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Straightforward Building Compliance

DURSTON HOUSE 3RD FLOOR

CHESTERFIELD ROAD

WORTHING

APPROVED DOCUMENT PART O - TM59 THERMAL ANALYSIS REPORT

For:

Inspire Property

February 24

Project no. QTE017964

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REVISION	DATE	PREPARED BY	REVIEWED BY	COMMENTS
1	02/24	AM	C80	For Issue

The results generated and analysed in this report are based upon complex arithmetical calculation that takes into consideration a number of design criteria and evaluations in a dynamic simulation. It gives an indication of the predicted environmental conditions based on climatic data and anticipated operating strategies of the building.

The predicted simulated internal temperatures may also not meet the actual internal air temperatures due to several reasons, namely change in space function, use of equipment, natural wear and tear of building elements, global climate change and meteorological changes, change in operational management of apertures etc.

C80 Solutions cannot be held liable for temperatures that vary from the simulated results as these have been calculated in a controlled virtual environment.

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1 Introduction

1.1 About C80 Solutions Ltd

C80 Solutions are independent Sustainability and Energy Consultants providing carbon reduction solutions to help the UK achieve its carbon emission reduction target of 80% by 2050 - as set out in the Government's Climate Change Act 2008.

Our range of affordable but comprehensive solutions for the construction industry are broken down into two sectors: i) Building Compliance and ii) Consultancy.

Building Compliance:

Our Building Compliance services include Code for Sustainable Homes Assessments, SAP Calculations, On Construction Energy Performance Certificates, Water Efficiency Calculations, SBEM Calculations, Commercial EPCs, BREEAM assessments, Thermal comfort analysis, Air Tightness Testing and Sound Testing.

Consultancy:

Our experience and exposure to building compliance combined with previous experience and IEMA accredited training means we have built up a vast amount of knowledge which enables us to provide our clients with invaluable advice. Our Consultancy services include Renewable Energy Feasibility Reports, Energy Statements for planning, Sustainability Statements and Building Compliance Advisory Reports.

1.2 Executive Summary

C80 Solutions have been instructed by Inspire Property. to prepare a TM59 Thermal Analysis Report to show compliance with Approved Document Part O of the building regulations for a proposed residential new build development in Poole.

The project assessed anticipates the provision of four 3rd Floor Flats, 2x 1-Bed Flats & 2x 2-Bed Flats.

Simulations have been undertaken for the plot on all applicable spaces, using DesignBuilder EnergyPlus, which is a CIBSE AM11 compliant dynamic simulation modelling software that can accurately simulate predicted internal environments and temperatures for the purposes of identifying area which are at a risk of overheating. This data is then used to assess the compliance against the criteria outlined in CIBSE TM59 and applicable criteria from Approved Document Part O.

The plans used to model the dwelling can be seen in Figures 1 & 2 below:

