

J003897-7184-DH-05

9th August 2024

Paul Smiles
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1280 Century Way
Thorpe Park
Leeds
LS15 8ZB

Great Ducie Street – Noise Assessment of MVHR System and Façade Penetrations

Dear Paul,

It is understood that further to our initial assessment of external noise transfer through the MVHR system ref: 'J003897-7184-DH-01 Great Ducie Street – Noise through MVHR system' dated 11th June 2023, there has been further development in the MVHR system design and external façade penetrations. We would also note that concerns have been raised within the decision notice respective to the discharge of condition 20 (a) (Noise) attached to planning permission 122280/F0/2019 as follows:

'The properties will need to be ventilated by mechanical means and the report confirms that a MVHR system is to be installed. The details of the proposed system will need to be reviewed by the consultant to ensure that it is suitable to ventilate the property without the need for residents to open windows for cooling purposes (as explained in point 4 above) to ensure the internal noise level is not exceeded when residents ventilate the properties, especially during the summer months. The mechanical ventilation system must also be assessed to ensure it is selected and suitably insulated to ensure that when in full use, including during any boost function, the internal noise criteria is not exceeded. The assessment will need to be provided for confirmation.'

Louvre openings and façade penetrations will require further assessment once they are known. Any façade penetration or louvred opening, especially on the eastern façade opposite the Arena or those at a elevation higher then / overlooking the area roof will require assessment and insulation measures recommending.'

Internal Noise Level Criteria

The internal noise level criteria has been derived from the Environmental Noise Assessment (ref: J003897-5694-DH-03 Environmental Noise Assessment – Great Ducie Street) which references to BS8233:2104 and WHO Guidelines for Community Noise 1999 guidance:

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Table 1. BS8233 recommended indoor ambient noise levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB L _{Aeq,16hour}	—
Dining	Dining room/area	40 dB L _{Aeq,16hour}	—
Sleeping (daytime resting)	Bedrooms	35 dB L _{Aeq,16hour}	30 dB L _{Aeq,8hour}

MCC - Planning and Noise – Technical Guidance 2022

In addition, further guidance is taken from Manchester City Council – Planning and Noise – Technical Guidance 2022 in regards to entertainment noise from the AO Arena, situated to the east of the development.

The guidance considers that with regards to music, noise in the 63Hz & 125Hz bands may be particularly disturbing to local residents exposed to it. Therefore the assessment of the noise from entertainment venues should consider the overall noise (L_{Aeq}) and the 63 Hz and 125 Hz octave band noise levels (L_{Zeq}).

The following design criteria is given for new residential developments that are structurally connected to the entertainment venue (or vice versa).

‘Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB (L_{eq}), respectively’.

The guidance notes that the above criteria may also be applicable to new residential developments that are structurally separated from an existing entertainment venue.

External to Internal Noise Transfer – MVHR System

Noise Source Levels

External noise source levels have been assessed within the Environmental Noise Assessment (ref: J003897-5694-DH-03) considering for day-time, night-time and entertainment noise from the surrounding noise sources and the AO Arena. A summary of the ‘worst-case’ noise levels is presented in the table below which are predicted to the eastern façade of the development.

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Table 2. Summary of predicted 'worst-case' noise levels

Period	Sound pressure level (dB) Octave band centre frequency (Hz)							Noise Level (L_{Aeq}) dB(A)
	63	125	250	500	1k	2k	4k	
Day-time	73	66	65	63	64	57	49	67
Night-time	69	63	62	60	61	55	46	64
AO Arena	71	62	60	58	58	53	45	62

Noise Break-in Calculations

Calculations have been undertaken based upon the above noise level data and the proposed MVHR system layout as provided within the following received drawings:

- '204-KIM-BA-01-DR-M-5002 C01 – 2 Bed Apartment Mechanical Services Layout' dated 21st March 2024
- '204-KIM-BA-01-DR-M-5003 C01 – 3 Bed Apartment Mechanical Services Layout' dated 21st March 2024
- '204-AGL-ZZ-ZZ-SP-X-1003 C02 – Panel Notching/ Perforations' dated 5th January 2024
- C2966-KIM-XX-XX-DR-M-3001 P02 – MVHR External Termination Detail Option 2' dated 28th June 2024.

