

Application Ref: 132429/FO/2021

Date: 4 February 2022

Subject: Trinity Islands - AVO Strategy

The following AVO Strategy has been prepared by the Applicant to provide Manchester City Council with clarification on Renaker's approach to applying recently introduced guidance relating to Acoustics, Ventilation and Overheating for their residential proposals at Trinity Islands. The content of the approach has been informed by consultation with MCC Environmental Health Officers and technical input relating to the following disciplines, details of which are contained in the enclosed technical reports:

- TM59 Overheating Assessment (WSP)
- Acoustic Assessment (Fisher Acoustics)
- Façade Design (Simpson Haugh Architects)

To deliver market leading and future proofed residential accommodation, which optimises internal environmental conditions, the proposed designs and operational strategies seek to balance a range of key priorities that comply with TM59 conditions and limit internal noise, whilst also delivering on the full range of wider priorities such as space standards, design quality, energy efficiency and addressing net zero carbon objectives.

Approach to AVO

The Applicant has developed an operational AVO model that ensures compliance with TM59 overheating at all times of the day, for all proposed dwellings. Please refer to the enclosed TM59 technical note, prepared by WSP.

Due to the need to respond to continuously changing patterns of solar gain and external noise levels (e.g. traffic flows) to achieve compliance with TM59, it is not practical to achieve uniform noise levels for all dwellings across a 24hr period.

In assessing the internal noise levels during times when windows are required to be open, the noise assessment attributes different sensitivities to different rooms at different times of the day. This is in line with the 'Guidelines for Environmental Noise Impact Assessment' published by the Institute of Environmental Management & Assessment (IEMA, 2014), which states:

"Time-of-day sensitivity is related to the activity being undertaken by the individual affected by the noise."

"It also can be argued that within the 16-hour period, the evening period (19:00–23:00 hours) is relatively more sensitive than the remaining 12-hour period [07:00 – 19:00 hours]. This is also activity-related, since during the evening people are generally at home relaxing, and children will be going to bed during this time."

The varying sensitivities to noise over the course of the day can be described as follows:

Daytime noise levels (7am – 7pm): Low sensitivity for both living rooms and bedrooms, due to residents either being out of the home, or generally being more active around the home.

Evening noise levels (7pm – 11pm): High sensitivity in living rooms, due to the majority of people using this space for relaxation / leisure time. Medium to low sensitivity in bedrooms, as the majority of people will not be asleep during this period.

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Night-time noise levels (11pm – 7am): High sensitivity in bedrooms and low sensitivity in living rooms, due to the majority of residents being asleep during these hours.

Regarding acceptable internal noise levels, the AVO 2020 Guidance recognises there's a balance to be struck between noise and overheating and identifies a suggested upper noise limit of 50dB LAeq,T for living rooms and bedrooms during the day [7am – 11pm]. In particular, paragraph 3.15 of AVO states *"For the daytime period, the upper category in Table 3-3 is defined on the basis that LAeq,T 50 dB represents the upper end of the range for reliable speech communication"*.

"The value of 'T', the averaging period used to determine the 'average' noise level 'LAeq,T', is not defined in the AVO. However, when discussing the further work required to better understand the issue of noise disturbance when windows are opened to control overheating, AVO states that further information is required, including:

- *how long will people tolerate higher noise levels in order to stay cool? One suggestion is to consider the overall average day (16h) and night (8h) time average noise levels. There is some logic to this as we all know that we can tolerate high noise levels for a short duration and moderately high levels for a little longer."*

The identified noise impacts are summarised below and further details are provided within the enclosed Noise Assessment, prepared by Fisher Acoustics.

Headline Results

As noted above, the operational model seeks to comply with TM59 overheating requirements at all times of the day and limits noise levels so far as possible during Evening and Night Time. To achieve optimum results, living room windows are allowed to be open for periods where necessary during the daytime period, between May and September. The model results show that windows to all living rooms are able to remain closed all evening (i.e. post 7pm) within all apartments and at all times overnight, which are considered to be most sensitive periods. Windows to all bedrooms within all apartments can remain closed at all times overnight. Windows to bedrooms are allowed during the day as required.

In Building C1, all rooms requiring open windows to achieve the requirements of TM59 are expected to achieve daytime noise levels ≤48dB LAeq, 16 hrs. In Buildings C2, D1 and D2, all living rooms requiring open windows to achieve the requirements of TM59 are expected to achieve daytime noise levels ≤50dB LAeq, 16 hrs..

It is also important to highlight that the results reflect that fact that noise levels decrease at each story up the building, due to the increased distance from the noise source.

It should be noted that the TM59 models vents being closed when the internal temperature drops back down to 22 Deg C. If the occupant of an apartment chose to close their vent(s) before the internal temperature dropped to 22 Deg C, it could quite often be the case that the internal temperature would not then rise above the 'fail' temperature criterion of TM59 (e.g. during evening periods when solar gain reduces).

Therefore the opening hours of the purge vents are not necessarily the opening hours required to maintain thermal comfort for the occupants. It could therefore be quite possible to achieve thermal comfort with shorter opening hours.

Further Design Considerations

Notwithstanding the internal noise exceedances, the design team has interrogated the feasibility of incorporating louvres into the façade to further reduce noise levels whilst also maintaining compliance with TM59. Unfortunately, it is not possible to incorporate louvres into the design due to the fact that they have not been tested at the heights

required and associated warranties and insurance will not be possible to secure. Renaker is also unable to delay this element, in the hope a feasible louvre solution may be found during the construction process, as they will shortly be procuring the façade at risk to avoid rapidly escalating construction materials costs. In the event Renaker were to be significantly delayed around procurement, it would pose a substantial risk of the delivery strategy being jeopardised. For the reasons set out within the enclosed design note, the inclusion of louvres has been discounted.

Conclusions

As outlined above, the Applicant's multi-disciplinary technical team have sought to balance the range of competing considerations to optimise the internal environment for future residents at Trinity Islands.

From the analysis undertaken to date, it has been determined that no living rooms across Trinity Islands will experience higher noise levels than the upper noise level identified in AVO guidance. All bedrooms will achieve the night time noise level recommendations as all bedroom windows can remain closed overnight whilst achieving the TM59 overheating criterion.

The Applicant has ensured the LPA and EHO have been fully briefed on the approach throughout pre-application and determination planning stages and written agreement has been received from the EHO to confirm the strategy is acceptable.



Z1-WSP-A180-RP-XX-003

TRINITY ISLAND – Plots D1 & D2 and C1 & C2 - TM59 & AVO Considerations – Rev 11

TO	Renaker	FROM	Charlotte Hodgson
DATE	05 November 2021	CONFIDENTIALITY	Confidential
SUBJECT	TM59 Initial Overheating Assessment – Residential Apartments		

1. EXECUTIVE SUMMARY

This Design Development Note (DDN) has been produced to assess the overheating risk for a full floor plate of each plot of residential towers of the Trinity Islands development.

CIBSE TM59 methodology has been utilised to assess the overheating risk within a relevant selection of units. Compliance with TM59 minimum criteria has been analysed using the Manchester weather Centre data. Current scenario weather files were considered with the possibility of considering future weather files at further stages.

WSP understands that some facades of the development are exposed to high noise levels and air quality constraints which may limit the use of natural ventilation for reducing the risk of overheating within the affected dwellings. To account for acoustic requirements, this TM59 study includes profiles on the openable purge ventilation panels in accordance with AVO guidance.

Trinity Island Plots D1 & D2 and C1 & C2 Towers pass CIBSE TM59 without further acoustic considerations.

Acoustic proposals

As per advice from Fisher Acoustics to demonstrate consideration with AVO we are restricting window opening times, which is not a TM59 requirement:

- Bedroom ventilation opening hours profile - Open 7am-11pm
- Living room ventilation opening profile - Open 7am-7pm

Under this further extended analysis the only 4 no. rooms across typical floor plates for both C1 & C2 along with D1 & D2 that don't align with this restriction are the following living rooms:

- South West (C2_14_10) living room vent panels are closed after 8:30pm
- West (WC1_14_10) living room vent panels are closed after 7:30pm
- West (D1_14_05) living room vent panels are closed after 8:30pm
- North west (D2_14_07) living room vent panels are closed after 8:30pm

2. INTRODUCTION

This Design Development Note (DDN) has been produced to assess the overheating risk for a sample of the residential elements within the development of the C1 & C2 and D1 & D2 towers of Trinity Islands following on from discussions within the design team.

3. METHODOLOGY

The overheating study has been carried out in line with the recommendations made by the CIBSE documents 'TM52: 2013: The Limits of Thermal Comfort: Avoiding Overheating', and 'TM59 2017: Design Methodology for the Assessment of Overheating Risk in Homes'.

Compliance with TM59 is based on passing both of the following two criteria, as the homes are 'predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery (MVHR), with good opportunities for natural ventilation in the summer'. We shall be using the following:

- Criteria (a): For living rooms, kitchens and bedrooms: The number of hours during which the operative temperature of the space is above the adaptive temperature of the space by one-degree Kelvin during the period May to September inclusive shall not be more than 3% of occupied hours.
- Criteria (b): For bedrooms only: The operative temperature in the bedroom from 10pm to 7am shall not exceed 26°C for more than 1% of annual hours (i.e. 33 or more hours is a fail).

WSP utilised a dynamic simulation software package, the Virtual Environment (VE) suite from Integrated Environmental Solutions (IES) to perform overheating assessments according to CIBSE TM52 (2013) and TM59 (2017) guidance.

The IES models were developed based on the outline tender package design received by Simpson Haugh architects on the 24th August 2021. 14th floor apartments were modelled in IES-VE software and tested for overheating according to TM59 methodology (sample floor shown in Figure 1, Figure 2 shows view taken from IES model). These floor levels were assessed as considered "worst case" based on the façade detailing on this level.



Figure 1- Sample flats example floor 14 C2

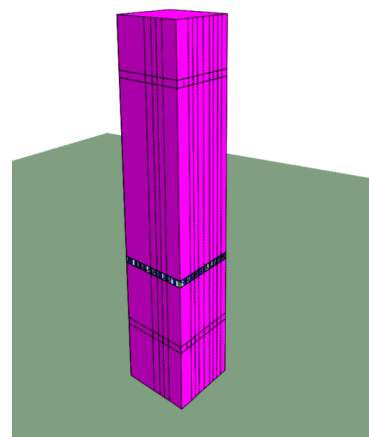


Figure 2 - C2 tower IES model

4. MODELLING ASSUMPTIONS

Occupancy and equipment gains are specified by the TM59 guidance. For clarity, the following assumptions have been used and the proposals for purge vent openings are also detailed below:

Table 1 – Model assumptions – Residential

Assumptions	Target performance
Curtain Walling (W/m ² . K) (including frame and thermal bridging)	0.9
Glazing G-value (all glazing areas excluding purge vents)	0.4
Floor plan	10364-C2-SHP-G200_PL-14-0001 D06 (C2) 10364-C1-SHP-G200_PL-14-0001 (C1) D1-SHP-F200_MD-XX-0001-Apartments_detached-Floor plan:D1_14 (D1) D2-SHP-F200_MD-XX-0001-Apartments_detached-Floor plan:D2_14 (D2)
Façade layout	As per floor plan (C1+C2) D1-SHP-F200_MD-XX-0001-Facade_detached-Floor plan:D1_14 (D1) D2-SHP-F200_MD-XX-0001-Facade_detached-Floor plan:D2_14 (D2)
Angle of north	53° (C1) 6° (C2) 42° (D1) 73° (D2)
Weather data	Manchester_DSY1_2020High50.epw
Bedroom ventilation (l/s)	8
Bathroom ventilation (l/s)	8
Kitchen/ diner ventilation (l/s)	21
Solid Vent panel design	Solid vent panels. In IES these have been modelled as a grille on a semi exposed wall of a high-rise building.
Glazed Vent panel design	Glazed vent panels. In IES these have been modelled as a grille on a semi exposed wall of a high-rise building with a g value of 0.2.
Vent panel conditions	50% openable area with 0.4 coefficient of discharge

Bedroom ventilation opening hours profile	Open 7am-11pm and when the temperature exceeds 22°C ¹ (hours of opening advised by Fisher Acoustics)
Living room ventilation opening profile	Open 7am-7pm and when the temperature exceeds 22°C ¹ (hours of opening advised by Fisher Acoustics)
Blind shading coefficient	0.28
Blind operational profile	When incident solar irradiance exceeds 300W/m ²

It has been confirmed that the above parameters align with Element SAP input figures issued on 17/08/21.

