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9-10 Hitchin High Street Overheating Analysis (Part O)

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Executive Summary

This overheating analysis has been prepared by Integration Consultancy Limited to demonstrate compliance with Part O Building Regulations 2021 for the proposed development at 9-10 High Street, Hitchin. The development comprises 44 new build 1 and 2 bed units and a ground floor retail unit.

The analysis follows the Part O methodology which is based on CIBSE Technical Memorandum 59. This requires the creation of a 3D dynamic thermal model of the development. The assessment examines the performance of a sample of typical worst case units, i.e. those with a greater proportion of south and west facing glazing.

The overheating strategy for the development includes solar control glazing ($g=0.4$) and dual aspect design which allows for cross-flow ventilation through the main living spaces. Mechanical ventilation will increase occupant comfort by removing warm air from the apartments. The building construction includes heavyweight floor slabs which adds thermal mass to stabilise internal temperatures. Large balcony overhangs over south facing glazing limit direct solar gains during the hottest hours of the day.

An acoustic survey has been carried out to determine the impact of external noise to residents during the night-time. The acoustician has advised that the local background noise level at night exceeds the Part O noise criteria and, to mitigate the level of noise entering bedrooms at night, openable areas have been restricted. Full details can be found in Section 1.4. The scheme also includes ground floor units and in these units the kitchen/living area windows have been modelled as closed at night for security purposes.

Residential overheating is considered to occur if an occupied room fails any of the following two criteria:

- Criteria 1 – Annual Overheating Hours (living rooms, kitchen and bedrooms).
3% of occupied hours the operative temperature exceeds the threshold comfort temperature (upper limit of the range of comfort temperature) by 1°C from 1st May to 30th September.
- Criteria 2 – Overheating Temperature limit (Bedrooms only)
During sleeping hours the operative temperature in the bedroom from 10pm to 7 am shall not exceed 26°C for more than 1% of annual hours.

The report details 3 overheating results cases. Case 1 shows that the scheme passes the overheating criteria when no opening restrictions are applied to the model. Case 2 shows that when the above restrictions are applied, some units fail. Case 3 shows that a small increase in openable area to 2 rooms and additional (boost) mechanical ventilation has been applied to pass the Part O standard, details of which can be found in Section 3.3.

The additional measures in Case 3 have been applied to the proposed scheme. **Therefore, the study shows that the sampled new build units meet the Part O / CIBSE TM59 overheating standard.**

The room specific results are presented below. The results are based on the assumptions contained within the report associated with heat gains, building operation, construction thermal properties and windows openings.

Blinds have not been used in the dynamic model in order to achieve the pass ratings given below. Therefore, there are additional measures that can be put in place to decrease the risk should overheating become an issue in the future in certain areas. A building user guide will be created to help building users manage overheating.

Flat & Room Name	Criteria 1 – Overheating Hours		Criteria 2 – Overheating Temperatures Limit (bedrooms only)	
	(3% or less)	Pass/Fail	(1% or less annual hours over 26°C, 10pm-7am)	Pass/Fail
Unit 006 Bedroom 1	0.8	Pass	0.73	Pass
Unit 006 Bedroom 2	0.6	Pass	0.67	Pass
Unit 006 Living/kitchen	2.2	Pass	-	-
Unit 007 Bedroom 1	0.7	Pass	0.67	Pass
Unit 007 Living/kitchen	1.4	Pass	-	Pass
Unit 202 Bedroom 1	1.8	Pass	0.94	-
Unit 202 Bedroom 2	1.7	Pass	0.97	Pass
Unit 202 Living/kitchen	2.5	Pass	-	-
Unit 210 Bedroom 1	0.2	Pass	0.85	Pass
Unit 210 Living/Kitchen	1.7	Pass	-	-
Unit 212 Bedroom 1	2.1	Pass	0.64	Pass
Unit 212 Bedroom 2	1	Pass	0.76	Pass
Unit 212 Living/kitchen	2.6	Pass	-	-
Unit 301 Bedroom 1	1.4	Pass	0.79	Pass
Unit 301 Bedroom 2	1.1	Pass	0.82	Pass
Unit 301 Living/kitchen	1.3	Pass	-	-

Table 1: Case 3 overheating analysis results

1 Introduction

This report has been prepared by Integration Consultancy Limited to demonstrate compliance with Part O Building Regulations 2021 for the proposed development at 9-10 High Street, Hitchin, North Hertfordshire. The North Herts Council local plan has no reference to overheating, however the scheme will require compliance with Building Regulations Part O, which is demonstrated in this report.

