requirements because of the intensity of the DSY3 weather file. It must be considered that it is very difficult to be able to address these variables in the future without substantially changing the design or retrofitting active cooling which is not considered viable. Moreover, as seen from the assessment, most living spaces meet overheating requirements in the future climate scenario and these spaces are more likely to be used during daytime, which is the warmest part of the day.

Future occupants will be made aware of overheating risks via the home user guide and that they would need to activate internal shading devices and open windows at a lower temperature set point than assumed for this study. Moreover, night ventilation for living rooms/kitchen could improve the overheating results. Plug-in fans could be used as an additional measure during heatwaves.

Note that the analysis was performed assuming that opening windows were controlled based on the level of occupancy and the operative indoor temperature of the space. To achieve the thermal comfort levels shown in this report the level of occupant control for the opening windows would need to be optimum i.e. fully responsive to indoor temperature.

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### Appendix A

#### Appendix A

Appendix A - Heat gain profile

| 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   | 1     | 0.7   |
| 2                | Studio occupancy                | 150           | 110    | 1           | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 1                | 1-bed: 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     | 0     | 0     |
| 1                | 1-bed: 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     | 0     |
| 1                | 1-bed: 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     | 0     |
| 2                | 2-bed: 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     | 0     | 0     |
| 2                | 2-bed: 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     | 0     |
| 2                | 2-bed: 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     | 0     |
| 3                | 3-bed: 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     | 0     | 0     |
| 3                | 3-bed: 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     | 0     |
| 3                | 3-bed: 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     | 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  | 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  | 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   | 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  | 1     | 1     | 0.17  | 0.17  | 0.17  | 0.17  |       |       |
|                  | Lighting profile                | 2 (W/m2)      |        | 0           | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 1     | 1     | 1     | 1     | 1     | 1     | 0     |       |

# Overheating Analysis

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### Appendix B

#### Appendix B

Appendix B – Compliance checklist in line with Part O

#### Part 1 – Building details and declarations

|                                                    |                                |
|----------------------------------------------------|--------------------------------|
| 1.1 Building and site details                      |                                |
| Residential building name/number                   | Wellington Road                |
| Street                                             | Wellington Road                |
| Town                                               | Wokingham                      |
| County                                             | Berkshire                      |
| Postcode                                           | RG40 2AN                       |
| Proposed building use/type of building             | Residential                    |
| Are there any security, noise or pollution issues? | No                             |
| 1.2 Designer's details                             |                                |
| Designer's name                                    | AS                             |
| Company                                            | Kendall Kingscott              |
| Address line 1                                     | Glentworth Court               |
| Address line 2                                     | Lime Kiln Close, Stoke Gifford |
| Postcode                                           | Bristol, BS34 8SR              |
| Telephone number                                   | +44 (0)117 931 2062            |
| Email address                                      | www.kendallkingscott.co.uk     |

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### Part 2b – Dynamic thermal modelling method

|                                                                                                                                        |                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2b.1 Modelling details                                                                                                                 |                                                                                                                                                                         |
| Dynamic software name and version                                                                                                      | Design Builder v7.2.0.32                                                                                                                                                |
| Weather file location used, including any additional, more extreme weather files                                                       | London_LHR_DSY1_2020High50<br>London_LHR_DSY2_2020High50<br>London_LHR_DSY3_2020High50                                                                                  |
| Number of sample units modelled, including an explanation of why the size/selection has been chosen                                    | Whole scheme                                                                                                                                                            |
| 2b.2 Modelled occupancy                                                                                                                |                                                                                                                                                                         |
| Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6?(1) | Yes                                                                                                                                                                     |
| Details of the occupancy profiles used                                                                                                 | As per CIBSE TM59, See Appendix A                                                                                                                                       |
| Details of the equipment profiles used                                                                                                 | As per CIBSE TM59, See Appendix A                                                                                                                                       |
| Details of the opening profiles used                                                                                                   | Ground floor: ON 24/7 for secured ventilation panels and ON during the day only (8-11am) for windows<br>First floor and above: ON 24/7 (windows and ventilation panels) |
| 2b.3 Modelled overheating mitigation strategy                                                                                          |                                                                                                                                                                         |
| Free areas                                                                                                                             | See Appendix D                                                                                                                                                          |
| Infiltration and mechanical flow rates                                                                                                 | Infiltration: 3 m <sup>3</sup> /hm <sup>2</sup> at 50 Pa<br>Mechanical ventilation: 10l/s/person and 0.3 l/s/m <sup>2</sup>                                             |
| Window g-value                                                                                                                         | 0.30                                                                                                                                                                    |
| Shading strategy                                                                                                                       | Overhangs                                                                                                                                                               |
| Mechanical cooling                                                                                                                     | No                                                                                                                                                                      |