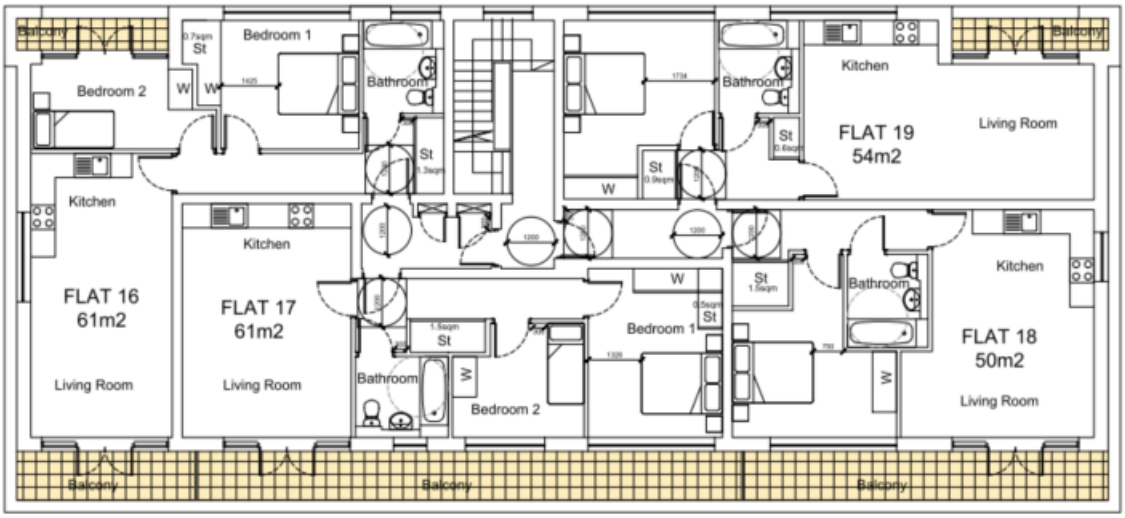

Figure 1: Proposed Floor Layout; Ref: '6541-P01 Rev E.pdf'

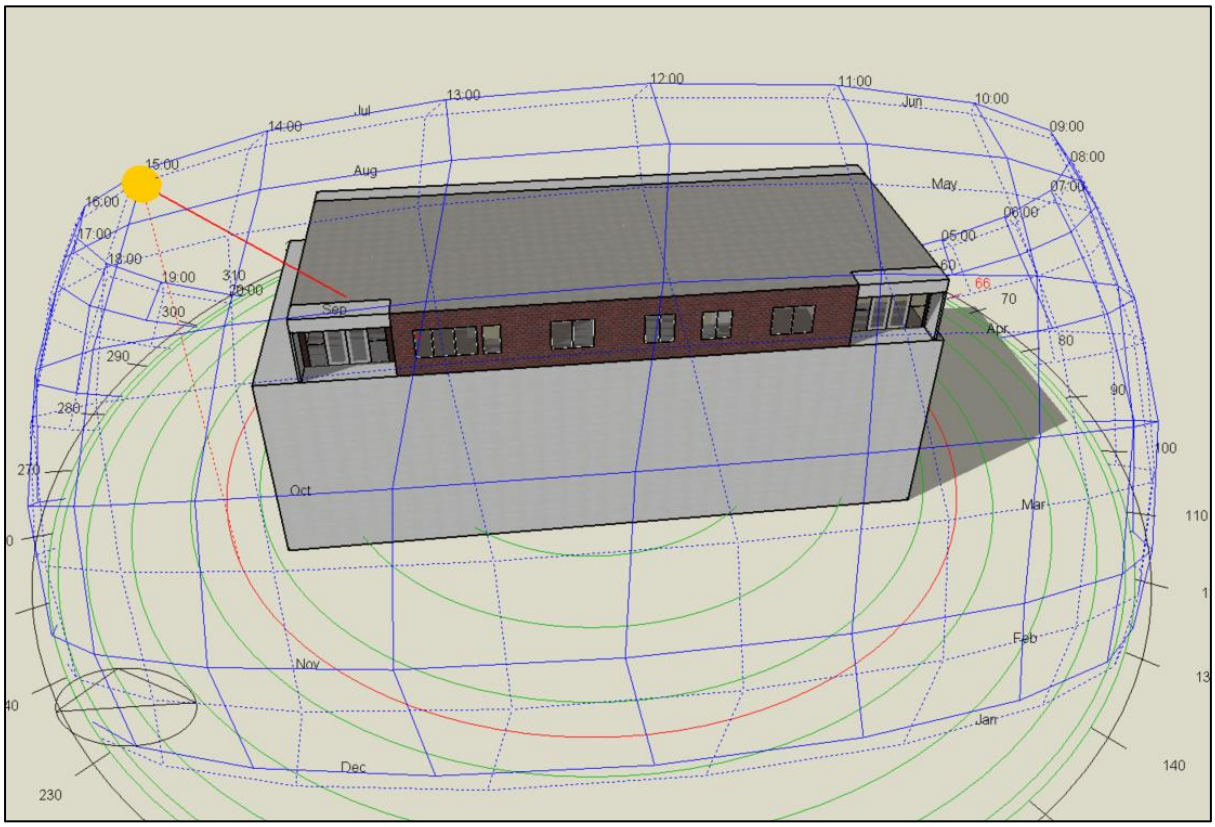

Figure 2: Rendered View of the Site taken from Design Builder

1.3 Software Calculation Specification

This overheating analysis was conducted using the DesignBuilder EnergyPlus software package.