1.1 THE DEVELOPMENT SITE

The site is located at 9-10 High Street, Hitchin.



Figure 1: Site Location

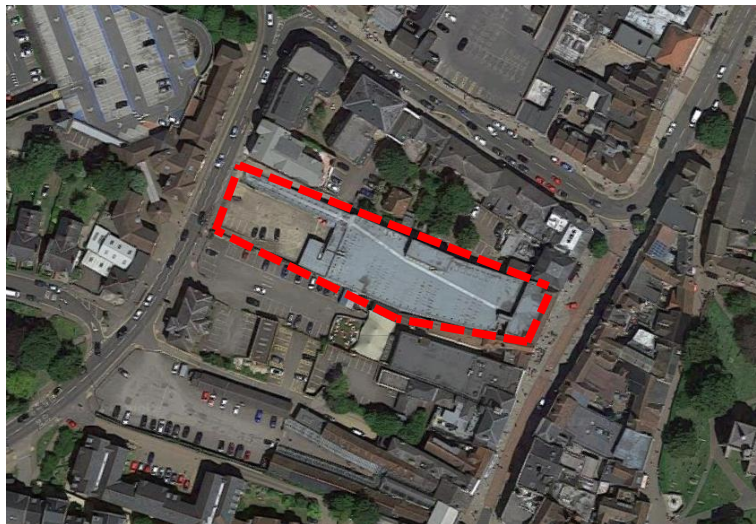


Figure 2: Aerial view of site

1.2 PROPOSED DEVELOPMENT OVERVIEW

The proposed development includes 44 new build 1 and 2 bedroom homes, and a ground floor retail unit.



Figure 3: Proposed development ground floor plan

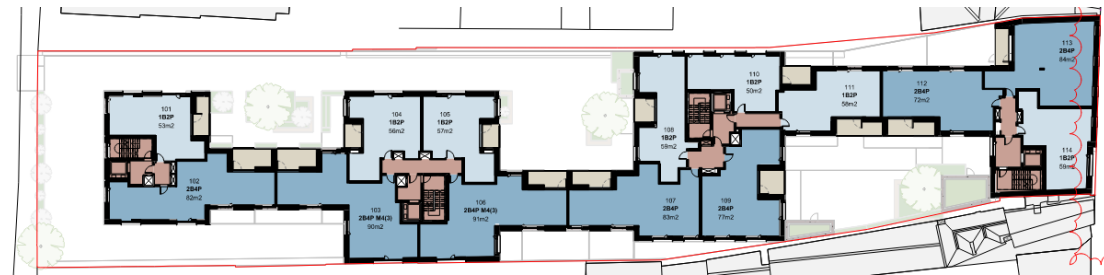


Figure 4: Proposed development first floor plan



Figure 5: Proposed development second floor plan



Figure 6: Proposed development third floor plan



Figure 7: Proposed development South elevation

1.3 CIBSE TM59 RESIDENTIAL OVERHEATING REQUIREMENT

The analysis follows the Part O standard which is based on CIBSE Technical Memorandum TM59 (2017) methodology. This is a standardised approach predicting overheating risk for residential building design using dynamic thermal analysis.

The methodology builds on the CIBSE TM52 (2012) method and has been through several rounds of testing on a variety of real and prototype projects. The results of the testing indicate that the methodology is reliable.

Overheating is considered to occur if an occupied room fail any of the following criteria:

- Criteria 1 – Overheating Hours.
3% of occupied hours the operative temperature exceeds the threshold comfort temperature (upper limit of the range of comfort temperature) by 1°C from 1st May to 30th September.
- Criteria 2 – Overheating Temperature limit (Bedrooms only)
During sleeping hours, the operative temperature in the bedroom from 10pm to 7 am shall not exceed 26°C for more than 1% of annual hours (note: 1% of annual hours between 10pm and 7am is 32 hours. Therefore 33 or more hours a year above 26°C will be recorded as a fail).