|                                                                                                                                     |                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2b.4 Modelling results                                                                                                              |                                                                                                                                                                                                                 |
| Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6? | Yes                                                                                                                                                                                                             |
| What is the overall overheating strategy (i.e. what design features are key to the project passing)?                                | Limiting solar gains by fixed shading devices (overhangs) and glazing design (g-value of 0.30).<br>Removing excess heat by natural ventilation through openable windows and louvres, and mechanical ventilation |
| 2b.5 Thermal modeller's declaration                                                                                                 |                                                                                                                                                                                                                 |
| Has the building construction proposal been modelled accurately?                                                                    | Yes                                                                                                                                                                                                             |
| Thermal modeller's name                                                                                                             | Stephanie Pedrozo                                                                                                                                                                                               |
| Thermal modeller's organisation                                                                                                     | Eight Versa                                                                                                                                                                                                     |
| Thermal modeller's signature                                                                                                        | SP                                                                                                                                                                                                              |
| Registration number (if applicable)                                                                                                 | N/A                                                                                                                                                                                                             |
| Date of design                                                                                                                      | 06/06/2025                                                                                                                                                                                                      |

# Overheating Analysis

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### Appendix C

#### Appendix C

Appendix C – Results table part 1

| Block / Floor / Room / Unit | DSY1                       |                            |                          |                          |                         |            | DSY2                       |                            |                          |                          |                         |            | DSY3                       |                            |                          |                          |                         |            |
|-----------------------------|----------------------------|----------------------------|--------------------------|--------------------------|-------------------------|------------|----------------------------|----------------------------|--------------------------|--------------------------|-------------------------|------------|----------------------------|----------------------------|--------------------------|--------------------------|-------------------------|------------|
|                             | Criterion 1 (%)<br>TM52&59 | Criterion 2 (K.hr)<br>TM52 | Criterion 3 (hr)<br>TM52 | Criterion 4 (hr)<br>TM59 | Criterion 5 (%)<br>TM59 | Compliance | Criterion 1 (%)<br>TM52&59 | Criterion 2 (K.hr)<br>TM52 | Criterion 3 (hr)<br>TM52 | Criterion 4 (hr)<br>TM59 | Criterion 5 (%)<br>TM59 | Compliance | Criterion 1 (%)<br>TM52&59 | Criterion 2 (K.hr)<br>TM52 | Criterion 3 (hr)<br>TM52 | Criterion 4 (hr)<br>TM59 | Criterion 5 (%)<br>TM59 | Compliance |
| GF-FLAT3-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 26.25                    | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 59.5                     | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 85.75                    | N/A                     | Fail       |
| GF-FLAT3-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.6                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| GF-FLAT4-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 26                       | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 59.25                    | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 85.75                    | N/A                     | Fail       |
| GF-FLAT4-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.5                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| GF-FLAT5-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 25.5                     | N/A                     | Pass       | 0.0                        | N/A                        | N/A                      | 57.75                    | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 84.75                    | N/A                     | Fail       |
| GF-FLAT5-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.5                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| GF-FLAT6-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 23                       | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 54.5                     | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 78                       | N/A                     | Fail       |
| GF-FLAT6-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.8                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.4                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| GF-FLAT1-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 23                       | N/A                     | Pass       | 0.0                        | N/A                        | N/A                      | 53.5                     | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 83.75                    | N/A                     | Fail       |
| GF-FLAT1-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.5                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| GF-FLAT2-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 19.5                     | N/A                     | Pass       | 0.0                        | N/A                        | N/A                      | 55.5                     | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 81                       | N/A                     | Fail       |
| GF-FLAT2-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.8                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.6                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT10-DBBEDROOM         | 0.0                        | N/A                        | N/A                      | 27.75                    | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 58.75                    | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 84.25                    | N/A                     | Fail       |
| FF-FLAT10-KTLV1B            | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.6                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.3                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT11-DBBEDROOM         | 0.0                        | N/A                        | N/A                      | 27.25                    | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 58.25                    | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 83.5                     | N/A                     | Fail       |
| FF-FLAT11-KTLV1B            | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.6                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.3                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT12-DBBEDROOM         | 0.0                        | N/A                        | N/A                      | 27                       | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 58                       | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 83.25                    | N/A                     | Fail       |
| FF-FLAT12-KTLV1B            | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 1.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.7                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT13-DBBEDROOM         | 0.0                        | N/A                        | N/A                      | 21.75                    | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 57.5                     | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 70                       | N/A                     | Fail       |
| FF-FLAT13-KTLV1B            | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.5                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT14-DBBEDROOM         | 0.0                        | N/A                        | N/A                      | 32                       | N/A                     | Pass       | 0.2                        | N/A                        | N/A                      | 69                       | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 94.25                    | N/A                     | Fail       |
| FF-FLAT14-KTLV1B            | 0.1                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 1.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.8                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT9-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 27.5                     | N/A                     | Pass       | 0.1                        | N/A                        | N/A                      | 58.75                    | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 83.75                    | N/A                     | Fail       |
| FF-FLAT9-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.6                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.3                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT7-DBBEDROOM          | 0.0                        | N/A                        | N/A                      | 27.75                    | N/A                     | Pass       | 0.0                        | N/A                        | N/A                      | 50.75                    | N/A                     | Fail       | 0.0                        | N/A                        | N/A                      | 86.25                    | N/A                     | Fail       |
| FF-FLAT7-KTLV1B             | 0.0                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.6                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       | 0.2                        | N/A                        | N/A                      | N/A                      | N/A                     | Pass       |
| FF-FLAT8-DBBEDROOM1         | 0.0                        | N/A                        | N/A                      | 28                       | N/A                     | Pass       | 0.3                        | N/A                        | N/A                      | 58.75                    | N/A                     | Fail       | 0.1                        | N/A                        | N/A                      | 93                       | N/A                     | Fail       |