The through-duct transmitted noise levels have been calculated to a representative Bedroom and Living Room as given in Detail 4 of '204-KIM-BA-01-DR-M-5002' and '204-KIM-BA-01-DR-M-5003'. Typical ductwork insertion losses have been taken based upon data in Cibse Guide B4 Noise and Vibration Control for Building Services Systems, Noise Control in Building Services authored by Cibse, or manufacturer data for the following:

System Insertion Loss

- Sound power entering the duct from outside (300mm x 115mm external termination)
- End Reflection
- MVHR heating coils and filters
- Duct run length, Branches and Bends
- Flexible ducting (30mm insulated wall lining)
- Valve termination from Lindab Ki manufacturer data (100mm $\varnothing$)

Within the calculations it is assumed that the Bedroom has a typical volume of 26m³ and the Living Room is 60m³. The reverberation time is assumed as 0.5 seconds for each

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dwelling room as per the recommendations of BS EN 12354-3 and Cibse. The Living Room has both supply and extract terminations whilst the Bedroom has only supply.

Table 3. Noise break-in through the ducted system - Bedroom

Element	Sound pressure level/ Insertion Loss (dB) Octave band centre frequency (Hz)							dB(A)
	63	125	250	500	1k	2k	4k	
External day-time noise level	73	66	65	63	64	57	49	67
System Insertion Loss as above	-62	-55	-45	-42	-40	-45	-46	
Total SWL per outlet	11	11	20	21	23	13	2	
Total SPL (Day-time)	9	9	18	19	21	11	0	23
External night-time noise level	69	63	62	60	61	55	46	64
System Insertion Loss as above	-62	-55	-45	-42	-40	-45	-46	
Total SWL per outlet	7	8	17	18	21	10	0	
Total SPL (Night-time)	5	6	15	16	19	8	0	20
External AO Arena noise level	71	62	60	58	58	53	45	62
System Insertion Loss as above	-62	-55	-45	-42	-40	-45	-46	
Total SWL per outlet	9	7	15	17	18	9	0	
Total SPL (AO Arena)	7	5	13	15	16	7	0	18

NOTE: Total SPL noise level is the summed noise level of the direct and reverberant noise levels.

Table 4. Noise break-in through the ducted system - Living Room

Element	Sound pressure level/ Insertion Loss (dB) Octave band centre frequency (Hz)							dB(A)
	63	125	250	500	1k	2k	4k	
External day-time noise level	73	66	65	63	64	57	49	67
System Insertion Loss as above	-62	-55	-45	-42	-40	-45	-46	
Total SWL per outlet	11	11	20	21	23	13	2	

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Correction for supply and extract	3	3	3	3	3	3	3	
Total SPL (Day-time)	9	10	18	19	22	11	1	24
External night-time noise level	69	63	62	60	61	55	46	64
System Insertion Loss as above	-62	-55	-45	-42	-40	-45	-46	
Total SWL per outlet	7	8	17	18	21	10	0	
Correction for supply and extract	3	3	3	3	3	3	3	
Total SPL (Night-time)	6	7	15	17	19	9	0	21
External AO Arena noise level	71	62	60	58	58	53	45	62
System Insertion Loss as above	-62	-55	-45	-42	-40	-45	-46	
Total SWL per outlet	9	7	15	17	18	9	0	
Correction for supply and extract	3	3	3	3	3	3	3	
Total SPL (AO Arena)	7	6	13	15	17	7	0	19

NOTE: Total SPL noise level is the summed noise level of the direct and reverberant noise levels.