The assessment examines the performance of a representative sample of accommodation. Typically, areas at most risk are occupied areas that:

- Have large unshaded glazing area (especially south facing).
- Are on the highest floor levels with the least shading from surrounding buildings and trees.
- Have limited openable windows.
- Have single aspects windows (which may limit the efficacy of natural ventilation).

1.4 NOISE

Part O Building Regulations set out acoustic conditions for consideration:

In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- b. 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).

Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use.

The acoustic assessment by *KP Acoustics* details restrictions to bedroom opening areas for each façade which will provide the appropriate attenuation to pass Part O noise criteria – this has been reproduced below. These restrictions have been applied to the thermal model for cases 2 and 3.

Elevation	Maximum Open Area of the Window as a Percentage of the Floor Area to Achieve ADO Target Internal Noise Levels			
	Ground Floor	First Floor	Second Floor	Third Floor
	1%	1%	1%	1%
	0%	0%	1%	1%
	2%	2%	3%	3%

Table 2: Window opening restrictions (Table 6.3 KP Acoustics)

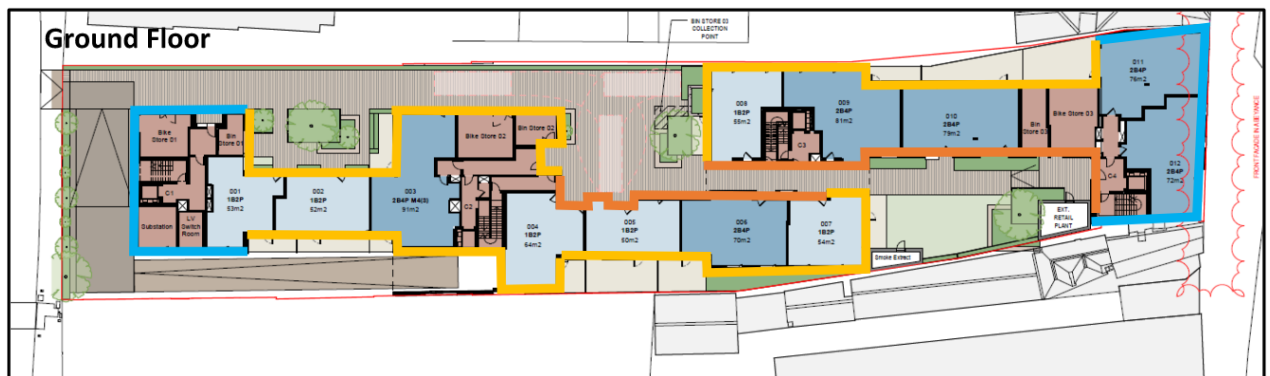


Figure 8: Ground floor window restrictions assignment (Figure 6.1 KP Acoustics).

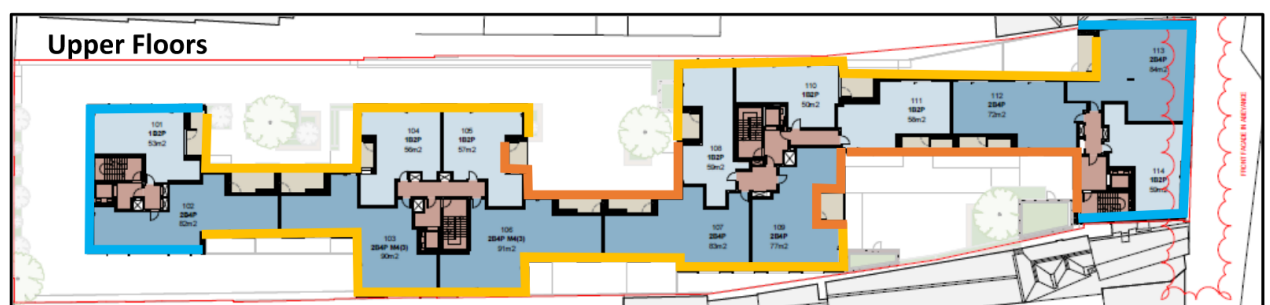


Figure 9: Upper floors floor window restrictions assignment (Figure 6.1 KP Acoustics).