5. RESULTS

The following section sets out the results from the TM59 overheating study with acoustic considerations applied. Opening hours as specified above as defined by Fisher Acoustics unless not achievable where stated and later opening times are given in the “notes” column. Note that there is no TM59 criteria for closing windows at any time but windows in each room should be controlled separately and modelled as open when both the internal dry bulb temperature exceeds 22 °C and the room is occupied.

Table 2 – TM59 results – C1

Room name	Criteria a	Criteria b	Passes TM59	Notes
	% Hours T _{op} T _{max} >= 1°C	Hours between 10pm – 7am > 26°C (per annum)		
0011 SC1_14_11 living area	0.5	n/a	yes	
0010 S/WC1_14_10 bedroom 2	0.6	13	yes	
0011 SC1_14_11 bedroom	0	0	yes	
0010 S/WC1_14_10 bedroom 1	1	24	yes	
0001 S/E C1_14_02 bedroom	0	0	yes	
0001 S/E C1_14_02 living area	0	n/a	yes	
0001 N/E C1_14_05 bedroom	0	0	yes	
0001 N/E C1_14_05 living area	0	n/a	yes	
0001 NC1_14_07 living area	1.6	n/a	yes	
0001 N/W C1_14_09 living area	0	n/a	yes	
0001 SEC1_14_01 Bedroom	0.2	8.5	yes	
0001 SEC1_14_01 Bedroom	0	10	yes	
0001 SC1_14_01 living area	2.8	n/a	yes	
0001 S C1_14_12 bedroom	0	0	yes	

¹ Windows in each room should be controlled separately and modelled as open when both the internal dry bulb temperature exceeds 22°C and the room is occupied (as stated in section 3.3 of TM59 2017).

0001 S C1_14_12 living area	0.1	n/a	yes	
0001 N C1_14_07 bedroom	0	0	yes	
0001 N/EC1_14_06 Bedroom	0	0	yes	
0001 N/EC1_14_06 Bedroom	0	0	yes	
0001 N/EC1_14_06 living area	0	n/a	yes	
0001 N/EEC1_14_04 Bedroom	0	0	yes	
0001 N/EEC1_14_04 Bedroom	0	9	yes	
0001 EC1_14_04 Living area	2.1	n/a	yes	
0001 S/E C1_14_03 Bedroom	0	10	yes	
0001 S/E C1_14_03 Bedroom	0	11.5	yes	
0001 S/E C1_14_03 living area	0	n/a	yes	
0001 S C1_14_12 Bedroom	0	3.5	yes	
0001 NN/W C1_14_07 bedroom	0	0	yes	
0001 N/W C1_14_09 bedroom	0	0	yes	
0001 C1N/W_14_09 living area	0.1	n/a	yes	
0001 C1N/W_14_09 bedroom 1	0.1	0	yes	
0010 WC1_14_10 living area	2.9	n/a	yes	Purge vents close 7:30pm
0001 C1N/W_14_09 bedroom 2	0	4	yes	

In summary, if west (WC1_14_10) living room vent panels are closed after 7:30pm all rooms can meet TM59 along with acoustic requirements. All other living rooms pass when vent panels are closed after 7pm.

Table 3 – TM59 results – C2

Room name	Criteria a	Criteria b	Passes TM59	Notes
	% Hours T_{op} $T_{max} \geq 1^{\circ}C$	Hours between 10pm – 7am $> 26^{\circ}C$ (per annum)		
0011 SC2_14_11 living area	0	n/a	yes	
0010 SWC2_14_10 bedroom 2	0	2	yes	
0011 SC2_14_11 bedroom	0	1.5	yes	
0010 SWC2_14_10 bedroom 1	0.6	21.5	yes	
0010 SWC2_14_10 living area	2.8	n/a	yes	Purge vents close 8:30pm
0001 W C2_14_02 bedroom	0	25	yes	
0001 W C2_14_02 living area	0.1	n/a	yes	

0001 N C2_14_05 bedroom	0	4.5	yes	
0001 N C2_14_05 living area	0	n/a	yes	
0001 NW C2_14_07 living area	2.1	n/a	yes	
0001 W C2_14_09 living area	0.7	n/a	yes	
0001 SEC2_14_01 Bedroom	0	6	yes	
0001 SEC2_14_01 Bedroom	0	26	yes	
0001 SEC2_14_01 living area	2.5	n/a	yes	
0001 S C2_14_12 bedroom	0	0	yes	
0001 S C2_14_12 living area	0	n/a	yes	
0001 NW C2_14_07 bedroom	0	15	yes	
0001 NC2_14_06 Bedroom	0	5	yes	
0001 NC2_14_06 Bedroom	0	12	yes	
0001 NC2_14_06 living area	0	n/a	yes	
0001 NEC2_14_04 Bedroom	0	11.5	yes	
0001 NEC2_14_04 Bedroom	0	29.5	yes	
0001 NEC2_14_04 Living area	2.1	n/a	yes	
0001 W C2_14_03 Bedroom	0	26.5	yes	
0001 W C2_14_03 Bedroom	0	27	yes	
0001 W C2_14_03 living area	0	n/a	yes	
0001 S C2_14_12 Bedroom	0.1	8.5	yes	
0001 C2W_14_09 living area	0.3	n/a	yes	

In summary, if South West (SWC2_14_10) living room vent panels are closed after 8:30pm all rooms can meet TM59 along with acoustic requirements. All other living rooms pass when vent panels are closed after 7pm.

Table 4 – TM59 results – D1

Room name	Criteria a	Criteria b	Passes TM59	Notes
	% Hours T_{op} $T_{max} \geq 1^{\circ}\text{C}$	Hours between 10pm – 7am $> 26^{\circ}\text{C}$ (per annum)		
D1_14_09 bedroom (1)	0	13.5	yes	
D1_14_07 bedroom (1)	0.1	19.5	yes	
D1_14_03 living room (1)	0.9	n/a	yes	
D1_14_06 living room (1)	0	n/a	yes	

D1_14_10 living room (1)	0	n/a	yes	
D1_14_09 living room (1)	1.9	n/a	yes	
D1_14_08 living room (1)	0.2	n/a	yes	
D1_14_08 bedroom (1)	0	11	yes	
D1_14_07 bedroom (1)	0.3	20.5	yes	
D1_14_01 living room (1)	2.4	n/a	yes	
D1_14_01 bedroom (1)	0	3.5	yes	
D1_14_01 bedroom (1)	0	0	yes	
D1_14_02 living room (1)	1.5	n/a	yes	
NWD1_14_02 bedroom (1)	0.1	6.5	yes	
D1_14_10 bedroom (1)	0	0	yes	
D1_14_10 bedroom (1)	0	0	yes	
D1_14_07 living room (1)	2	n/a	yes	
D1_14_09 bedroom (1)	0.2	19.5	yes	
D1_14_06 bedroom (1)	0.3	11	yes	
D1_14_06 bedroom (1)	0.5	11.5	yes	
D1_14_05 living room (1)	2.8	n/a	yes	Purge vents close 8:30pm
D1_14_05 bedroom (1)	1.1	22	yes	
D1_14_14 living room (1)	2.9	n/a	yes	
D1_14_14 bedroom (1)	0.6	25	yes	
D1_14_05 bedroom (1)	0	6	yes	
D1_14_03 bedroom (1)	0.1	13.5	yes	

In summary, if West (D1_14_05) living room vent panels are closed after 8:30pm all rooms can meet TM59 along with acoustic requirements. All other living rooms pass when vent panels are closed after 7pm.

Table 5 – TM59 results – D2

Room name	Criteria a	Criteria b	Passes TM59	Notes
	% Hours T_{op} $T_{max} \geq 1^{\circ}C$	Hours between 10pm – 7am $> 26^{\circ}C$ (per annum)		
D2_14_09 bedroom (1) (1)	0	0	yes	
D2_14_07 bedroom (1) (1)	0	0	yes	
D2_14_03 living room (1) (1)	0	n/a	yes	
D2_14_06 living room (1) (1)	0.1	n/a	yes	

D2_14_10 living room (1) (1)	0	n/a	yes	
D2_14_09 living room (1) (1)	0.5	n/a	yes	
D2_14_08 living room (1) (1)	0	n/a	yes	
D2_14_08 bedroom (1) (1)	0	0	yes	
D2_14_07 bedroom (1) (1)	0	0	yes	
D2_14_01 living room (1) (1)	2.1	n/a	yes	
D2_14_01 bedroom (1) (1)	0	5	yes	
D2_14_01 bedroom (1) (1)	0	0	yes	
D2_14_02 living room (1) (1)	0.3	n/a	yes	
D2_14_02 bedroom (1) (1)	0.1	14.5	yes	
D2_14_10 bedroom (1) (1)	0	0	yes	
D2_14_10 bedroom (1) (1)	0	0	yes	
D2_14_07 living room (1) (1)	1.9	n/a	yes	Purge vents close 8:30pm
D2_14_09 bedroom (1) (1)	0	0	yes	
D2_14_06 bedroom (1) (1)	0.3	10	yes	
D2_14_06 bedroom (1) (1)	0.4	8	yes	
D2_14_05 living room (1) (1)	2.8	n/a	yes	
D2_14_05 bedroom (1) (1)	1.5	26.5	yes	
D2_14_14 living room (1) (1)	0.5	n/a	yes	
D2_14_14 bedroom (1) (1)	0.2	22.5	yes	
D2_14_05 bedroom (1) (1)	0.2	6	yes	
D2_14_03 bedroom (1) (1)	0	11.5	yes	

In summary, if North West (D2_14_07) living room vent panels are closed after 8:30pm all rooms can meet TM59 along with acoustic requirements. All other living rooms pass when vent panels are closed after 7pm.

6. PURGE VENTILATION OPENING HOURS

All apartments meet the proposed acoustic requirements (bedrooms – purge vents closed 11pm-7am and living rooms – closed 7pm-7am) and pass TM59 on the C1 & C2 Towers and D1 & D2 Towers, with the exception of West corner living room on C1, South West corner living room on C2, West corner living room on D1 and West corner living room on D2 which still passes TM59.

However, several days in June to August require windows in living rooms to be open more than the proposed time constraints as provided above.

The tables below present a further level of detail within the worst case performing apartments in C1 & C2 towers. These show throughout a month, the different hours that the purge vents are required to open to comply with TM59 requirements. Please note that the below results are indicative and based on the dynamic simulation worst case scenario, the actual weather conditions and operational parameters will vary whilst the building is in use.

Table 6 – TM59 Further Analysis – C1

West corner Apartment (WC1_14_10)	Hours of window opening occurrence in the month (to comply with TM59 and acoustic advice from fisher acoustics)		Hours of window opening occurrence in the month (to comply with TM59 and acoustic advice from fisher acoustics)	
	Month (days in month)	Open Plan Living Room/ Kitchen	Bedrooms	Occurrence in the month (days)
May (31)	0 – 3 hours	14	0 – 3 hours	19
	3 – 6 hours	7	3 – 6 hours	4
	6 – 9 hours	8	6 – 9 hours	3
	9 – 11 hours	2	9 – 11 hours	3
	11 – 13 hours	0	11 – 16 hours	2
June (30)	0 – 3 hours	10	0 – 3 hours	10
	3 – 6 hours	4	3 – 6 hours	4
	6 – 9 hours	2	6 – 9 hours	0
	9 – 11 hours	8	9 – 11 hours	2
	11 – 13 hours	6	11 – 16 hours	14
July (31)	0 – 3 hours	2	0 – 3 hours	4
	3 – 6 hours	1	3 – 6 hours	0
	6 – 9 hours	3	6 – 9 hours	1
	9 – 11 hours	11	9 – 11 hours	0
	11 – 13 hours	14	11 – 16 hours	26
Aug (31)	0 – 3 hours	0	0 – 3 hours	0
	3 – 6 hours	0	3 – 6 hours	0
	6 – 9 hours	6	6 – 9 hours	0

Sept (30)	9 – 11 hours	8	9 – 11 hours	0
	11 – 13 hours	17	11 – 16 hours	31
	0 – 3 hours	30	0 – 3 hours	17
	3 – 6 hours	0	3 – 6 hours	3
	6 – 9 hours	0	6 – 9 hours	3
	9 – 11 hours	0	9 – 11 hours	2
	11 – 13 hours	0	11 – 16 hours	5

Note that 37 days per annum the living room doesn't comply with acoustic proposals. The worst case opening time is 7:30pm instead of 7pm as proposed.