Discussion

Calculations suggest that the noise levels within the Bedroom, solely due to noise transfer through the ducted system, are no more than 23 dBA during the daytime, 20 dBA during the night time and 18 dBA during noise from the AO Arena. These values are 10dB or more below the target noise level criteria for the room of 35 dBA (daytime) and 30 dBA (night time) respectively, and therefore unlikely to give rise to the internal noise levels, which are likely to be dominated by noise from the MHVR system and break-in from outside through the façade.

Calculations suggest that the noise levels within the Living Room, solely due to noise transfer through the ducted system, are no more than 24 dBA during the daytime, 21 dBA during the night time and 19 dBA during noise from the AO Arena. These values are considerably below the target noise level criteria for the room of 35 dBA (daytime) and 30 dBA (night time) respectively, and therefore unlikely to have a significant contribution to the internal noise levels, which are likely to be dominated by noise from the MHVR system and break-in from outside through the façade.

In addition, it should be noted that the calculated internal noise levels indicate that there will be negligible noise contribution at 63Hz and 125Hz from noise break-in from the AO Arena. We would expect that the noise levels would be dominated by break-in through the façade which

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has been assessed within the Environmental Noise Assessment (ref: J003897-5694-DH-03) and Glazing Review (ref: J003897-7157-DH-01).

It should be noted that calculations are based upon the 'worst-case' noise levels as predicted upon the eastern façade, and on that basis all other incident noise levels for the development will be lower than the above.

We would suggest that the performance of the proposed MVHR system should meet the System Insertion Loss as given within Tables 3 and 4.

MVHR Internal System Noise Transfer

In order to assess the noise generated from the MVHR system when under operation we have utilised the manufactures details provided for the proosed Vent-Axia 'Lo-Carbon Sentinel Econiq S' unit. We have been informed that the 'boost' setting for 3 bed apartments is 60% duty and 40% for 1 and 2 bed apartments.

It is our understanding that the manufacturers data accounts for end reflection loss of the in-duct noise, however we have included for additional loss via duct run, bends, branches, flexible ducting and valve termination. The insertion loss values have been derived from those provided within CIBSE Guide B4 – '*Noise and vibration control for building services systems*' dated 2016. The total calculated insertion loss of the internal system (excluding end reflection) has been summarised as follows:

Table 5. Total Internal System Insertion Loss

Element	Insertion Loss Octave band centre frequency (Hz) dB						
	63	125	250	500	1k	2k	4k
MVHR Internal System Insertion Loss	-24	-25	-21	-22	-25	-27	-21

The following table presents the calculated noise levels for the supply and extract feeds under different duty ratings with the insertion loss detailed above applied to manufacturers duct noise level data.

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Table 6. Noise break out from MVHR system – Vent-Axia ‘Lo-Carbon Sentinel Econiq S’

Speed	Test Element	Sound pressure level (dB) at 2m Octave band centre frequency (Hz)							Sound pressure level at 2 meters dB(A)
		63	125	250	500	1k	2k	4k	
60% (Boost – 3 Bed Apartment)	Supply	40	34	39	37	30	24	19	37
	Extract	29	29	29	23	15	5	2	24
40% (Boost – 1 & 2 Bed Apartment)	Supply	32	28	35	29	20	12	7	30
	Extract	23	21	23	14	9	0	0	18

It can be seen from the table above that the sound pressure levels meet the BS8233 criteria for the 1 & 2 bedroom apartment type but are exceeded for the supply feed within the 3 bed apartment types. Please note that calculations have been carried out based upon the shortest duct path to from MVHR unit to valve termination as a ‘worst-case’ scenario.

In order to meet the internal noise level criteria of BS8233 a silencer will be required to the supply feed of the 3 bedroom apartment MVHR system. The required insertion loss of the silencer is detailed in the following table:

Table 7. Silencer Insertion Loss Required

Element	Insertion Loss Octave band centre frequency (Hz) dB						
	63	125	250	500	1k	2k	4k
Silencer 220x90 (Length 1008)	-2	-5	-4	-13	-18	-35	-43

NOTE: Insertion loss values have been taken from typical manufacture data for the size of silencer specified.