Calculation Engine: DesignBuilder EnergyPlus

Calculation Engine Version: v7.2.0.032

1.4 Weather File Detail

In accordance with CIBSE Technical Memorandum 59, the development is required to pass the overheating criteria using the DSY1 weather file for the most appropriate location nearest to the development.

The DSY represents warmer than typical year and is used to evaluate overheating risk within buildings.

The specific weather location chosen for this assessment was Southampton Southampton_DSY1_2020High50_.

2 Methodology for and use of TM59 For Approved Document Part O

CIBSE TM59 is an overheating methodology specifically for residential developments. TM59 provides a methodology for how to construct an overheating assessment and draws upon guidance previously given in TM52 and CIBSE Guide A.

The assessment for Plot has been run using the defined profiles and gains as described in Section 3 of this report.

The criteria for TM59 are determined by the type of ventilation the space receives, either predominantly naturally ventilated or predominantly mechanically ventilated. Homes that are predominantly naturally ventilated including homes that have mechanical ventilation with heat recovery (MVHR), with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method based on CIBSE TM52 (2013), as described in "*Criteria for Predominantly naturally ventilated homes"* below.

In order to allow the occupants to 'adapt', each habitable room needs operable windows with a minimum free area that satisfies the purge ventilation criteria set in Part F of the Building Regulations for England, and equivalent regulations in other countries, i.e. the window opening area should be at least 1/20th of the floor area of the room (different conditions exist for windows with restricted openings, and the same requirement applies for external doors). Control of overheating may require accessible, secure, quiet ventilation with a significant openable area.

Homes that are predominantly mechanically ventilated because they have either no opportunity or extremely limited opportunities for opening windows (e.g. due to noise levels or air quality) should be assessed for overheating used the fixed temperature method based on CIBSE Guide A (2015a), as described in "*Criteria for Predominantly mechanically ventilated homes"* on the following page.

Criteria for Predominantly naturally ventilated homes;

Criterion One: Hours of Exceedance for Living Rooms, Kitchens & Bedrooms:

The number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion1: Hours of exceedance).

Criterion Two: Night time comfort in bedrooms only:

To guarantee comfort during the sleeping hours the operative temperature in the bedroom shall not exceed 26°C for than 1% of the occupied hours, defined as 10pm to 7am.
1% of annual hours between 10pm to 7am is 32 hours, failure of Criterion 2 occurs when the space experiences 33 hours or more when the above conditions are met.

Criteria for Predominantly mechanically ventilated homes;

For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of the annual occupied hours (CIBSE Guide A (2015a)).

Approved Document Part O Deviations from TM59 Methodology

CIBSE's TM59 method requires the modeler to make choices. The dynamic thermal modelling method Part-O applies limits to these choices, which are detailed in paragraph 2.6 below. These limits should be applied when following the guidance in CIBSE's TM59.

All the following limits on CIBSE's TM59, section 3.3, apply.

a. When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following.

i. Start to open when the internal temperature exceeds 22°C.

ii. Be fully open when the internal temperature exceeds 26°C.

iii. Start to close when the internal temperature falls below 26°C.

iv. Be fully closed when the internal temperature falls below 22°C.

b. At night (11pm to 8am), openings should be modelled as fully open if both of the following apply. i. The opening is on the first floor or above and not easily accessible.

ii. The internal temperature exceeds 23°C at 11pm.

c. When a ground floor or easily accessible room is unoccupied, both of the following apply.

i. In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely, following the guidance in paragraph 3.7 below.

ii. At night, windows, patio doors and balcony doors should be modelled as closed.

d. An entrance door should be included, which should be shut all the time.

3 Overheating Model Inputs

3.1 Heat Gains Parameters & Occupancy Profiles

Table 2 and Figure 1 found within CIBSE TM59 outline the occupant densities in the rooms which fall under the requirements of the assessment, these tables also show the heat gain parameters which should be used.

For this assessment, the information found within this reference material has been applied to the thermal comfort calculations for the rooms which are assessed under the TM59 criteria.