Table 7 – TM59 Further Analysis – C2

South West corner Apartment (C2_14_10)		Hours of window opening occurrence in the month (to comply with TM59 and acoustic advice from fisher acoustics)		Hours of window opening occurrence in the month (to comply with TM59 and acoustic advice from fisher acoustics)	
Month (days in month)	Open Plan Living Room/ Kitchen	Occurrence in the month (days)	Bedrooms	Occurrence in the month (days)	
May (31)	0 – 3 hours	11	0 – 3 hours	31	
	3 – 6 hours	4	3 – 6 hours	0	
	6 – 9 hours	11	6 – 9 hours	0	
	9 – 11 hours	4	9 – 11 hours	0	
	11 – 13 hours	1	11 – 16 hours	0	
June (30)	0 – 3 hours	9	0 – 3 hours	10	
	3 – 6 hours	2	3 – 6 hours	4	
	6 – 9 hours	3	6 – 9 hours	0	
	9 – 11 hours	9	9 – 11 hours	1	
	11 – 13 hours	7	11 – 16 hours	15	
July (31)	0 – 3 hours	1	0 – 3 hours	4	

	3 – 6 hours	2	3 – 6 hours	0
	6 – 9 hours	2	6 – 9 hours	0
	9 – 11 hours	5	9 – 11 hours	1
	11 – 13 hours	21	11 – 16 hours	26
Aug (31)	0 – 3 hours	0	0 – 3 hours	0
	3 – 6 hours	0	3 – 6 hours	0
	6 – 9 hours	1	6 – 9 hours	0
	9 – 11 hours	10	9 – 11 hours	0
	11 – 13 hours	20	11 – 16 hours	31
Sept (30)	0 – 3 hours	30	0 – 3 hours	30
	3 – 6 hours	0	3 – 6 hours	0
	6 – 9 hours	0	6 – 9 hours	0
	9 – 11 hours	0	9 – 11 hours	0
	11 – 13 hours	0	11 – 16 hours	0

Note that 46 days per annum the living room doesn't comply with acoustic proposals. The worst-case opening time is 8:30pm instead of 7pm as proposed.

7. CONCLUSION

In conclusion, all apartments comply with TM59, tables 2, 3, 4 and 5 above.

As per advice from Fisher Acoustics to show compliance with AVO we are restricting window opening times, which is not a TM59 requirement. As per this advice; Bedroom ventilation opening hours profile - Open 7am-11pm only (closed at all other times). Living room ventilation opening profile - Open 7am-7pm (closed at all other times).

The only 2 no. rooms across typical floor plates for both C1 & C2 that don't align with this restriction are as follows:

- South West (C2_14_10) living room vent panels are closed after 8:30pm
- West (WC1_14_10) living rooms are closed after 7:30pm



The only 2 no. rooms across typical floor plates for both D1 & D2 that don't align with this restriction are as follows:

- West (D1_14_05) living room vent panels are closed after 8:30pm
- North West (D2_14_07) living rooms are closed after 8:30pm

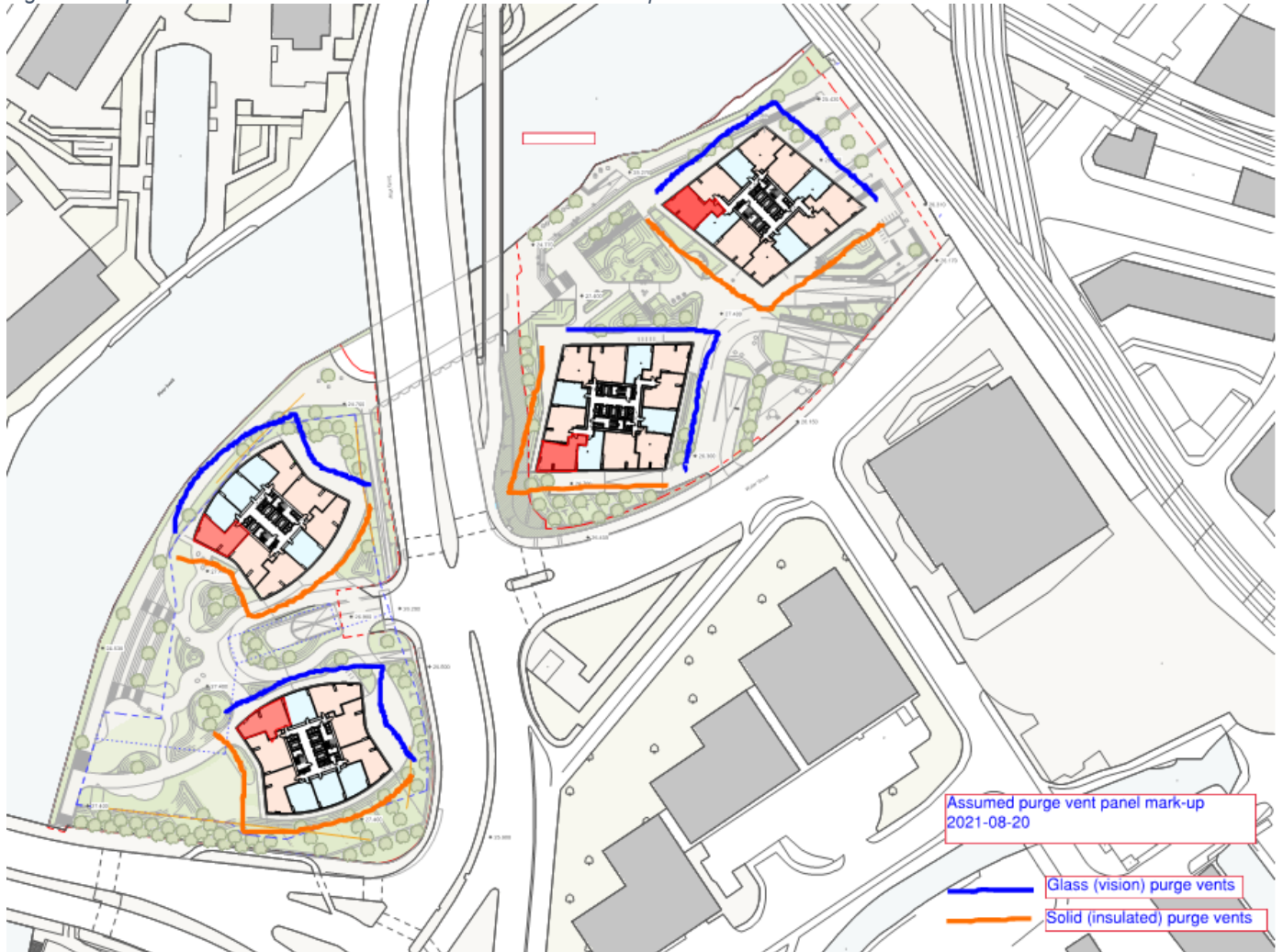
As stated above, we comply with TM59 in all apartments. What we are exceeding on the above 4 is the acoustic interpretations of AVO compliance.

Further, tables 6 and 7 provide a breakdown of the number of days in a month that the purge vent is required to be open to comply with TM59 along with acoustic interpretations of AVO compliance for the worst case apartment of each tower.

For example, there are 7 days in June that the SW apartment in C2 is required to be open between 11 and 13 hours to not overheat as per the methodology of TM59.

Figure 3 shows the apartments where we comply with TM59 but are exceeding on the acoustic interpretations of AVO compliance as per tables 2,3,4 and 5.

Figure 3 – Apartments where acoustic interpretations of AVO compliance are exceeded.



APPENDIX A

Plot C1

Required daily opening hours for May to Sept of purge vents to living rooms

Room Name	Month	Purge Vent Open (time)	Notes
S C1_14_01 living area			
	May	07:00 – 18:00	(11 hours)
	June	07:00 – 18:00	(11 hours)
	July	07:00 – 18:00	(11 hours)
	Aug	07:00 – 18:00	(11 hours)
	Sept	08:00 – 18:00	(10 hours)
S/E C1_14_02 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	17:00 – 18:00	(1 hours)
S/E C1_14_03 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	17:00 – 18:00	(1 hours)
E C1_14_04 Living area			
	May	17:00 – 18:00	(1 hours)
	June	07:00 – 18:00	(11 hours)
	July	07:00 – 18:00	(11 hours)
	Aug	07:00 – 18:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
N/E C1_14_05 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)

	Aug	17:00 – 18:00	(1 hours)
	Sept	n/a	(0 hours)
N/E C1_14_06 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	n/a	(0 hours)
N C1_14_07 living area			
	May	17:00 – 18:00	(1 hours)
	June	07:00 – 18:00	(11 hours)
	July	07:00 – 18:00	(11 hours)
	Aug	07:00 – 18:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
N/W C1_14_08 living area			
	May	n/a	(0 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
N/W C1_14_09 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
W C1_14_10 living area			
	May	08:00 – 19:00	(11 hours)
	June	07:00 – 19:00	(12 hours)
	July	07:00 – 19:30	(12.5 hours)
	Aug	07:00 – 19:30	(12.5 hours)
	Sept	17:00 – 19:00	(2 hours)
S C1_14_11 living area			

	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
S C1_14_12 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)

Plot C1

Required daily opening hours for May to Sept of purge vents to living rooms with addition of purge fan of 41 l/s - on constantly for “C1_14_10 living area”.

Window restricted to max 6 hours.

Room name	Month	Purge Vent Open (time)	Notes
S C1_14_10 living area			
	May	13:00 – 19:00	(6 hours)
	June	13:00 – 19:00	(6 hours)
	July	13:00 – 19:00	(6 hours)
	Aug	13:00 – 19:00	(6 hours)
	Sept	14:00 – 19:00	(5 hours)

Note this apartment complies with TM59 Methodology.

Plot C2

Required daily opening hours for May to Sept of purge vents to living rooms

Room Name	Month	Purge Vent Open (time)	Notes
SE C2_14_01 living area			
	May	17:00 – 18:00	(1 hours)
	June	08:00 – 19:00	(11 hours)
	July	08:00 – 19:00	(11 hours)
	Aug	08:00 – 19:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
W C2_14_02 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	17:00 – 18:00	(1 hours)
W C2_14_03 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	17:00 – 18:00	(1 hours)
N/E C2_14_04 Living area			
	May	17:00 – 18:00	(1 hours)
	June	08:00 – 19:00	(11 hours)
	July	08:00 – 19:00	(11 hours)
	Aug	08:00 – 19:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
N C2_14_05 living area			
	May	n/a	(0 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	n/a	(0 hours)

N C2_14_06 living area			
	May	n/a	(0 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	n/a	(0 hours)
N/W C2_14_07 living area			
	May	09:00 – 19:00	(10 hours)
	June	08:00 – 19:00	(11 hours)
	July	08:00 – 19:00	(11 hours)
	Aug	08:00 – 19:00	(11 hours)
	Sept	12:00 – 19:00	(7 hours)
N/W C2_14_08 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
W C2_14_09 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
W C2_14_10 living area			
	May	07:00 – 19:00	(12 hours)
	June	07:00 – 20:00	(13 hours)
	July	07:00 – 20:30	(13.5 hours)
	Aug	07:00 – 20:30	(13.5 hours)
	Sept	15:00 – 18:00	(3 hours)
S C2_14_11 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)

	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
S C2_14_12 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)

Plot C2

Required daily opening hours for May to Sept of purge vents to living rooms with addition of purge fan of 41 l/s - on constantly for “C2_14_10 living area”.

Window restricted to max 6 hours.