Following the implementation of a silencer to the supply feed of the 3 bed apartment system, the following internal noise levels have been predicted.

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Table 8. Noise break out from MVHR system – Vent-Axia ‘Lo-Carbon Sentinel Econiq S’ – Silencer applied to Supply Run

Speed	Test Element	Sound pressure level (dB) at 2m Octave band centre frequency (Hz)							Sound pressure level at 2 meters dB(A)
		63	125	250	500	1k	2k	4k	
60% (Boost – 3 Bed Apartment)	Supply	39	30	35	24	12	0	0	28
	Extract	29	29	29	23	15	5	2	24

It is noted that with the silencer applied to the supply of the 3 bed apartment system then the predicted noise levels are within the criteria of BS8233 when under ‘boost’ settings in bedroom and kitchen/living spaces. Please note that calculations have been carried out based upon the shortest duct path to from MVHR unit to valve termination as a ‘worst-case’ scenario.

We would note that where the MVHR system is used for background ‘trickle’ ventilation, which is understood to be 20% speed, then the predicted noise levels from manufacturers data for the MVHR system with the calculated insertion losses of the duct system will be suitable to meet the criteria of BS8233 in bedrooms and living rooms.

It is understood that the main MVHR system will be enclosed within a cupboard. In order to establish the noise transfer into adjacent spaces we have assessed the breakout through the cupboard door which will be the main transmission path. Please note that we have included for a 3mm gap around the door edges within the calculation.

For 1 and 2 bedroom apartments where the cupboard is understood to open out onto the kitchen/living room areas we have predicted a noise level of 20 dB(A). For the 3 bedroom apartments it is understood that the cupboard opens out onto a corridor area and as such we have allowed for the transmission through 2 no. doors areas. This results in a predicted noise level of 9 dB(A). It can be seen how the predicted noise levels are within the criteria of BS8233 and are also ≥ 10 dB below the supply levels, thus will not give rise to the overall noise level from the MVHR system as a whole. Please note that sound transfer through the adjacent bathroom pod walls is predicted to be lower than that through the door due to the 40 dB R_w internal wall specification.

External to Internal Noise Transfer – Air Brick Façade Penetration

It is understood that there is to be air brick penetrations through the façade. In order to assess the effect of the air brick on the internal noise levels we have carried out calculations based upon the open area of the air brick and accounted for the cavity and internal wall linings of the proposed external wall build up as follows:

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- Air Brick (215mm x 135mm), 180mm cavity with 180mm mineral wool insulation (min density 10kg/m³), 12mm cement board, 100mm cavity filled with 100mm mineral wool insulation (min density 10kg/m³), 2 no. 12.5mm SoundBloc plasterboard.

The calculation of noise break-in to the residential rooms has been undertaken in accordance with the calculation methods of BS EN 12354-3:2000 Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements. Part 3: Airborne sound insulation against outdoor sound, in octave bands. Reverberation time is taken as 0.5 seconds as per the BS EN 12354-3 reference time for dwellings. As a 'worst-case' basis we have assessed day-time noise levels into a bedroom area and accounting for 1 no. air brick in the façade which we have assumed the entire area to be open.

Table 8. Internal Noise Levels – Façade Break-In

Element	Octave Band Noise Level Data (dB)								Noise Level (dB[A])
	63	125	250	500	1k	2k	4k	8k	
Air Brick and Internal Lining	36	21	9	0	0	0	0	0	12
External Façade (Windows/ External wall/ Panel Opening)	45	29	23	14	10	3	0	0	22

As can be seen from the table above the resultant noise levels from the air brick opening with the cavity and internal lining are 10 dB lower or more in each octave band compared to the internal noise levels predicted to break through the external façade which accounts for window openings, external wall build up and openable panels. Therefore, we would suggest that the resultant noise levels due to the air brick opening on the facade would not give rise to the predicted internal ambient noise level, thus being capable of achieving the proposed criteria of BS8233 and MCC limits on low frequency from entertainment noise.

Yours Sincerely,



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