# Overheating Analysis

## Wellington Road

Appendix C - Results table part 2

| Block / Floor / Room / Unit | DSY1            |                    |                  |                  |                 |            | DSY2            |                    |                  |                  |                 |            | DSY3            |                    |                  |                  |                 |            |
|-----------------------------|-----------------|--------------------|------------------|------------------|-----------------|------------|-----------------|--------------------|------------------|------------------|-----------------|------------|-----------------|--------------------|------------------|------------------|-----------------|------------|
|                             | Criterion 1 (%) | Criterion 2 (K.hr) | Criterion 3 (hr) | Criterion 4 (hr) | Criterion 5 (%) | Compliance | Criterion 1 (%) | Criterion 2 (K.hr) | Criterion 3 (hr) | Criterion 4 (hr) | Criterion 5 (%) | Compliance | Criterion 1 (%) | Criterion 2 (K.hr) | Criterion 3 (hr) | Criterion 4 (hr) | Criterion 5 (%) | Compliance |
|                             | TM52&59         | TM52               | TM52             | TM59             | TM59            |            | TM52&59         | TM52               | TM52             | TM59             | TM59            |            | TM52&59         | TM52               | TM52             | TM59             | TM59            |            |
| FF-FLAT8-DBBEDROOM2         | 0.0             | N/A                | N/A              | 23               | N/A             | Pass       | 0.0             | N/A                | N/A              | 53               | N/A             | Fail       | 0.0             | N/A                | N/A              | 86               | N/A             | Fail       |
| FF-FLAT8-KTLV2B             | 0.0             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.7             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.5             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT17-DBBEDROOM         | 0.0             | N/A                | N/A              | 30.75            | N/A             | Pass       | 0.3             | N/A                | N/A              | 60.25            | N/A             | Fail       | 0.2             | N/A                | N/A              | 84               | N/A             | Fail       |
| SF-FLAT17-KTLV1B            | 0.2             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.9             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.8             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT18-DBBEDROOM         | 0.0             | N/A                | N/A              | 30.75            | N/A             | Pass       | 0.2             | N/A                | N/A              | 60.25            | N/A             | Fail       | 0.2             | N/A                | N/A              | 84.25            | N/A             | Fail       |
| SF-FLAT18-KTLV1B            | 0.2             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.9             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.7             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT19-DBBEDROOM         | 0.0             | N/A                | N/A              | 30.75            | N/A             | Pass       | 0.2             | N/A                | N/A              | 60.25            | N/A             | Fail       | 0.2             | N/A                | N/A              | 84.25            | N/A             | Fail       |
| SF-FLAT19-KTLV1B            | 0.2             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.9             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.7             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT20-DBBEDROOM         | 0.0             | N/A                | N/A              | 30               | N/A             | Pass       | 0.3             | N/A                | N/A              | 59               | N/A             | Fail       | 0.3             | N/A                | N/A              | 82.5             | N/A             | Fail       |
| SF-FLAT20-KTLV1B            | 0.2             | N/A                | N/A              | N/A              | N/A             | Pass       | 1.4             | N/A                | N/A              | N/A              | N/A             | Pass       | 1.2             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT21-DBBEDROOM         | 0.0             | N/A                | N/A              | 28.25            | N/A             | Pass       | 0.2             | N/A                | N/A              | 61.5             | N/A             | Fail       | 0.0             | N/A                | N/A              | 74.75            | N/A             | Fail       |
| SF-FLAT21-KTLV1B            | 0.0             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.7             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.4             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT15-DBBEDROOM         | 0.0             | N/A                | N/A              | 29.25            | N/A             | Pass       | 0.1             | N/A                | N/A              | 52.25            | N/A             | Fail       | 0.1             | N/A                | N/A              | 86.5             | N/A             | Fail       |
| SF-FLAT15-KTLV1B            | 0.0             | N/A                | N/A              | N/A              | N/A             | Pass       | 1.0             | N/A                | N/A              | N/A              | N/A             | Pass       | 0.8             | N/A                | N/A              | N/A              | N/A             | Pass       |