Room name	Month	Purge Vent Open (time)	Notes
W C2_14_10 living area			
	May	13:00 – 19:00	(6 hours)
	June	13:00 – 19:00	(6 hours)
	July	13:00 – 19:00	(6 hours)
	Aug	13:00 – 19:00	(6 hours)
	Sept	13:00 – 19:00	(6 hours)

Plot D1

Required daily opening hours for May to Sept of purge vents to living rooms

Room Name	Month	Purge Vent Open (time)	Notes
N D1_14_01 living area			
	May	17:00 – 18:00	(1 hours)
	June	08:00 – 19:00	(11 hours)
	July	08:00 – 19:00	(11 hours)
	Aug	08:00 – 19:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
N/W D1_14_02 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
N/W D1_14_03 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
N/W D1_14_04 living area			
	May	17:00 – 18:00	(1 hours)
	June	15:00 – 18:00	(3 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	17:00 – 18:00	(1 hours)
W D1_14_05 living area			
	May	07:00 – 19:30	(12.5 hours)
	June	07:00 – 20:00	(13 hours)
	July	07:00 – 20:30	(13.5 hours)
	Aug	07:00 – 20:30	(13.5 hours)
	Sept	16:00 – 18:00	(2 hours)

S/W D1_14_06 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
S D1_14_07 living area			
	May	08:00 – 19:00	(11 hours)
	June	07:00 – 19:00	(12 hours)
	July	07:00 – 19:00	(12 hours)
	Aug	07:00 – 19:00	(12 hours)
	Sept	09:00 – 18:00	(9 hours)
S/E D1_14_08 Living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
E D1_14_09 living area			
	May	17:00 – 18:00	(1 hours)
	June	08:00 – 19:00	(11 hours)
	July	08:00 – 19:00	(11 hours)
	Aug	08:00 – 19:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
N/E D1_14_10 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	17:00 – 18:00	(1 hours)
	Sept	n/a	(0 hours)

Plot D1

Required daily opening hours for May to Sept of purge vents to living rooms with addition of purge fan of 50 l/s - on constantly for “W D1_14_05 living area”.

Window restricted to max 6 hours.

Room name	Month	Purge Vent Open (time)	Notes
W D1_14_05 living area			
	May	13:00 – 19:00	(6 hours)
	June	13:00 – 19:00	(6 hours)
	July	13:00 – 19:00	(6 hours)
	Aug	13:00 – 19:00	(6 hours)
	Sept	13:00 – 19:00	(5 hours)

Note this apartment complies with TM59 Methodology.

Plot D2

Required daily opening hours for May to Sept of purge vents to living rooms

Room Name	Month	Purge Vent Open (time)	Notes
E D2_14_01 living area			
	May	17:00 – 18:00	(1 hours)
	June	08:00 – 19:00	(11 hours)
	July	07:00 – 19:00	(12 hours)
	Aug	07:00 – 19:00	(12 hours)
	Sept	17:00 – 18:00	(1 hours)
S/E D2_14_02 living area			
	May	17:00 – 18:00	(1 hours)
	June	15:00 – 19:00	(4 hours)
	July	15:00 – 19:00	(4 hours)
	Aug	15:00 – 19:00	(4 hours)
	Sept	17:00 – 18:00	(1 hours)
S/E D2_14_03 living area			
	May	17:00 – 18:00	(1 hours)
	June	15:00 – 19:00	(4 hours)
	July	15:00 – 19:00	(4 hours)
	Aug	15:00 – 19:00	(4 hours)
	Sept	17:00 – 18:00	(1 hours)
S/E D2_14_04 Living area			
	May	17:00 – 18:00	(1 hours)
	June	15:00 – 19:00	(4 hours)
	July	15:00 – 19:00	(4 hours)
	Aug	15:00 – 19:00	(4 hours)
	Sept	17:00 – 18:00	(1 hours)
S D2_14_05 living area			
	May	08:00 – 18:00	(10 hours)
	June	07:00 – 18:30	(11.5 hours)
	July	07:00 – 19:00	(12 hours)
	Aug	07:00 – 19:00	(12 hours)
	Sept	10:00 – 18:00	(8 hours)

S/W D2_14_06 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
W D2_14_07 living area			
	May	07:00 – 19:00	(12 hours)
	June	07:00 – 19:30	(12.5 hours)
	July	07:00 – 20:30	(13.5 hours)
	Aug	07:00 – 20:30	(13.5 hours)
	Sept	09:00 – 18:30	(9.5 hours)
N/W D2_14_08 living area			
	May	17:00 – 18:00	(1 hours)
	June	17:00 – 18:00	(1 hours)
	July	17:00 – 18:00	(1 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	17:00 – 18:00	(1 hours)
N D2_14_09 living area			
	May	17:00 – 18:00	(1 hours)
	June	08:00 – 19:00	(11 hours)
	July	08:00 – 19:00	(11 hours)
	Aug	08:00 – 19:00	(11 hours)
	Sept	17:00 – 18:00	(1 hours)
N/E D2_14_10 living area			
	May	17:00 – 18:00	(1 hours)
	June	15:00 – 19:00	(4 hours)
	July	15:00 – 19:00	(4 hours)
	Aug	15:00 – 19:00	(4 hours)
	Sept	n/a	(0 hours)

Plot D2

Required daily opening hours for May to Sept of purge vents to living rooms with addition of purge fan of 50 l/s - on constantly for "D2_14_07 living area".

Window restricted to max 4 hours.

Room name	Month	Purge Vent Open (time)	Notes
W D2_14_07 living area			
	May	15:00 – 19:00	(4 hours)
	June	15:00 – 19:00	(4 hours)
	July	15:00 – 19:00	(4 hours)
	Aug	15:00 – 19:00	(4 hours)
	Sept	15:00 – 19:00	(4 hours)

APPENDIX B

Further study of a selection of apartments to ensure that they do not exceed an internal noise level of 50dB LAeq, 16 hrs. Apartment selection provided by Fisher Acoustics.

Required daily opening hours for May to Sept of purge vents to living rooms with addition of purge fan of 50 l/s - on constantly. Purge Vent Hours restricted as low as possible.

Room name	Month	Purge Vent Open (time)	Notes
N C2_14_07 living area			
	May	16:00 – 17:00	(1 hours)
	June	16:00 – 17:00	(1 hours)
	July	16:00 – 17:00	(1 hours)
	Aug	16:00 – 17:00	(1 hours)
	Sept	16:00 – 17:00	(1 hours)
W C2_14_10 living area			
	May	14:00 – 19:00	(5 hours)
	June	14:00 – 19:00	(5 hours)
	July	13:00 – 19:00	(6 hours)
	Aug	13:00 – 19:00	(6 hours)
	Sept	14:00 – 19:00	(5 hours)
E D1_14_09 living area			
	May	15:00 – 16:00	(1 hour)
	June	15:00 – 16:00	(1 hour)
	July	15:00 – 16:00	(1 hour)
	Aug	15:00 – 16:00	(1 hour)
	Sept	15:00 – 16:00	(1 hour)
E D2_14_01 living area			
	May	15:00 – 17:00	(2 hours)
	June	15:00 – 17:00	(2 hours)
	July	15:00 – 17:00	(2 hours)
	Aug	15:00 – 17:00	(2 hours)
	Sept	15:00 – 17:00	(2 hours)
S D2_14_05 living area			
	May	15:00 – 18:00	(3 hours)

	June	15:00 – 19:00	(4 hours)
	July	15:00 – 19:00	(4 hours)
	Aug	15:00 – 19:00	(4 hours)
	Sept	16:00 – 19:00	(3 hours)
W D2_14_07 living area			
	May	16:00 – 17:00	(1 hour)
	June	16:00 – 17:00	(1 hour)
	July	15:00 – 18:00	(3 hours)
	Aug	15:00 – 18:00	(3 hours)
	Sept	16:00 – 17:00	(1 hour)
N D2_14_09 living area			
	May	n/a	(0 hours)
	June	n/a	(0 hours)
	July	n/a	(0 hours)
	Aug	n/a	(0 hours)
	Sept	n/a	(0 hours)

Note all apartments above comply with TM59 Methodology.

Technical Note

Project:	Trinity Islands, Manchester
Document Reference:	T01-PR0661-MPF
Date:	18/11/2021
Author:	Matt Fisher
Subject:	Acoustics Ventilation & Overheating assessment

INTRODUCTION

Manchester City Council has advised that planning applications for residential applications must include an assessment in line with 'Acoustics, Ventilation and Overheating, Residential Design Guide', (AVO) published by the Association of Noise Consultants and the Institute of Acoustics in January 2020.

The apartments within the proposed development at Trinity Islands are to be ventilated using continuous mechanical supply and extract with heat recovery (MVHR) units in order to comply with the 'whole dwelling' ventilation requirements of Approved Document F of the Building Regulations (ADF). Purge ventilation is required under ADF to rapidly dilute pollutants (eg paint fumes) and/or water vapour to maintain indoor air quality. Purge ventilation of the apartments is to be provided by opening windows (purge panels) within the curtain wall.

The provisions for purge ventilation (eg openable purge panels) can also be used to improve thermal comfort, although this is not currently controlled under the Building Regulations. The AVO recommends that when using provisions for purge ventilation such as opening windows, an assessment is carried out of the potential effect of the subsequent internal noise levels within apartment rooms.

This Technical Note discusses the potential effect of the control of overheating on the internal noise levels within the proposed apartments of Trinity Islands, Manchester.

ACOUSTICS, VENTILATION AND OVERHEATING, RESIDENTIAL DESIGN GUIDE (AVO)

As stated in the Foreword of the document, the AVO

- 'provides an approach as to how the competing aspects of thermal and acoustic comfort can be managed'.

In the current absence of mandatory requirements under the Building Regulations in relation to the overheating of dwellings, the AVO is

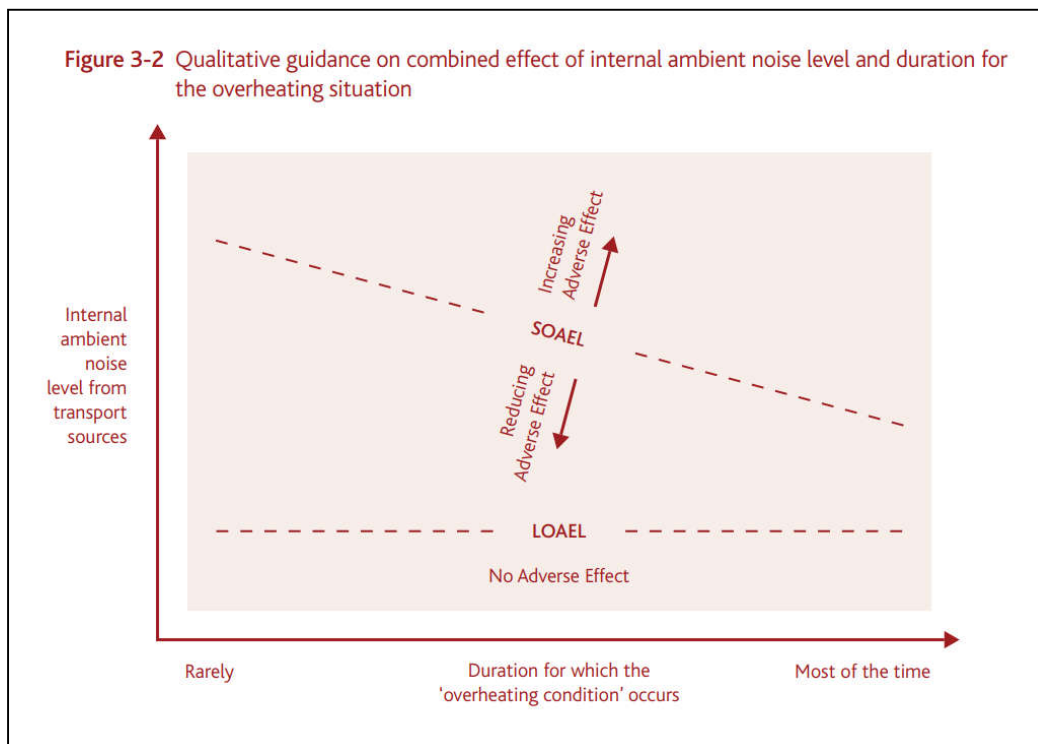
- 'intended to be used by acoustics practitioners as well as all those involved in the planning, development, design and commissioning of new dwellings. It recommends an approach to acoustic assessments for new residential development that takes due regard of the interdependence of provisions for acoustics, ventilation, and overheating'.

The AVO presents a method for assessing the risk of an adverse effect on occupants depending on 1) the potential internal noise level within apartments with windows open and 2) the duration of window opening.

With regard to the duration of window opening required to mitigate overheating, the AVO states:

- No quantitative guidance regarding the combined effect of level and duration for the overheating condition is included in the current version of this document. However, the situation is summarised qualitatively in Figure 3-2 and also addressed in the worked examples included in Appendix B.