1.5 SECURITY

Part O Building Regulations set out considerations related to security:

When determining the free area available for ventilation during sleeping hours, only the proportion of openings that can be opened securely should be considered to provide useful ventilation. This particularly applies in the following locations, where openings may be vulnerable to intrusion by a casual or opportunistic burglar.

- a. Ground floor bedrooms.
- b. Easily accessible bedrooms.

Open windows or doors can be made secure by using any of the following.

- a. Fixed or lockable louvred shutters.
- b. Fixed or lockable window grilles or railings.

There are windows on the ground floor of units which have been tested. To comply with security regulations, these windows have been modelled as closed at night in unoccupied spaces.

2 Thermal Model

2.1 MODEL SETUP

The CIBSE Technical Memorandum TM59 methodology requires the creation of a 3D dynamic thermal model of the proposed development. The set-up is described below.

Software:	IES VE PRO Engineer (2023)
Weather Data:	CIBSE DSY 1 (Design Summer Year) for London Gatwick 2020 high emissions 50th percentile.
Sampling:	The study considers a representative sample of 6 typical 1 and 2 bed units.
Model Assumptions:	Input values are presented in the tables below. In line with Part O of the UK Building Regulations, openable windows start to open when internal temperature exceeds 22°C and reach fully open when internal temperature reaches 26°C, between the hours 8:00-23:00. From 23:00-08:00, openable windows are opened if the internal temperature exceeds 23°C.
Geometry Data:	Geometry is depicted below and is based on drawing as indicated the table below. All areas modelled have been zoned into separate rooms including living areas, bedrooms, bathrooms etc. Building construction are modelled as proposed and reflect thermal properties such as thermal mass, insulation and airtightness. Internal doors are considered to be closed at night.

Drawing No (version)	Name	Source
270-HH-P-104	Lower Ground Floor Plan	Tigg Coll Architects
270-HH-P-100	Ground Floor Plan	Tigg Coll Architects
270-HH-P-101	First Floor Plan	Tigg Coll Architects
270-HH-P-102	Second Floor Plan	Tigg Coll Architects
270-HH-P-103	Third Floor Plan	Tigg Coll Architects
270-HH-P-200	North & South Elevations	Tigg Coll Architects
270-HH-P-201	East & West Elevations	Tigg Coll Architects