In some circumstances, rooms may be labelled in a way that is not specific to the wording used within CIBSE TM59 but may have similar usage and occupancy patterns. Where the consultant working on the overheating analysis deems this to be applicable, they will assume what they view as the closest room type to be applicable for usage, occupancy and gain patterns, for example, a snug will be assessed under the criteria for living rooms.

Where a dwelling contains more than the standardised 3 bedrooms of CIBSE TM59, occupancy levels are adjusted in the required areas to account for this in rooms which are primarily identifiable within the CIBSE TM59 profiles i.e. a 3 bedroom dwelling assumes an occupancy of 3 people within a living space, whereas, if the dwelling is identified to contain 4 bedrooms, the occupancy will be adjusted to 4 people within this space.

Figure 1 Heat gain profile

Number of people	Description	Peak load (W) Sensible	Peak load (W) Latent	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 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	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
1	1-bedroom living/kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1-bedroom living occupancy	75	55	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1-bedroom kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bedroom living/kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2-bedroom living occupancy	150	110	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2-bedroom kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3-bedroom living/kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3-bedroom living occupancy	225	165	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3-bedroom kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	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	0.4	1	1	1	1	0.4	0.4
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17
	Lighting profile	2 (W/m2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0

*Material extracted directly from CIBSE TM59 and is the copyright property of CIBSE. Source www.CIBSE.org

Table 2 Occupancy and equipment gain descriptions

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

* All times in GMT

*Table extracted directly from CIBSE TM59 and is the copyright property of CIBSE. Source www.CIBSE.org

3.2 Building Fabric Parameters

The building fabrics specified within the calculations provided are as follows:

Construction		U-Value	
	Build Up		
External Walls	Build up data taken from '6541-BR 03 Proposed Section A-A.PDF'	0.19	W/m2K
Roof		0.17	W/m2K
Ground Floor		N/A	W/m2K
Glazing	G Value – 0.7	1.2	W/m2K
Design Air Pressure Value		5	$M^3/hr\text{-}m^2$

3.3 Mechanical Ventilation Strategy

Mechanical Ventilation	Heat Recovery	Schedule
N/A	N/A	N/A

3.4 Proposed Free Aperture Areas of Openings

Windows applicable	Schedule	Free Aperture
All Openable Windows	TM59_Unrestricted_Openings	0.62

3.5 Drawings utilised for modelling.

Drawing Reference	Use
'6541-P01 Rev E.pdf'	Floor Plan
'Opening Windows.pdf'	Elevations

4. Results

Results set 1:

This data set is taken from a simulation using Restricted Opening Profiles for the ground floor windows and unrestricted profiles for the 3rd floor windows the scenario in place is completely Naturally Ventilated

Using base glazing g-value of 0.7 for all glazing on the site

Flat	Zone	Criterion A (%)	Criterion B (Hr)	Pass/Fail
16	Living Kitchen	0.23	N/A	Pass
16	Bedroom 1	0.27	14.17	Pass
16	Bedroom 2	0.28	4.67	Pass
17	Living Kitchen	0.31	N/A	Pass
17	Bedroom 1	0.54	22.17	Pass
17	Bedroom 2	0.35	18.50	Pass
18	Living Kitchen	0.45	N/A	Pass
18	Bedroom 1	0.33	18.50	Pass
19	Living Kitchen	0.82	N/A	Pass
19	Bedroom 1	0.23	7.83	Pass

4 Conclusion

The plot has been dynamically modelled using the methodology outlined in Approved Document Part O and CIBSE TM59, using the provided architectural drawings and documentation provided.

The model has been accurately modelled using floor plans elevations and sections provided.

Initially in Results Set 1 the Glazing U-Value used is 1.2 and the g-value applied is 0.70 and No mechanical Ventilation is present.

From Results Set 1 we can see that all rooms meet Part O requirements, this is because the flats are on the 3rd floor meaning the openings can be modelled using unrestricted opening hour profiles reducing solar gains significantly, this as well as large overhanging over the majority of the glazing leading to the flats passing without the need for an improved g-value or consideration of Mechanical Ventilation. No more simulations are required.