Figure 3-2 from the AVO is reproduced below.



It will be noted that no absolute noise levels are indicated on the y-axis and no specific durations are identified on the x-axis of Figure 3.2.

With regard to the duration of the overheating condition (i.e. the time that windows or purge panels may be open), 'rarely' and 'most of the time', as reference in Figure 3-2 of the AVO are not defined, although reference is made to 'Overheating in New Homes', published by the Good Homes Alliance in July 2019, which provides an early design stage tool in order to identify key factors contributing to overheating risk, and possible mitigation measures.

The tool 'is not meant to provide a detailed assessment, but instead to sit between existing high level guidance...and detailed calculation and modelling tools...'.

The AVO recognises that further development work is required to better understand how long people will tolerate higher noise levels in their homes in order to stay cool, with the ultimate aim of creating 'cost effective and sustainable buildings'.

Furthermore, the AVO advises that:

- In the case of the overheating condition, the effect of increased internal ambient noise from external noise sources will depend both on the absolute noise level and the amount of time for which the overheating condition occurs. A good design process should therefore, as a priority, seek to minimise heat gains thereby reducing the amount and duration of ventilation required to control overheating and the consequential effect from increased ingress of noise.

Importantly, the AVO acknowledges that

- Appropriate research work is urgently needed to better inform the guidance for the overheating condition.

and

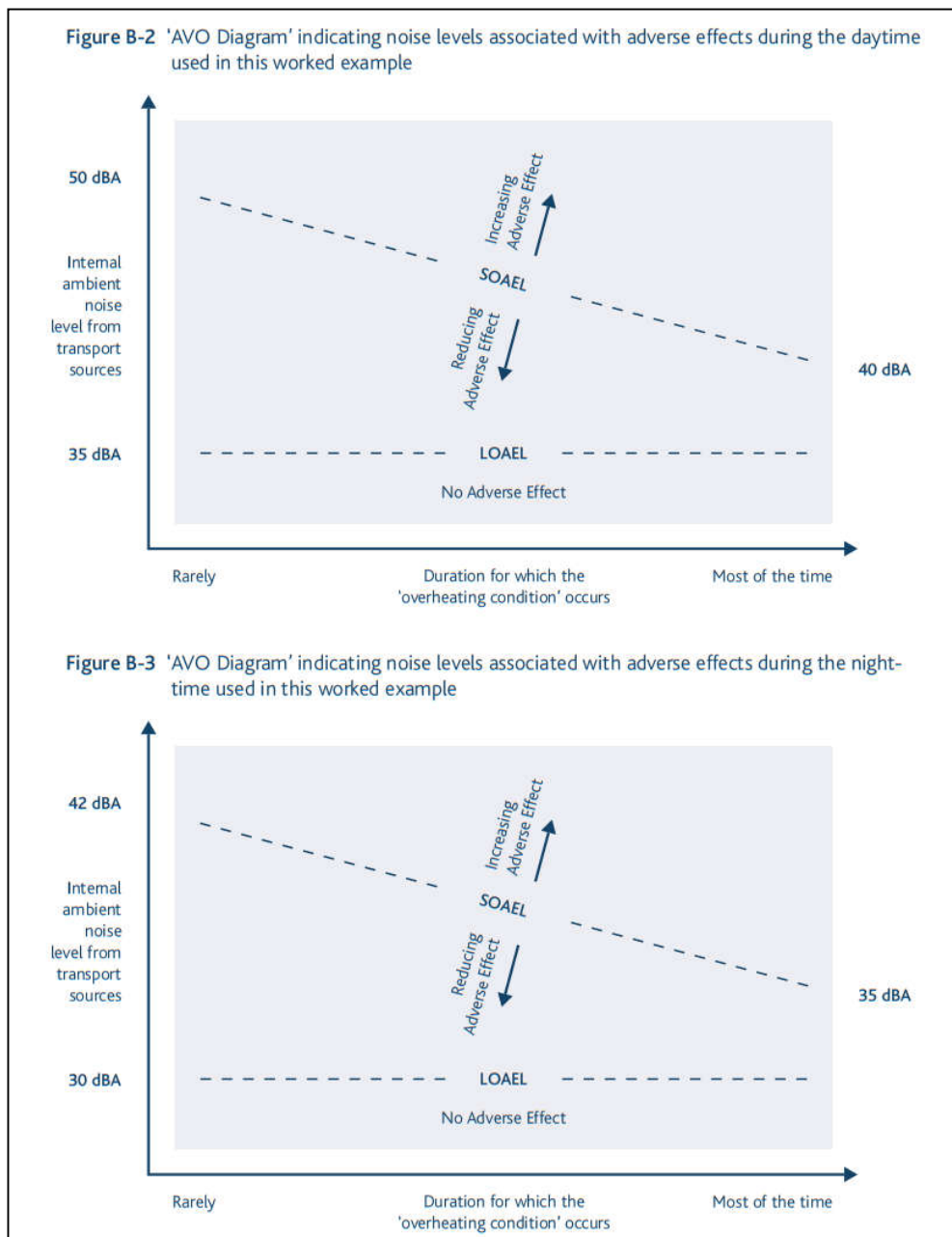
- There are other benefits for occupants from opening windows, such as the connection with the outside, sense of fresh air, experience of draughts when overheating, and sense of control over one's environment' and states that 'consideration of these factors is also beyond the scope of the AVO Guide.

Worked examples are provided in Appendix B of the AVO. These examples give suggested absolute dB levels for the SOAEL (Significant Observed Adverse Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) curves in Figure 3-2. The LOAEL is defined as the level above which adverse effects on health and quality of life can be detected. The SOAEL is defined as the level above which significant adverse effects on health and quality of life occur.

The AVO advises that

- 'although for both LOAEL and SOAEL, the word 'level' is used, this does not mean that the impact can only be described as an individual noise level or exposure. It could also include factors such as the number of times the noise impact occurs, the duration of the impact, and the time of day the impact occurs. Thus, depending on the circumstance, the noise impact could be managed by reducing how often it occurs rather than just reducing the level of impact when it does occur.

Figures B-2 and B-3 from the AVO worked examples are reproduced below.



The AVO advises that the NPSE (Noise Policy Statement for England) states it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times.

The AVO states that the suggested upper daytime noise limit of 50 dB LAeq,T is defined on the basis that it represents the upper end of the range for reliable speech communication. The upper night time noise limit of 42 dB LAeq,T is defined in the AVO with reference to the WHO Night Noise guidelines, which state that for external levels above 55dB LAeq,T, 'adverse health effects occur frequently and a sizeable proportion of the population is highly annoyed and sleep-disturbed'.

A noise level of 50dB LAeq,T is also the upper limit for indoor long-term ambient noise within open plan offices recommended in BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'.

The value of 'T', the averaging period used to determine the 'average' noise level 'LAeq,T', is not defined in the AVO. However, when discussing the further work required to better understand the issue of noise disturbance when windows are opened to control overheating, AVO states that further information is required, including

- how long will people tolerate higher noise levels in order to stay cool? One suggestion is to consider the overall average day (16h) and night (8h) time average noise levels. There is some logic to this as we all know that we can tolerate high noise levels for a short duration and moderately high levels for a little longer.

With regard to the absolute dB noise levels representing the LOAEL and the SOAEL in Figures B-2 and B-3, AVO states:

- The values presented....should not be regarded as fixed thresholds and reference can also be made to relevant dose-response relationships such as those described in a DEFRA 2014 study.the references are based on evidence drawn from *external* noise levels. There is currently very little robust evidence linking *internal* averaged noise levels with health outcomes and occupant behaviour.

Therefore, the noise levels identified in Figures B-2 and B-3 must be viewed with caution.

BUILDING REGULATIONS APPROVED DOCUMENT [X] – CONSULTATION VERSION (JAN 2021)

The consultation version of Building Regulations Approved Document [X] – ‘Overheating’ accompanies the January 2021 consultation on the Future Buildings Standard: Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for non-domestic buildings and dwellings; and overheating in new residential buildings. The Government is currently seeking views on the standards for work to residential buildings and the structure of the draft guidance.

The draft guidance states that

In the Secretary of State’s view, the requirement for overheating is met if the building’s overheating strategy is usable by occupants by taking account of the following.

- a. Noise at night – paragraphs 3.1 - 3.4.
- b. Pollution – paragraphs 3.5
- c. Security – paragraphs 3.6 - 3.8.
- d. Protection from falling – paragraphs 3.9 - 3.11.
- e. Protection from entrapment – paragraph 3.12

Section 3: Ensuring the overheating strategy is usable**Noise**

- 3.1. When the removing excess heat part of the overheating strategy is in use, noise levels in bedrooms should be kept to a minimum during the sleeping hours of 23.00 – 07.00. Noise within bedrooms should not normally exceed the following limits.
 - a. When openings are used
 - i. 40 dB LAeq, T, averaged over 8 hours.
 - ii. 55 dB LAFmax, maximum no more than 10 times a night.
 - b. When a mechanical system is used
 - i. 30 dB LAeq, T, averaged over 8 hours.
- 3.2 Building control bodies may accept as evidence that this requirement is satisfied, any of the following.
 - a. Documentation to demonstrate that the local planning authority did not consider external noise to be an issue at the site at the planning stage.
 - b. Noise measurements of the indoor environment once the building is completed. 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.
 - c. Modelling of the noise of the indoor environment, using appropriate external noise measurements, with the overheating mitigation strategy in use.
- 3.3 Where noise measurements are used, sample testing on a development is appropriate. The sample should include one of each dwelling design, facing each orientation. The dwellings to be sample tested should be selected by the building control body in consultation with the person carrying out the measurement.

- 3.4 Where external noise is identified as an issue at the planning stage either of the following measures could be followed.
- a. Assess external noise and reduce the building's exposure.
 - b. Design the building to reduce the passage of noise from the external to the internal environment.

Guidance can be found in the Association of Noise Consultants' Acoustics, ventilation and overheating residential design guide.

Therefore, the draft version of Approved Document [X], whilst referring to the AVO, only requires that internal noise levels within bedrooms at night achieve certain criteria. No requirement for the achievement of daytime internal noise levels within dwellings in the overheating condition is presented in the draft version of Approved Document.

CIBSE TECHNICAL MEMORANDUM 59 'DESIGN METHODOLOGY FOR THE ASSESSMENT OF OVERHEATING RISK IN HOMES (TM59)'

CIBSE TM59 provides guidance on the assessment of overheating in dwellings. The document sets out a standardised methodology for predicting temperatures inside dwellings using dynamic thermal modelling and also provides overheating compliance criteria.

Dynamic thermal modelling has been carried out by WSP for a number of representative apartments within the proposed development at Trinity Islands. The detailed output from the modelling studies are provided under separate cover.

The input parameters for the TM59 model for Trinity Islands are identified in Table 1.

Assumptions	Target performance
Curtain Walling (W/m ² . K) (including frame and thermal bridging)	0.9
Glazing G-value (all glazing areas excluding purge vents)	0.4
Angle of north	6°
Weather data	Manchester_DSY1_2020High50.epw
Bedroom ventilation (l/s)	8
Bathroom ventilation (l/s)	8
Kitchen/ diner ventilation (l/s)	21
Solid Vent panel design	Solid vent panels. These have been modelled as a grille on a semi exposed wall of a high-rise building.
Glazed Vent panel design	Glazed vent panels. These have been modelled as a grille on a semi exposed wall of a high-rise building with a g value of 0.2.
Vent panel conditions	50% openable area with 0.4 coefficient of discharge
Bedroom ventilation opening hours profile	Open 7am-11pm <u>and</u> when the temperature exceeds 22°C
Living room ventilation opening profile	Open 7am-7pm <u>and</u> when the temperature exceeds 22°C
Blind shading coefficient	0.28
Blind operational profile	When incident solar irradiance exceeds 300W/m ²

Table 1: CIBSE TM59 model assumptions

The 'DSY1' weather data used in the model is the 30 year average of weather years from 2009 to 2039.

It will be noted that in the TM59 model, the purge panels to bedrooms are prevented from opening between 11pm and 7am. Thus if compliance with the bedroom criterion of TM59 is achieved, then the bedroom purge vents can remain closed all night and the internal night time noise criteria of Manchester City Council can be achieved.