Table 3: Drawings used to create the dynamic thermal model

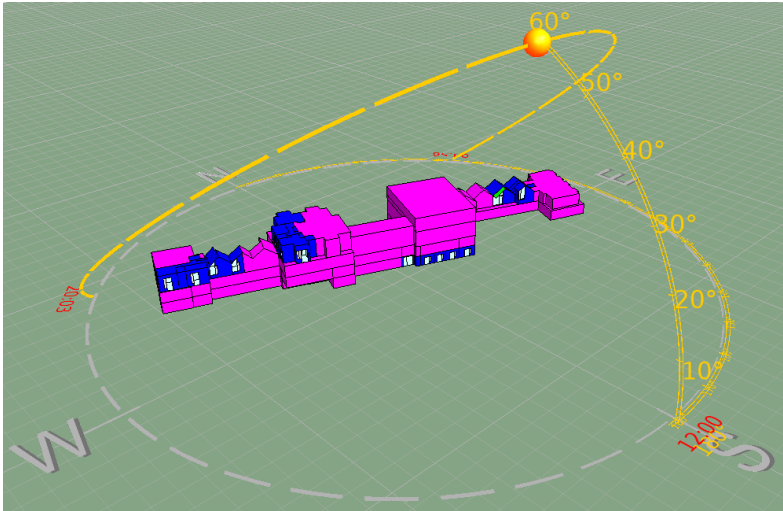


Figure 10: Model geometry – development viewed from the South-West

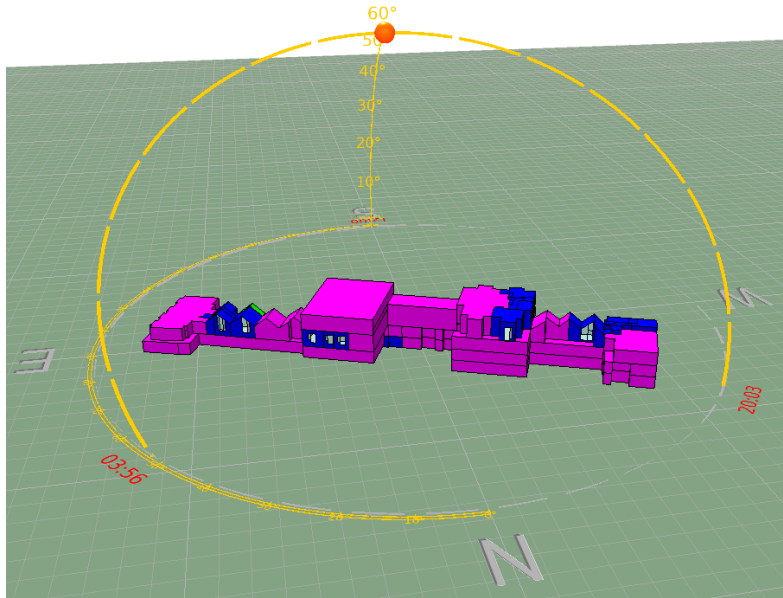


Figure 11: Model geometry – development viewed from the North-East

The building construction and operation is summarised as follows:

Element	Inputs
External Walls	0.15 W/m²K
Floor	0.12 W/m²K
Roof	0.12 W/m²K
Windows	1.4 W/m²K (g value 0.4)
Air Tightness	3 m³/m²/h @50Pa

Table 4: Building envelope properties

2.2 WINDOW OPENINGS

Natural ventilation is essential to remove excess heat during the summer months and enable the provision of high air quality. The scheme has heavyweight thermal mass floors and ceilings which, along with natural ventilation, will reduce internal daily temperature fluctuations and minimise the overheating risk.

The window openings are summarised below.

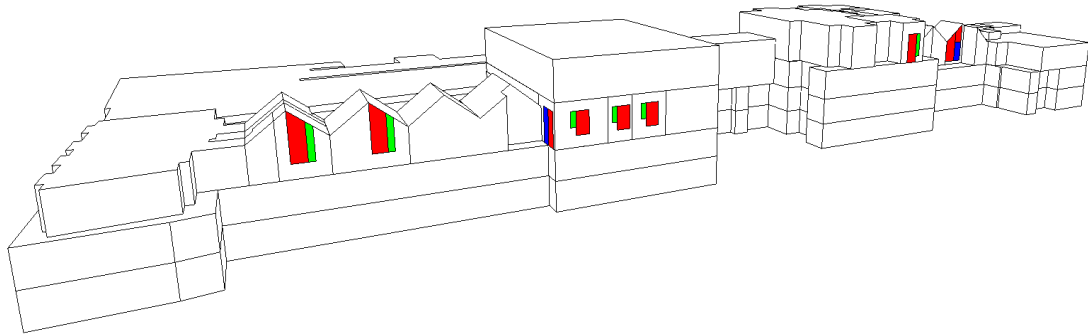


Figure 12: North-East window types – refer to table below.

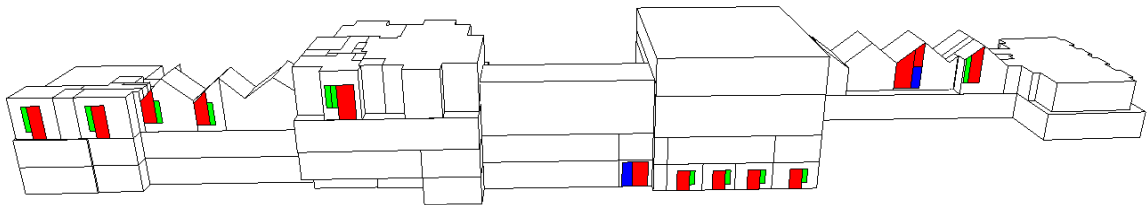


Figure 13: South-West window types – refer to table below.



