28 MIDLAND ROAD, BRISTOL

ACOUSTIC REPORT FOR PLANNING

Acoustics Report A1736/R01
17th May 2021

Report for:	Thrubwell Properties Limited. Unit 1 Ty Verlon Trading Estate Cardiff Road Bristol CF63 2BE
Issued to:	David Cahill Design Consultants Ltd. Attention: David Cahill

Prepared by: Tony James BSc(Hons) AMIOA Consultant	Checked by: David O'Neill BEng CEng Msc MIOA Director
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1 Introduction

Ion Acoustics is appointed by Thrubwell Properties Limited to provide acoustic design input to David Cahill Design Consultants Ltd. for the development at The Former Christadelphian Hall, 28 Midland Road, Bristol. Planning permission has been granted by Bristol City Council (BCC) for the construction of six flats comprising four 1 bed, one 3 bed, and one 2 bed. The planning application reference is 19/02785/F with conditions. There is one condition relating to noise, condition 5. This report contains the details of a noise survey and assessment demonstrating compliance with condition 5 of the planning application.

2 Proposed Scheme

The proposed site is on Midland Road, Bristol, opposite the junction with St Philips Road. The proposed development has been superimposed upon the existing location in order to illustrate the relationship with the surrounding area. Figure 1 below shows the site boundary line in Red and the proposed residential building in blue. The proposed building is four storeys, ground, first, second, and third.

Figure 1 – Proposed development superimposed upon site location

The existing site is open, and only in use for limited car parking. The neighbouring property to the north-west along Midland Road is residential, demonstrating that residential use on Midland Road is viable. To the south east along Midland road is a mail order shop/office with other industrial sites to the south including Manor Scrap, which was not operational during our

assessment. Midland Road at the front of site is moderately busy, however traffic has a greater than typical contribution from heavy good vehicles (HGV's) as it provides access to industrial areas nearby. The surrounding area is a mixture of residential and industrial buildings, with a school nearby too.

Manor Scrap to the south was closed during the assessment period, with notices on site indicating the reason was the COVID-19 pandemic, however traffic on surrounding roads is expected to be a fairly typical levels equivalent to pre-pandemic traffic flows.

3 National and Local Noise Criteria

3.1 Planning Conditions

Planning permission has been given by BCC under application ref 19/02785/F with condition 5 relating to noise. Condition 5 has been copied below:

> *No development shall take place until a detailed acoustic report on the existing noise climate at the development site has been submitted to and approved in writing by the Council. If necessary the report shall include a scheme of noise insulation measures for all residential accommodation.*
>
> *The noise assessment shall be carried out by a suitably qualified acoustic consultant/engineer and shall take into account the provisions of BS4142: 2014 Methods for rating and assessing industrial and commercial sound and BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings. The approved scheme shall be implemented prior to the commencement of the use and be permanently maintained thereafter.*
>
> *Reason: In order to safeguard the amenities of nearby occupiers.*

An advice was given in relation to this condition 5, as follows:

> *The recommended design criteria for dwellings are as follows:*
>
> *Daytime (07.00 - 23.00) 35 dB LAeq 16 hours in all rooms & 50 dB in outdoor living areas.*
>
> *Night time (23.00 - 07.00) 30 dB LAeq 8 hours & LAmax less than 45 dB in bedrooms.*

The above condition 5 and advice are clear and will be used within this assessment. Whilst this assessment quantifies and assesses noise from traffic on Midland Road, it was not possible to measure noise from Manor scrap as it was closed. Desktop assessment and observations from the site visit indicates that there will be a large amount of screening between activity in Manor Scrap and the residential development, and therefore no significant noise impact is expected. We have been provided with an internal noise measurement made by others for another residential site on Horton St which, as we understand, was carried out for planning compliance in respect of noise from Manor Scrap.

3.2 Internal Noise Criteria – BS 8233:2014

Noise targets for dwellings are usually set in two noise parameters: the ambient level L_{Aeq} and the maximum level, L_{AFmax}. The L_{AFmax} is the highest noise level in a given period and is determined by individual events such as a vehicle pass-bys.

British Standard BS 8233: 2014 provides internal noise criteria for living rooms and bedrooms set in terms of the L_{Aeq}. An L_{AFmax} limit is no longer included within the current version of BS 8233:2014 but the World Health Organisation Community Noise Guidelines[1] state that individual events over 45 dB(A) should be avoided for a good night's sleep. This limit is therefore only applicable at night, when sleep disturbance is an issue. WHO Guidelines propose internal limits of L_{Aeq} 35dB for living/dining rooms and L_{Aeq} 30dB / 45 dB L_{AFmax} inside a bedroom at night. Table 1 below shows the BS 8233: 2014 and WHO internal noise standards for housing.