| SF-FLAT16-DBBEDROOM1        | 0.0             | N/A                | N/A              | 30.5             | N/A             | Pass       | 0.5             | N/A                | N/A              | 58.25            | N/A             | Fail       | 0.3             | N/A                | N/A              | 92.25            | N/A             | Fail       |
| SF-FLAT16-DBBEDROOM2        | 0.0             | N/A                | N/A              | 25               | N/A             | Pass       | 0.1             | N/A                | N/A              | 53.75            | N/A             | Fail       | 0.0             | N/A                | N/A              | 85.25            | N/A             | Fail       |
| SF-FLAT16-KTLV2B            | 0.2             | N/A                | N/A              | N/A              | N/A             | Pass       | 1.0             | N/A                | N/A              | N/A              | N/A             | Pass       | 1.0             | N/A                | N/A              | N/A              | N/A             | Pass       |
| GF-COMMUNAL CORRIDOR 1      | N/A             | N/A                | N/A              | N/A              | 0               | Pass       | N/A             | N/A                | N/A              | N/A              | 2.58            | Pass       | N/A             | N/A                | N/A              | N/A              | 4.28            | Fail       |
| GF-COMMUNAL CORRIDOR 2      | N/A             | N/A                | N/A              | N/A              | 0               | Pass       | N/A             | N/A                | N/A              | N/A              | 1.86            | Pass       | N/A             | N/A                | N/A              | N/A              | 4.57            | Fail       |
| FF-COMMUNAL CORRIDOR 1      | N/A             | N/A                | N/A              | N/A              | 0.59            | Pass       | N/A             | N/A                | N/A              | N/A              | 3.16            | Fail       | N/A             | N/A                | N/A              | N/A              | 6.85            | Fail       |
| FF-COMMUNAL CORRIDOR 2      | N/A             | N/A                | N/A              | N/A              | 0               | Pass       | N/A             | N/A                | N/A              | N/A              | 2.16            | Pass       | N/A             | N/A                | N/A              | N/A              | 6.43            | Fail       |
| SF-COMMUNAL CORRIDOR 1      | N/A             | N/A                | N/A              | N/A              | 1.25            | Pass       | N/A             | N/A                | N/A              | N/A              | 4.17            | Fail       | N/A             | N/A                | N/A              | N/A              | 8.07            | Fail       |
| SF-COMMUNAL CORRIDOR 2      | N/A             | N/A                | N/A              | N/A              | 0.12            | Pass       | N/A             | N/A                | N/A              | N/A              | 2.48            | Pass       | N/A             | N/A                | N/A              | N/A              | 6.78            | Fail       |
| GF-CONSERGE OFFICE          | 0.4             | 5                  | 0                | N/A              | N/A             | Pass       | 4.0             | 12                 | 0                | N/A              | N/A             | Fail       | 6.2             | 15                 | 0                | N/A              | N/A             | Fail       |
| Total Rooms                 | 51              |                    |                  |                  |                 |            | 51              |                    |                  |                  |                 |            | 51              |                    |                  |                  |                 |            |
| Pass                        | 51              |                    |                  |                  |                 |            | 25              |                    |                  |                  |                 |            | 21              |                    |                  |                  |                 |            |
| Fail                        | 0               |                    |                  |                  |                 |            | 26              |                    |                  |                  |                 |            | 30              |                    |                  |                  |                 |            |
|                             | 100.0%          |                    |                  |                  |                 |            | 49.0%           |                    |                  |                  |                 |            | 41.2%           |                    |                  |                  |                 |            |
|                             | 0.0%            |                    |                  |                  |                 |            | 51.0%           |                    |                  |                  |                 |            | 58.8%           |                    |                  |                  |                 |            |

# Overheating Analysis

## Wellington Road

eight  
versa

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### Appendix D

Proposed North Elevation



Proposed West Elevation



Proposed South Elevation



Proposed East Elevation



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# Overheating Analysis

## Wellington Road

eight  
versa

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info@eightversa.com

### Legend

|                      |
|----------------------|
| Fixed window         |
| Full 100%            |
| Louvre               |
| No night ventilation |