Figure 14: East window types (left), West window types (right) – refer to table below.

Window Type	Description	Total openable area (as a proportion of the glazing area)
Type 1 (RED)	Fixed glazing/door	0% openable
Type 2 (DARK BLUE)	Openable window/door	100% openable
Type 3 (GREEN)	Openable panel	100% openable

Table 5: Window types

2.3 LIGHTING, EQUIPMENT AND OCCUPANCY GAINS

The TM59 occupancy residential gains used in the modelling process are given below.

Unit/ 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
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 am. Base load of 85 W for the rest of the day.
Double bedroom	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.

Table 6: Residential occupancy and equipment gains

3 Model Results

3.1 CASE 1 – INITIAL RESULTS – WITHOUT WINDOW RESTRICTIONS

The room specific results from the study are given below.
Case 1 shows that the spaces pass the CIBSE TM59 overheating standard without window opening restrictions.

Flat & Room Name	Criteria 1 – Overheating Hours		Criteria 2 – Overheating Temperatures Limit (bedrooms only)	
	(3% or less)	Pass/Fail	(1% or less annual hours over 26°C, 10pm-7am)	Pass/Fail
Unit 006 Bedroom 1	0.2	Pass	0.27	Pass
Unit 006 Bedroom 2	0.2	Pass	0.27	Pass
Unit 006 Living/kitchen	0.6	Pass	-	-
Unit 007 Bedroom 1	0.3	Pass	0.27	Pass
Unit 007 Living/kitchen	1.1	Pass	-	-
Unit 202 Bedroom 1	2.2	Pass	0.21	Pass
Unit 202 Bedroom 2	1.7	Pass	0.43	Pass
Unit 202 Living/kitchen	2.2	Pass	-	-
Unit 210 Bedroom 1	0.1	Pass	0.27	Pass
Unit 210 Living/Kitchen	0.6	Pass	0.27	-
Unit 212 Bedroom 1	1.8	Pass	0.33	Pass
Unit 212 Bedroom 2	0.5	Pass	0.24	Pass
Unit 212 Living/kitchen	2.3	Pass	-	-
Unit 301 Bedroom 1	1.1	Pass	0.21	Pass
Unit 301 Bedroom 2	0.8	Pass	0.52	Pass
Unit 301 Living/kitchen	2.1	Pass	-	-

Table 7: Case 1 overheating analysis results

3.2 CASE 2 – INITIAL RESULTS – WITH WINDOW RESTRICTIONS

Case 2 applies the window restrictions discussed in Section 1.4 and Section 1.5. The room specific results from the study are given below.

The case shows that some sampled bedrooms fail the CIBSE TM59 overheating standard due to the restriction in openable area resulting in night-time overheating.

Flat & Room Name	Criteria 1 – Overheating Hours		Criteria 2 – Overheating Temperatures Limit (bedrooms only)	
	(3% or less)	Pass/Fail	(1% or less annual hours over 26°C, 10pm-7am)	Pass/Fail
Unit 006 Bedroom 1	0.8	Pass	0.91	Pass
Unit 006 Bedroom 2	0.7	Pass	0.73	Pass
Unit 006 Living/kitchen	2.8	Pass	-	-
Unit 007 Bedroom 1	0.7	Pass	0.82	Pass
Unit 007 Living/kitchen	2	Pass	-	-
Unit 202 Bedroom 1	2.4	Pass	1.34	Fail
Unit 202 Bedroom 2	2.6	Pass	1.83	Fail
Unit 202 Living/kitchen	2.6	Pass	-	-
Unit 210 Bedroom 1	0.7	Pass	1.64	Fail
Unit 210 Living/Kitchen	2.1	Pass	-	-
Unit 212 Bedroom 1	2.1	Pass	0.64	Pass
Unit 212 Bedroom 2	1	Pass	0.76	Pass
Unit 212 Living/kitchen	2.5	Pass	-	-
Unit 301 Bedroom 1	1.5	Pass	0.82	Pass
Unit 301 Bedroom 2	1.3	Pass	1.10	Fail
Unit 301 Living/kitchen	1.4	Pass	-	-

Table 8: Case 2 overheating analysis results

3.3 CASE 3 – FINAL PROPOSAL WITH MECHANICAL VENTILATION

To overcome the reduced performance arising from acoustic restrictions, additional ventilation is required. The proposed mechanical ventilation with heat recovery system in each apartment is able to provide a boost ventilation rate in order to expel hot air at night, to mitigate nighttime overheating. 35l/s has been supplied to the bedroom areas, and 20l/s has been supplied to the living areas.