It should be noted that the opening hours of the purge vent are based on the vent opening at an internal temperature of 22 deg C. It could be considered that the TM59 model represents a worst case in terms of opening hours, as not all occupants may feel the need to open a purge vent at this temperature.

Furthermore, the TM59 modelling results identify the opening hours of the vent on the basis of the vent only closing when the internal temperature has dropped to 22 Deg C.

If the occupant of an apartment chose to close their vent before the internal temperature dropped back to 22 Deg C, it could quite often be the case that the internal temperature would not then rise above the 'fail' temperature criterion of TM59.

Therefore the opening hours of the purge vents identified by the TM59 model are not necessarily the opening hours required to maintain thermal comfort for the occupants. It would be quite possible to achieve thermal comfort with shorter opening hours than those stipulated by the TM59 modelling results.

The building design initially incorporated the following measures to mitigate overheating:

- 1) Low G value (0.4) of vision glazing to curtain wall to minimize solar heat gain to apartments
- 2) Low G value (0.2) of glazed vent panels to minimize solar heat gain to apartments
- 3) Blind shading coefficient of 0.28 to minimize solar heat gain to apartments
- 4) Continuously-running whole-house ventilation (MVHR) units with Summer Bypass within each apartment
- 5) Passive ventilative cooling via opening purge vents

TRINITY ISLANDS DEVELOPMENT SITE

The proposed development comprises four residential towers C1, C2, D1 and D2 located across two sites to the north of Regent Road and Water Street. The two sites are separated by Trinity Way.

EXTERNAL NOISE LEVELS

The prevailing noise levels at various locations on the development site have been measured by Fisher Acoustics, at positions representative of the closest proposed façade to the surrounding roads and rail lines. Daytime and night time measurements have been undertaken.

Figure 1 identifies the measurement locations in relation to the proposed positions of the four towers.

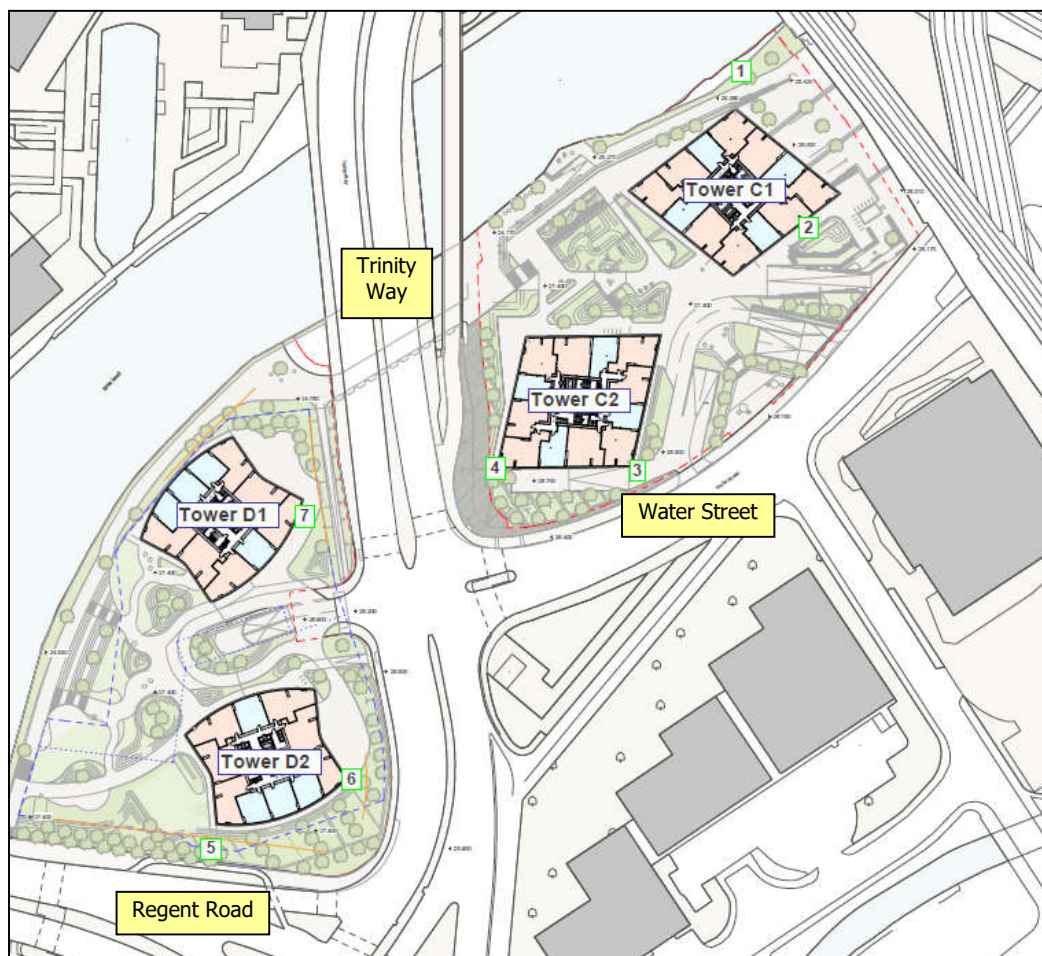


Figure 1: Proposed site plan and noise survey measurement locations

The results of the noise survey have been used to develop a 3D model of the site, from which the external noise levels across the facades of the proposed residential buildings have been determined.

Figure 2 shows the modelled free-field noise levels incident upon the facades, viewed from the south east.

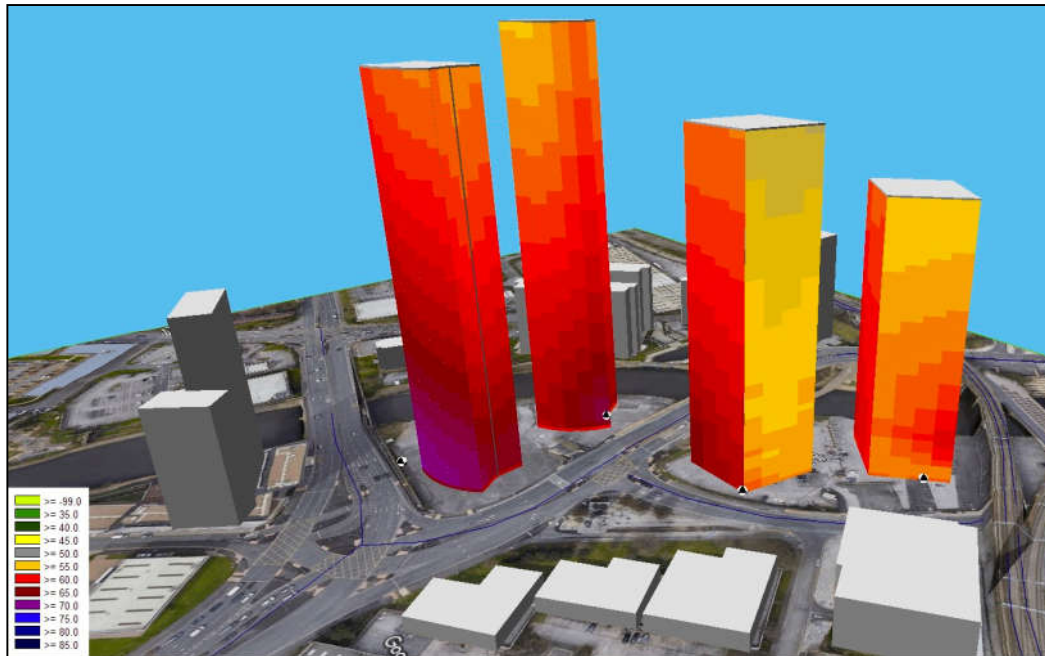


Figure 2: 3D model of development proposals & predicted incident noise levels

Figure 3 shows the calculated external daytime average (LAeq) noise levels expected to be incident upon the various façades of the proposed building. The incident noise levels are those at an elevation of 15 metres above ground floor to ensure a clear line of sight to the adjacent rail viaducts and elevated sections of road.



Figure 3: Summary external daytime noise levels incident on each façade (dB LAeq)

RESULTS OF TM59 DYNAMIC THERMAL MODELLING

Night time

The dynamic thermal modelling carried out by WSP has confirmed that the night time criterion of TM59 is achieved without the need to open purge vents to the bedrooms and living rooms of all apartments within the proposed development between 11pm and 7am. Therefore, full compliance with the internal noise criteria of Manchester City Council for bedrooms at night time can be achieved.

Daytime

As identified in Table 1 above, the TM59 model assumes that the purge vents to bedrooms can be opened as required between 7am and 11pm.

In addition, the TM59 model assumes that the purge vents to living rooms can be opened as required between 7am and 7pm.

This restriction of purge vent opening times in living rooms is on the assumption that under normal circumstances, the impact of internal noise would be less significant during a normal working day than in the evening.

This follows from the acknowledgement in the AVO that the SOAEL is likely to be different at different times of the day.

On this point, the 'Guidelines for Environmental Noise Impact Assessment' published by the Institute of Environmental Management & Assessment (IEMA) in 2014 states

- Time-of-day sensitivity is related to the activity being undertaken by the individual affected by the noise.

It also can be argued that within the 16-hour period, the evening period (19:00–23:00 hours) is relatively more sensitive than the remaining 12-hour period [07:00 – 19:00 hours]. This is also activity-related, since during the evening people are generally at home relaxing, and children will be going to bed during this time.

With reference to the above, it is suggested that the varying sensitivities to noise over the course of the day could be described as follows:

- Daytime noise levels (7am – 7pm): Low sensitivity for both living rooms and bedrooms, due to residents either being out of the home, or generally being more active around the home.
- Evening noise levels (7pm – 11pm): High sensitivity in living rooms, due to the majority of people using this space for relaxation / leisure time. Medium to low sensitivity in bedrooms, as the majority of people will not be asleep during this period.
- Night-time noise levels (11pm – 7am): High sensitivity in bedrooms and low sensitivity in living rooms, due to the majority of residents being asleep during these hours.

To comply with the daytime criterion of TM59, the modelling has determined that the purge vents to the majority of living rooms must be opened for a certain length of time between 7am and 7pm. A small minority of apartments may need to open purge vents in living rooms until 7.30pm or 8.30 pm in the warmest months, as discussed below.

However, as discussed above, the opening hours of the purge vents identified by the TM59 model are not necessarily the opening hours required to maintain thermal comfort for the occupants. It would be quite possible to achieve thermal comfort with shorter opening hours.

Purge ventilation opening hours

All living rooms in the proposed residential towers achieve the TM59 requirement given the restriction of purge vent opening times to 7pm, with the exception of south corner apartments in Tower C1, south west corner apartments in Tower C2, west corner apartments in Tower D1 and south corner apartments in Tower D2. In order to comply with TM59, the purge vents to living rooms of these apartments are required to be open beyond 7pm on several days in June to August.

Tables 2 and 3 below present a further level of detail within the worst case performing apartment in Towers C1 and C2. The tables show the number of hours that the purge vents are required to open throughout each month between May and September to comply with the TM59 requirements. It should be noted that the below results are indicative and based on the dynamic simulation worst case scenario. The actual weather conditions and operational parameters will vary whilst the building is in use.

