Thermal Comfort Analysis

CIBSE TM59:2017 and CIBSE TM49:2014

Southampton Row Residential Units
London, WC1B 4AE

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1.0 Executive Summary

RES Design has been commissioned to conduct a thermal comfort assessment for the Southampton Row development to support the planning application. This report will be maintained throughout design to ensure continued compliance.

The Southampton Row Hotel development is an existing building with a new extension, consisting of 88 hotel rooms (use Class C1), a restaurant and bar area and 9 dwellings (use Class C3).

This thermal comfort assessment reports only on residential units of the development, contained in the new extension part of the development.

The information used for the modelling process and the results of compliance against thermal comfort requirements are contained in this report. All of the occupied spaces of residential units are included within this assessment in line with the relevant thermal comfort standards.

The report assesses the thermal comfort of the proposed development against relevant CIBSE standards with the residential units of the development being assessed against both CIBSE TM59:2017 requirements and the future weather files of CIBSE TM49:2014.

CIBSE TM59:2017 'Design methodology for the assessment of overheating risk in homes' is a technical memorandum providing templates for internal gains to be applied to residential and communal spaces for overheating studies. The assessment then determines thermal comfort of the spaces by using the thermal comfort guidance contained within CIBSE TM52:2013 document.

Due to the location of the development there are both air quality and acoustic issues meaning that openable windows cannot be used for controlling thermal comfort. In addition, controlling thermal comfort via mechanical cooling is not feasible due to the high air volumes required and as such, cooling is to be utilised within the living/kitchen and bedroom spaces of the dwellings.

CIBSE TM59:2017 contains different overheating criteria that must be met for the residential units depending on whether natural ventilation or mechanical ventilation is utilised. For mechanically ventilated spaces, no more than 3% of annual occupied hours can exceed an operative temperature of 26°C and it is this criteria that has been applied to the cooled spaces at Southampton Row. It should be noted that whilst the hotel of the Southampton Row development is largely cooled, this assessment sizes, and then fixes the non-residential cooling and heating capacity of each space in accordance with external design temperatures so that the full effect of each weather file on the current design can be understood. If the loads were not fixed, the software would increase the cooling loads in the non-residential section of the development thus unfairly maintaining compliance.

A summary of results showing the risk of overheating against the requirements of CIBSE TM59:2013 thermal comfort criteria for the residential units are presented below. The information used within the simulation used to gain these results are contained Section 4 of this report.

Weather File	Spaces Passing CIBSE TM59 Overheating Criteria	Spaces Failing CIBSE TM59 Overheating Criteria
CIBSE DSY1 2020, high emissions 50% percentile	100%	0%

In addition, this report demonstrates the impact of the future climate in relation to the proposed Southampton Row dwellings by using CIBSE TM49:2014 guidance. The version used for this report is CIBSE TM49:2014 "Design Summer Years for London". As mentioned above, the cooling loads for the development are fixed so that the impacts of future weather files are fully understood.

This report utilises the summer weather data in accordance with the "Energy Planning: Greater London Authority Guidance on Preparing Energy Assessments" (March 2016). This requires using summer weather profiles from different years (1976, 1989 and 2003) for the most appropriate London location. The profiles of these weather files are then adjusted to account for various predicted future climate changes. They account for different years (2020, 2050 and 2080), different carbon emission scenarios (low, medium and high), and then further split into various percentiles (10%, 50% and 90%). This analysis, where possible, uses the medium and 50% percentiles for each of the future weather years. This means simulating, including the base weather file, 12 weather files for the TM59 study. These weather files are not those used for thermal comfort compliance against the CIBSE TM59:2017 document but are used to inform risk of potential future overheating of the development. The risk of overheating should be understood and decisions made as to whether changes are made to the current design to mitigate future overheating.

To pass the TM59 study, the development only needs to pass DSY1 for the London Weather Centre for the 2020's, with high emissions, 50% percentile scenario. However, for completeness more extreme weather files are also tested (DSY2 and DSY3) as well as their future files for the 2050's and 2080's. This shows thermal comfort is achieved even in extreme future weather conditions.

The results showing the risk of overheating, when using CIBSE TM59:2017 internal gains applied to the residential areas, with CIBSE TM49:2014 weather scenarios, tested against CIBSE TM59:2017 thermal comfort criteria, are presented below.

Summer type	Year		Climate scenario	Spaces Passing CIBSE TM59 Overheating Criteria	Spaces Failing CIBSE TM59 Overheating Criteria
Current warm	-	DSY1		100%	0%
	2020	DSY1	High 50%	100%	0%
	2050	DSY1	Medium 50%	100%	0%
	2080	DSY1	Medium 50%	100%	0%
Short and intense	-	DSY2		100%	0%
	2020	DSY2	High 50%	100%	0%
	2050	DSY2	Medium 50%	100%	0%
	2080	DSY2	Medium 50%	100%	0%
Warm and persistent	-	DSY3		100%	0%
	2020	DSY3	High 50%	100%	0%
	2050	DSY3	Medium 50%	100%	0%
	2080	DSY3	Medium 50%	100%	0%

2.0 Thermal Comfort Criteria

CIBSE TM59:2017 contains different overheating criteria that must be met for the residential units depending on whether natural ventilation or mechanical ventilation is utilised. For mechanically ventilated spaces, no more than 3% of annual occupied hours can exceed an operative temperature of 26°C and it is this criteria that has been applied to the cooled spaces at Southampton Row. 2.2 CIBSE TM52 Criteria

3.0 Thermal Modelling

A Dynamic Thermal Model of the design proposal has been constructed to investigate the overheating risks in the Southampton Row development.