In addition to the ventilation set out above, increased openable area (during the daytime) is required. The panels set out in blue below are required to be openable.



Figure 15: Block 1 south elevation, additional openable area required.

These results shows that each sampled unit meets the Part O / CIBSE TM59 overheating standard.

Flat & Room Name	Criteria 1 – Overheating Hours		Criteria 2 – Overheating Temperatures Limit (bedrooms only)	
	(3% or less)	Pass/Fail	(1% or less annual hours over 26°C, 10pm-7am)	Pass/Fail
Unit 006 Bedroom 1	0.8	Pass	0.73	Pass
Unit 006 Bedroom 2	0.6	Pass	0.67	Pass
Unit 006 Living/kitchen	2.2	Pass	-	-
Unit 007 Bedroom 1	0.7	Pass	0.67	Pass
Unit 007 Living/kitchen	1.4	Pass	-	-
Unit 202 Bedroom 1	1.8	Pass	0.94	Pass
Unit 202 Bedroom 2	1.7	Pass	0.97	Pass
Unit 202 Living/kitchen	2.5	Pass	-	-
Unit 210 Bedroom 1	0.2	Pass	0.85	Pass
Unit 210 Living/Kitchen	1.7	Pass	-	-
Unit 212 Bedroom 1	2.1	Pass	0.64	Pass
Unit 212 Bedroom 2	1	Pass	0.76	Pass
Unit 212 Living/kitchen	2.6	Pass	-	-
Unit 301 Bedroom 1	1.4	Pass	0.79	Pass
Unit 301 Bedroom 2	1.1	Pass	0.82	Pass
Unit 301 Living/kitchen	1.3	Pass	-	-

Table 9: Case 3 overheating analysis results

4 Conclusions

4.1 PART O COMPLIANCE

The assessment has examined the overheating performance of representative sample of accommodation for 9-10 Hitchin High Street.

The overheating strategy for the development includes solar control glazing ($g=0.4$) and dual aspect design which allows for cross-flow ventilation through the main living spaces. Mechanical ventilation will increase occupant comfort by removing warm air from the apartments. The building construction includes heavyweight floor slabs which adds thermal mass to stabilise internal temperatures. Large balcony overhangs over south facing glazing limit direct solar gains during the hottest hours of the day.

An acoustic survey has been carried out to determine the impact of external noise to residents during the night-time. The acoustician has advised that the local background noise level at night exceeds the Part O noise criteria and, to mitigate the level of noise entering bedrooms at night, openable areas have been restricted. Full details can be found in Section 1.4. The scheme also includes ground floor units and in these units the kitchen/living area windows have been modelled as closed at night for security purposes.

The report details 3 overheating results cases. Case 1 shows that the scheme passes the overheating criteria when no opening restrictions are applied to the model. Case 2 shows that when the above restrictions are applied, some units fail. Case 3 shows that a small increase in openable area to 2 rooms and additional (boost) mechanical ventilation has been applied to pass the Part O standard, details of which can be found in Section 3.3 and have been applied to the scheme.

The additional measures in Case 3 have been applied to the proposed scheme. **Therefore, the study shows that the sampled new build units meet the Part O / CIBSE TM59 overheating standard.**

Blinds have not been used in the dynamic model in order to achieve the pass ratings given below. Therefore, there are additional measures that can be put in place to decrease the risk should overheating become an issue in the future in certain areas.

The cooling hierarchy has been followed to ensure the building mitigates overheating passively. This includes using large openable windows where possible and mechanical ventilation, which provides a flow of fresh air which supplements air flow from openable windows.