West corner Apartment (WC1_14_10)	Hours of window opening to comply with TM59 / occurrence in the month		Hours of window opening to comply with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen	Occurrence in the month (days)	Bedrooms	Occurrence in the month (days)
May (31)	0 – 3 hours	14	0 – 3 hours	19
	3 – 6 hours	7	3 – 6 hours	4
	6 – 9 hours	8	6 – 9 hours	3
	9 – 11 hours	2	9 – 11 hours	3
	11 – 13 hours	0	11 – 16 hours	2
June (30)	0 – 3 hours	10	0 – 3 hours	10
	3 – 6 hours	4	3 – 6 hours	4
	6 – 9 hours	2	6 – 9 hours	0
	9 – 11 hours	8	9 – 11 hours	2
	11 – 13 hours	6	11 – 16 hours	14
July (31)	0 – 3 hours	2	0 – 3 hours	4
	3 – 6 hours	1	3 – 6 hours	0
	6 – 9 hours	3	6 – 9 hours	1
	9 – 11 hours	11	9 – 11 hours	0
	11 – 13 hours	14	11 – 16 hours	26
Aug (31)	6 – 9 hours	6	6 – 9 hours	0
	9 – 11 hours	8	9 – 11 hours	0
	11 – 13 hours	17	11 – 16 hours	31
Sept (30)	0 – 3 hours	30	0 – 3 hours	17
	3 – 6 hours	0	3 – 6 hours	3
	6 – 9 hours	0	6 – 9 hours	3
	9 – 11 hours	0	9 – 11 hours	2
	11 – 13 hours	0	11 – 16 hours	5

Table 2: TM59 model results, West corner apartment, Tower C1

South West corner Apartment (C2_14_10)	Hours of window opening to comply with TM59 / occurrence in the month		Hours of window opening to comply with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen	Occurrence in the month (days)	Bedrooms	Occurrence in the month (days)
May (31)	0 – 3 hours	11	0 – 3 hours	31
	3 – 6 hours	4	3 – 6 hours	0
	6 – 9 hours	11	6 – 9 hours	0
	9 – 11 hours	4	9 – 11 hours	0
	11 – 13 hours	1	11 – 16 hours	0
June (30)	0 – 3 hours	9	0 – 3 hours	10
	3 – 6 hours	2	3 – 6 hours	4
	6 – 9 hours	3	6 – 9 hours	0
	9 – 11 hours	9	9 – 11 hours	1
	11 – 13 hours	7	11 – 16 hours	15
July (31)	0 – 3 hours	1	0 – 3 hours	4
	3 – 6 hours	2	3 – 6 hours	0
	6 – 9 hours	2	6 – 9 hours	0
	9 – 11 hours	5	9 – 11 hours	1
	11 – 13 hours	21	11 – 16 hours	26
Aug (31)	6 – 9 hours	1	6 – 9 hours	0
	9 – 11 hours	10	9 – 11 hours	0
	11 – 13 hours	20	11 – 16 hours	31
Sept (30)	0 – 3 hours	30	0 – 3 hours	30

Table 3: TM59 model results, south west corner apartment, Tower C2

Potential average internal daytime noise levels in living rooms and bedrooms

Given the above opening hours of purge vents, the internal daytime noise levels in living rooms and bedrooms have been determined.

The potential internal noise level within apartment rooms with the purge vents open can be initially estimated by assuming a partially open purge vent will provide an outside-to-inside level difference of 13 dB.

Tables 4 and 5 identify the expected daytime noise levels (LAeq,16 hours) in the west corner apartments of Tower C1 and the south west corner apartment of Tower C2 respectively, these being the worst-case apartments with regard to the opening hours of purge vents to comply with the daytime requirement of TM59. The reported noise levels are expected to prevail up to approximately Level 6. As height up the building increases, there will be a gradual decrease of external noise and hence internal noise levels will be lower. In reality, as thermal comfort could be maintained with shorter opening hours than those identified by the TM59 model, the internal noise levels could be lower than stated in Table 4 and 5.

West corner Apartment (WC1_14_10)	Potential daytime internal noise level given compliance with TM59 / occurrence in the month		Potential daytime internal noise level given compliance with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen (dB LAeq,16hrs)	Occurrence in the month (days)	Bedrooms (dB LAeq,16hrs)	Occurrence in the month (days)
May (31)	37 – 42	14	37 – 42	19
	42 – 45	7	42 – 45	4
	45 – 46.5	8	45 – 46.5	3
	47	2	47	3
	47 – 48	0	47 – 49	2
June (30)	37 – 42	10	37 – 42	10
	42 – 45	4	42 – 45	4
	45 – 46.5	2	45 – 46.5	0
	47	8	47	2
	47 – 48	6	47 – 49	14
July (31)	37 – 42	2	37 – 42	4
	42 – 45	1	42 – 45	0
	45 – 46.5	3	45 – 46.5	1
	47	11	47	0
	47 – 48	14	47 – 49	26
Aug (31)	45 – 46.5	6	45 – 46.5	0
	47	8	47	0
	47 – 48	17	47 – 49	31
Sept (30)	37 – 42	30	37 – 42	17
	42 – 45	0	42 – 45	3
	45 – 46.5	0	45 – 46.5	3
	47	0	47	2
	47 – 48	0	47 – 49	5

Table 4: Potential daytime internal noise level with open purge vents to comply with TM59, west corner apartment, Tower C1

It can be seen that the living rooms of the west corner apartments of Tower C1 are not expected to experience daytime noise levels greater than 48dB LAeq,16 hrs on any day of the year.

South West corner Apartment (C2_14_10)	Potential daytime internal noise level given compliance with TM59 / occurrence in the month		Potential daytime internal noise level given compliance with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen (dB LAeq,16hrs)	Occurrence in the month (days)	Bedrooms (dB LAeq,16hrs)	Occurrence in the month (days)
May (31)	42 – 47	11	42 – 47	31
	47 – 50	4	47 – 50	0
	50 – 51.5	11	50 – 51.5	0
	52	4	52	0
	52 – 53	1	52 – 53	0
June (30)	42 – 47	9	42 – 47	10
	47 – 50	2	47 – 50	4
	50 – 51.5	3	50 – 51.5	0
	52	9	52	1
	52 – 53	7	52 – 53	15
July (31)	42 – 47	1	42 – 47	4
	47 – 50	2	47 – 50	0
	50 – 51.5	2	50 – 51.5	0
	52	5	52	1
	52 – 53	21	52 – 53	26
Aug (31)	50 – 51.5	1	50 – 51.5	0
	52	10	52	0
	52 – 53	20	52 – 53	31
Sept (30)	42 – 47	30	42 – 47	30

Table 5: Potential daytime internal noise level with open purge vents to comply with TM59, south west corner apartment, Tower C2

It can be seen that the living rooms of the south west corner apartments of Tower C2 are not expected to experience daytime noise levels greater than 53 dB LAeq,16 hrs on any day of the year. However, an internal daytime noise level of between 50 dB LAeq,16 hrs and 53 dB LAeq,16 hrs may be experienced on up to 94 days of the year in the living rooms of the south west corner apartments.

Above approximately Level 15 of the building, internal daytime noise levels of 50dB LAeq,16 hrs or less are expected in all apartments of Tower C2.

POTENTIAL FURTHER MITIGATION MEASURES

Given the potential internal noise levels in the south west corner apartments of Tower C3 due to open purge vents, further mitigation of potential overheating has been assessed.

A passive mitigation measure could be the installation of acoustically attenuated purge vents, such as those manufactured by Tek Ltd.

The potential introduction of such purge vents has been assessed by Simpson Haugh architects (see separate design note). Unfortunately, it is not possible to incorporate louvres into the design due to the fact that they have not been tested at the heights required and associated warranties and insurance will not be possible to secure. Renaker is also unable to delay this element, in the hope a feasible louvre solution may be found during the construction process, as they will shortly be procuring the façade at risk to avoid rapidly escalating construction materials costs. In the event Renaker were to be significantly delayed around procurement, it would pose a substantial risk of the delivery strategy being jeopardised. For the reasons set out within the enclosed design note, the inclusion of louvres has been discounted.

Alternatively, the MVHR unit in the affected apartments could be operated in 'summer boost' mode. This would reduce the number of hours that the purge vent would need to be opened to achieve TM59 compliance.

As a consequence however, the in-room noise level generated by the MVHR would increase. It is expected that even with high efficiency in-line attenuation, daytime noise levels within the apartment rooms could be 40dB LAeq to 48dB LAeq. Therefore the noise generated by the MVHR when running in 'summer boost' mode could be of the same order as the internal levels of noise experienced when the purge vents to apartments are opened.

The additional energy use of an MVHR running in 'summer boost' mode compared to the passive solution of an open purge vent should also be taken into consideration.

The benefit of individual purge ventilation fans serving particular corner apartments of Towers C2, D1 and D2 has been assessed. In particular, further TM59 modelling has been undertaken with a purge ventilation fan extracting air at a rate of 41 l/s from the living room of particular apartments of C2 and at a rate of 50 l/s from the living room of particular apartments of D1 and D2. The individual purge fan can be accommodated in the ceiling void of the living room and provided with in-line attenuation to achieve noise levels within the living room due to the operation of the fan of approximately 38 dB LAeq,16 hrs, such that the total noise level in the living room due to all sources is expected to be approximately 40 dB LAeq,16 hrs.

Whilst this noise level is 5dB greater than the daytime noise level of 35dB LAeq,16 hrs recommended in BS8233: 2014 (assuming opening purge vents are closed), the Standard states that 'the internal targets may be relaxed by up to 5dB and reasonable internal conditions still achieved'.

The TM59 modelling has determined that the required opening time of the purge vents to the corner apartments would reduce to no greater than 6 hours given the operation of the purge fans between 7am to 11pm.

Given this reduction in purge vent opening hours, Tables 6, 7 and 8 identify the expected daytime noise levels (LAeq,16 hours) in a sample of affected corner apartments of Towers C2, D1 and D2 respectively. The reported noise levels are expected to prevail up to approximately Level 9, above which a 1dB reduction in the noise levels is expected relative to the lowest residential level of the buildings. As height up the building increases further, there will be a gradual decrease of external noise and hence internal noise levels will be lower.

SW corner Apartment (C2_x_10)	Potential daytime internal noise level given compliance with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen (dB LAeq,16hrs)	Occurrence in the month (days)
May (31)	49	31
June (30)	49	30
July (31)	50	31
Aug (31)	50	31
Sept (30)	47	30

Table 6: Potential daytime internal noise level with open purge vents to comply with TM59, southwest corner apartments (up to level 9), Tower C2

SW corner Apartment (D1_x_09)	Potential daytime internal noise level given compliance with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen (dB LAeq,16hrs)	Occurrence in the month (days)
May (31)	42	31
June (30)	42	30
July (31)	42	31
Aug (31)	42	31
Sept (30)	42	31

Table 7: Potential daytime internal noise level with open purge vents to comply with TM59, east corner apartments (up to level 9), Tower D1

S corner Apartment (D1_x_05)	Potential daytime internal noise level given compliance with TM59 / occurrence in the month	
Month (days in month)	Open Plan Living Room/ Kitchen (dB LAeq,16hrs)	Occurrence in the month (days)
May (31)	49	31
June (30)	50	30
July (31)	50	31
Aug (31)	50	31
Sept (30)	49	31

Table 8: Potential daytime internal noise level with open purge vents to comply with TM59, south corner apartments (up to level 9), Tower D2

Mechanical purge ventilation fans would be required to the following apartments to achieve the criterion of TM 59 and to achieve daytime noise levels within the living room of no greater than 50 dB LAeq,16hrs:

- Tower C2: south west corner apartments between Levels 4 and 15
- Tower C2: north west corner apartments between Levels 4 and 13
- Tower D1: east corner apartments between Levels 4 and 13
- Tower D2: south corner apartments between Levels 4 and 24
- Tower D2: west corner apartments between Levels 4 and 16
- Tower D2: north corner apartments between Levels 4 and 13
- Tower D2: east corner apartments between Levels 4 and 19

The power consumption of the proposed purge ventilation fans is only 20 Watts and as such, compliance with the requirements of Approved Document L (conservation of fuel and power) is still achieved.

Whilst 'whole-house' ventilation solutions are available that 'temper' the incoming warm air, the power consumption of these systems is typically 1000 Watts and as such are not compatible with low carbon aspirations or with the current design in relation to compliance with Approved Document L.

SUMMARY & CONCLUSION

The potential effect of the control of overheating on the internal noise levels within the proposed apartments of Trinity Islands, Manchester has been assessed in line with 'Acoustics, Ventilation and Overheating, Residential Design Guide', (AVO) published by the Association of Noise Consultants and the Institute of Acoustics.

Dynamic thermal modelling has been carried out to determine whether the buildings within the proposed development achieve the performance criteria of CIBSE Technical Memorandum 59 (TM59).

In particular, the TM59 modelling results identify the daily opening hours of the vents on the basis that the vents are opened when the internal temperature within a room reaches 22 Deg C and are closed when the internal temperature has dropped to 22 Deg C. The daily opening hours are identified between the months of May and September.