The simulation has been run using IES VE 2018, a dynamic thermal modelling tool via the following method:

I. Construction of a geometric model of the development proposal (IES – Model IT)
II. Definition of the construction module's fabric performance properties (IES - Apache)
III. Definition of the loads and conditions for each zone (IES - Apache)
IV. Solar Shading Analysis (IES – Suncast)
V. Dynamic simulation (IES – ApacheSim) – For overheating analysis

The ApacheSim thermal simulation engine complies with the requirements of CIBSE Application Manual AM11.

4.0 Modelling Information

The following sections present the input data used within the models for the Southampton Row development.

4.1 Weather Data

The base CIBSE TM59:2017 assessment utilises the CIBSE DSY1 2020 weather file for a high emissions 50% percentile case

In line with both CIBSE TM49:2017 and guidance from the Greater London Authority, the proposed development utilises the 12 required weather files from CIBSE when considering future climate change:

Summer type	Year		Climate scenario
Current warm	-	DSY1	
	2020	DSY1	High 50%
	2050	DSY1	Medium 50%
	2080	DSY1	Medium 50%
Short and intense	-	DSY2	
	2020	DSY2	High 50%
	2050	DSY2	Medium 50%
	2080	DSY2	Medium 50%
Warm and persistent	-	DSY3	
	2020	DSY3	High 50%
	2050	DSY3	Medium 50%
	2080	DSY3	Medium 50%

4.2 Construction Information

The following construction information has been utilised for this thermal comfort assessment for the residential areas of the development:

Data	Unit	Value
Construction		
External Walls	W/m^2.K	0.16
Roof U-Value	W/m^2.K	0.12
Exposed Ground Floor U-Value	W/m^2.K	0.15
Vertical Glazing U-Value (including frame)	W/m^2.K	1.3
Vertical Glazing G-Value	-	0.72
Ventilation		
Infiltration (at perimeter)	Air changes / hour	0.25

4.3 Internal Loads

The residential units utilise the internal loads (lighting, occupancy and equipment), schedules and temperatures given in CIBSE TM59:2017.

Infiltration is set to 0.25ACH on perimeter spaces.

4.5 Proposed Ventilation Strategy Approach

When considering the thermal comfort approach for the residential units the cooling hierarchy was considered. The cooling hierarchy recommends that natural ventilation then mechanical ventilation and then cooling are considered in that order when gaining thermal comfort compliance. Sections 4.5.1 to 4.5.3 below describe the approach and conclusions undertaken during initial design.

4.5.1 Natural Ventilation

Due to the location of the development there are both air quality and acoustic issues meaning that openable windows cannot be used for controlling thermal comfort.

4.4.2 Mechanical Ventilation

The dwellings are supplied with a mechanical ventilation heat recovery system. Fresh air is supplied to the living rooms and bedrooms from the atmosphere after being filtered with carbon filters. Foul air is extracted from the bathroom and kitchen areas to the atmosphere. The MVHR system provides a background rate of ventilation. It is fitted with energy reclaim. The energy in the air is therefore utilised to pre-heat or pre-cool the fresh air supply to the spaces. However, controlling thermal comfort via mechanical cooling is not feasible due to the high air volumes required and as such, cooling is to be utilised within the living/kitchen and bedroom spaces of the dwellings.

4.4.3 Cooling

Applying cooling to the living, kitchen and bedroom spaces of the dwellings allows thermal comfort compliance to be gained against both the CIBSE TM52:2013 Criteria 1 and the requirement to have no more than 1% of occupied overnight hours experiencing operative temperatures of greater than 26°C for all spaces. As such, considering the thermal comfort results gained when considering mechanical ventilation, cooling is deemed to be the most appropriate design response to gaining compliance with thermal comfort requirements.

5.0 Results

The results below reflect the proposed design, accounting for the modelling information contained in Section 4.

A summary of results showing the risk of overheating against the requirements of CIBSE TM59:2013 thermal comfort criteria for the residential units are presented below. The information used within the simulation used to gain these results are contained Section 4 of this report.

Weather File	Spaces Passing CIBSE TM59 Overheating Criteria	Spaces Failing CIBSE TM59 Overheating Criteria
CIBSE DSY1 2020, high emissions 50% percentile	100%	0%

The results showing the risk of overheating, when using CIBSE TM59:2017 internal gains applied to the residential areas, with CIBSE TM49:2014 weather scenarios, tested against CIBSE TM59:2017 thermal comfort criteria, are presented below.

Summer type	Year		Climate scenario	Spaces Passing CIBSE TM59 Overheating Criteria	Spaces Failing CIBSE TM59 Overheating Criteria
Current warm	2017	DSY1		100%	0%
	2020	DSY1	High 50%	100%	0%
	2050	DSY1	Medium 50%	100%	0%
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Short and intense	2017	DSY2		100%	0%
	2020	DSY2	High 50%	100%	0%
	2050	DSY2	Medium 50%	100%	0%
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Warm and persistent	2017	DSY3		100%	0%
	2020	DSY3	High 50%	100%	0%
	2050	DSY3	Medium 50%	100%	0%
	2080	DSY3	Medium 50%	100%	0%

6.0 Conclusion

The results contained in Section 5 of this report demonstrate that all of the residential spaces of the Southampton Row development comply with the requirements of CIBSE TM52: 2013 for the required CIBSE DSY1 2020, high emissions 50% percentile weather file.

The results contained in Section 5 of this report also demonstrate that all of the residential spaces of the Southampton Row development comply with the requirements of CIBSE TM549: 2014 for each of the 12 weather files.

Therefore the residential units of the Southampton Row development comply with the overheating requirements of both CIBSE TM52:2013 and CIBSE TM49:2014.