Following detailed assessments, the building design incorporates the following measures to mitigate overheating:

- 1) Low G value (0.4) of vision glazing to curtain wall to minimize solar heat gain to apartments
- 2) Low G value (0.2) of glazed vent panels to minimize solar heat gain to apartments
- 3) Blind shading coefficient of 0.28 to minimize solar heat gain to apartments
- 4) Continuously-running whole-house ventilation (MVHR) units with Summer Bypass within each apartment
- 5) Mechanical purge ventilation fan within living rooms of certain corner apartments of each building
- 6) Passive ventilative cooling via opening purge vents

The modelling has confirmed that the night time criterion of TM59 is achieved without the need to open purge vents to the bedrooms and living rooms of all apartments within the proposed development between 11pm and 7am. Therefore, the internal noise criteria of Manchester City Council for bedrooms at night time can be achieved whilst avoiding overheating as defined by TM59. The opening of purge vents in bedrooms is required for up to 16 hours a day between 7am and 11pm.

It has also been determined that no purge vent within the building façades would need to be opened for more than six hours a day prior to 7pm in any living room to achieve compliance with the TM59 criterion for living rooms. No opening purge vent in any living room is required to open beyond 7pm to achieve compliance with the TM 59 criterion.

In Building C1, the calculated daytime noise level in living rooms requiring open purge vents for the identified hours is no greater than 49dB LAeq, 16 hrs in any apartment.

In Building C2, the calculated daytime noise level in living rooms requiring open purge vents for the identified hours is no greater than 50dB LAeq, 16 hrs in any apartment.

In Building D1, the calculated daytime noise level in living rooms requiring open purge vents for the identified hours is no greater than 50dB LAeq, 16 hrs in any apartment.

In Building D2, the calculated daytime noise level in living rooms requiring open purge vents for the identified hours is no greater than 50dB LAeq, 16 hrs in any apartment.

The calculated noise levels are considered to be acceptable in the context of the control of overheating and with regard to the AVO Guide.

The assessment of the potential internal noise levels is based on the assumption that under normal circumstances, the impact of internal noise would be less significant during a normal working day than in the evening.

This follows from the acknowledgement in the AVO that the impact of internal noise is likely to be different at different times of the day.

Technical Note

Subject: Design Note – AVO Façade Performance

Date: 6 October 2021

Author: David Green

Reference: 10364/dg/001

Introduction

Renaker have been refining an approach to the design, manufacture and installation of facades to tall residential buildings through the development of a number of significant schemes in Manchester and Salford over the past decade. The following note outlines Renaker's design approach to appropriately balancing often competing requirements to maximise carbon performance, whilst also achieving the best living environment for residents.

The architectural design solutions proposed at Plot F Great Jackson Street & Trinity Islands each respond to site specific considerations and are bespoke to each project. However, a consistent approach has been taken to the buildings' operational performance, with the benefit of valuable lessons being learned through recently completed city centre developments. Renaker's approach has also evolved in response to the application of up to date technical guidance, such as AVO 2020. Within this context, the design of Renaker's buildings seek to achieve:

- Facades which are designed to satisfy strict sound insulation criteria, established in consultation with the Local Authority and acoustic consultant;
- Apartments which will not suffer from overheating. This is demonstrated through dynamic thermal modelling and TM59 analysis
- Internal noise levels which are reduced as far as is practical in all conditions.

As an overarching priority, Renaker is focused on providing sustainable homes for the future and explicitly supporting MCC in achieving its 2038 Net Zero Carbon targets. Following extensive technical analysis, Renaker considers the designs of Plot F and Trinity Islands represent the optimum solution with which to bring forward these proposals.

Design approach

The building façades will utilise a lightweight unitised solution to enable safe installation by operatives working within the building footprints. This is particularly important when working at height.

The system will be fabricated as a series of individual units under controlled conditions in a factory. It is assembled and fully sealed on site to create a highly efficient façade.

The façade system will be designed to satisfy strict performance criteria, dealing with issues such as fire resistance, wind loading, guarding, thermal performance, air and water tightness, interstitial condensation, natural day light and wellbeing as well as heat gain and noise reduction.

These many requirements do not sit in a mutually beneficial relationship, for example: open windows allow a green, carbon neutral solution to overheating but when open reduce the noise resistance of the external façade; providing cooling systems to address overheating has a significant carbon impact but would improve the noise resistance of the façade through negating the need to open windows.

Continued:

The design proposals respond to the BS guidance, Building Regs, industry expertise and the products available, to provide the best solution whilst ensuring the scheme remains viable and deliverable.

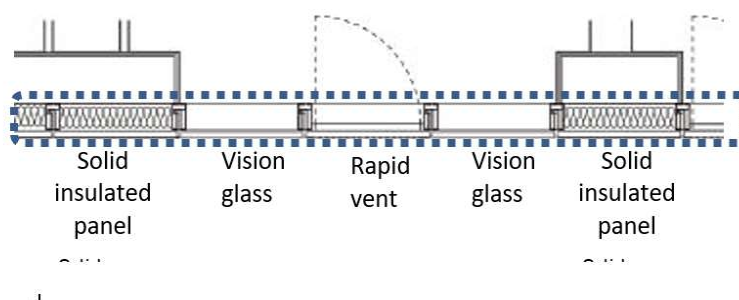
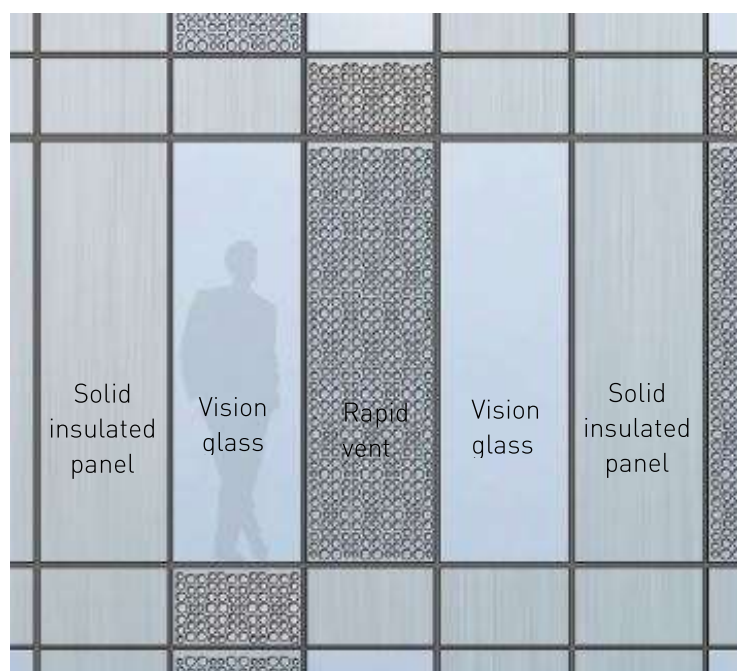
The design of the unitised façade accommodates the varying requirements set out above so that the responsibility for each is reached within the 200-250mm depth of the system, without relying on other adjacent components or other building elements designed by other parties.

Documents submitted with the planning applications demonstrate that Trinity and Plot F will achieve RIBA 2030 embodied carbon targets and RIBA 2025 targets during operation. One of the key components in achieving the operational performance is the ultra-low U-value (i.e. thermal efficiency) achieved in the detailed design of the facades.

Current proposals

The façade consists of a combination of vision glass, insulated panels and perforated 'rapid vents' which are combined in different ways to generate facades which complement and enhance the unique tower forms proposed on both.

The drawing below illustrates a section of the façade to one of the buildings and shows the various component parts.



200mm unitised zone providing a single point of responsibility to achieve, fire, TM59, nett zero carbon contributions, noise reduction.

Continued:

Rapid Vent panel

At least one rapid vent panel is provided to every habitable room.

The 'rapid vent' panel is comprised of a perforated metal panel flush with the outside face of the building, behind which is an insulated door which can be opened from within the apartment.

The rapid vent performs several functions:

- The door can be opened to provide purge ventilation to the apartment to remove unwanted odours as required by Approved Document F of the Building Regulations. The quantity of free area provided by the perforations in the panel is critical to achieving this requirement. In some instances, a habitable room has more than one rapid vent panel in order to satisfy this Part F requirement.
- At high level a duct connects into the rear of the perforated panel to provide supply and extract positions for the MVHR system which provides background ventilation to the apartment.
- The door can be opened to ventilate the apartment to control overheating. TM59 calculations demonstrate that rapid vents as currently incorporated into the design are sufficient to create apartments which comply with the prescribed overheating criteria.
- In terms of well-being, opening the door also creates instant access to fresh air for the apartment occupants
- The perforated panel acts as guarding, preventing the risk of falls or of apartment occupants accidentally dropping anything from height which might endanger those below.
- The door to the rapid vent is, in some instances, fully glazed, providing light to the apartment in addition to that gained via the clear vision panels.

The rapid vents are designed such that the building achieves the target internal noise criteria of Manchester City Council when they are closed.

Design Priorities

The building design attempts to balance the following key priorities:

A building that achieves the Net Zero carbon targets;

A building that improves upon the latest solar gain standards under TM59,

A building that achieves the recommended noise reduction levels

Of the three requirements the acoustic reduction potentially undermines the performance of the other two if it means that passive means of ventilating apartments to reduce overheating have to be ruled out. Therefore we have looked at ways of providing the best overall design that satisfies all three, using passive, non-energy demanding ie non carbon increasing approach .

Potential alternative approach

The addition of acoustic louvres to minimize noise break in whilst maintaining net zero carbon targets and overheating requirements.

As mentioned above, the building will achieve the target internal noise criteria of Manchester City Council when the rapid vents are closed. In a small number of apartments, living rooms may experience noise levels above the upper targets during the most sensitive hours. The design team have therefore considered the introduction of acoustic louvres into the rapid vent in those apartments to allow the ventilation path to be maintained and internal noise levels to be reduced relative to a standard non attenuated rapid vent when the internal door to the vent is open.

Any solution would have to retain an architectural perforated panel to the outer face for aesthetic reasons – to aspire to the high quality aesthetic standards that are required by National and Local Planning Policy and Guidance, particularly in respect of tall buildings. This will reduce the performance of the air flow through the louvre and will require bespoke testing.

The likely system build up would comprise: an architectural perforated panel to the outside face of the building with an attenuated louvre behind the panel and an insulated door between the louvre and the apartment. The louvre itself could be 450mm deep, and the entire system over 600mm deep. This compares with a depth generally for a unitised system of circa 200mm deep.

Acoustic louvres have been considered on earlier Renaker schemes scheme's but at present, they remain unsuitable for the following reasons.

The depth of the system needed to incorporate the louvre (circa 600mm) would project into the living and bedroom spaces, reducing space within the apartment. The implication of this is that, rather than sitting within the façade zone, the line of thermal performance within the building envelope would be changed, with insulated boxing out needing to be created to either side and above and below the louvre where it projects into the living space. This work would have to be carried out on site and would create interfaces between trades and designers which would need extremely careful management in order to ensure that the system performed and that there was no potential for condensation to occur within the wall build up. It is relevant to note that, as stated above, Trinity and Plot F will achieve RIBA 2030 embodied carbon targets and RIBA 2025 targets during operation. One of the key components in achieving the operational performance is the ultra-low U-value (i.e. thermal efficiency). Any introduction of louvres could therefore reduce the thermal performance of the façade and negatively impact the overall performance against RIBA targets

1. The current products available on the market have been developed for low rise dwelling use. They have not yet achieved the required CWCT performance testing standards for tall buildings. The performance data needs to prove compliance of the louvre system in relation to fire testing, wind loading, weather tightness and wind noise.
2. Renaker are already underway with designing the construction details of the façade to allow them to start on site pending a successful determination. This work is carried out at risk and the design therefore has to rely on proven, insurable, warrantable, building components. The current marketplace does not provide such a product for high rise installations.

The significant implications of introducing acoustic louvres into the system, as detailed above, led Renaker and the design team to review the overheating analyses in more detail.

Conclusion. Develop an approach that balances the benefits of passive natural ventilation with the acoustic impact of opening lights

To make sure that the net zero and overheating criteria are achieved the design team have carried out a detailed series of overheating analyses, looking in detail at the potential to allow rapid vent panels to be closed for longer periods than simply required to pass TM59. WSP/Future Serve and Fisher Acoustics have carried out an analysis of every apartment and developed a solution whereby the rapid vents are closed throughout the night, to ensure a good night's sleep and closed in the living rooms for the most part between 7pm and 11pm, ie at the time where occupants often relax in their living rooms. The outcome is presented in a separate report that explains that local noise break in is significantly reduced.

It is this solution that is most appropriate to satisfy all the various design considerations for these developments.