Table 1 – Indoor Ambient Noise Levels from BS 8233: 2014 / WHO Guidelines

Activity	Location	Day (07:00 to 23:00)	Night (23:00 to 07:00)
Resting	Living rooms	35 dB $L_{Aeq,\ 16\ hour}$	
Dining	Dining room/area	40 dB $L_{Aeq,\ 16\ hour}$	
Sleeping - night Resting - day	Bedrooms	35 dB $L_{Aeq,\ 16\ hour}$	30 dB $L_{Aeq,\ 8\ hour}$ 45 dB L_{AFmax}*
* WHO Guidelines			

The BS 8233: 2014 and WHO standards are an example of other relevant criteria as mentioned in Section 8.5 of BS 4142.

The internal noise criteria in BS 8233:2014 are followed by a number of notes. Those relevant to this scheme are reproduced below:

"Note 3: These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night on New Year's Eve."

"Note 4: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AFmax} depending on the character and number of events per night. Sporadic noise events could require separate values.

"Note 5: If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

"Note 6: Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions achieved."

3.3 Criteria for Garden Noise Levels

BS 8233:2014 states a desirable limit of 50dB L_{Aeq} and an upper guideline limit of 55dB L_{Aeq} in outdoor living areas. This would normally apply to the 16-hour daytime values (07.00 to 23.00 hours) and apply to quasi-steady characterless noises such as general road traffic.

[1] WHO Community Noise Guidelines https://apps.who.int/iris/handle/10665/66217

3.4 Acoustics, Ventilation and Overheating Guidance (AVOG) January 2020

The AVO Guidance was published by the Association of Noise Consultants in January 2020[2]. This is guidance for acoustic practitioners and others involved in planning, developing, designing and commissioning new dwellings in respect of achieving an appropriate balance of internal noise levels, ventilation and overheating control with regard to external transportation noise. It seeks to encourage an assessment of these issues at the planning stage. It is not mandatory guidance, but represents current best practice for assessing the issue. In particular, this gives advice on assessing when noise levels are such that it is reasonable to control overheating with openable windows and when it may be too noisy to do so without further assessment or controls. AVOG suggests that for brief periods where openable windows are required to control overheating the internal L_{AFmax} should not normally exceed 65 dB (more than 10 times per night in reference to ProPG) and the internal ambient levels should not exceed $L_{Aeq,16hr}$ 50dB (day) and $L_{Aeq,8hr}$ 42dB (night). If those levels can be met with open windows, then no additional overheating control is likely to be required in respect of noise levels.

3.5 Proposed Noise Criteria

The proposed noise criteria used within this assessment is as advised in the planning decision notice, copied below:

> *The recommended design criteria for dwellings are as follows:*
>
> *Daytime (07.00 - 23.00) 35 dB L_{Aeq} 16 hours in all rooms & 50 dB in outdoor living areas.*
>
> *Night time (23.00 - 07.00) 30 dB L_{Aeq} 8 hours & L_{AFmax} less than 45 dB in bedrooms.*

4 Baseline Noise Survey

4.1 Survey Methodology & Details

A noise survey was carried out from 6-7th May 2021 with a logging meter installed in a position representative of the first-floor windows of the proposed dwellings overlooking Midland Road, as shown in figure 1 above. A Rion NL-52 sound level meter was used fitted with WS15 windshield and calibrated before and after the survey with a Brüel & Kjær 4231 calibrator. The calibration drift at the end was -0.1 dB which is within expected tolerances and insignificant. Octave band measurements were made of various noise indices (L_{Aeq}, L_{A90}, L_{A10}, and L_{AFmax}) in 15-minute intervals. The audio recording functionality was used so that all events over a set threshold of 60 dBA would be recorded for identification. In addition, the sound level meter made a two-minute recording every 10 minutes. The meter and the calibrator were all within their respective calibration periods (two years for sound level meters, one year for the calibrator). Calibration certificates are available on request. A photo of the monitoring position is shown below in Figure 2.

2 https://www.association-of-noise-consultants.co.uk/acoustics-ventilation-and-overheating-guidance-released/

Figure 2 – View looking south-west at 28 Midland Road with MP1 on right of gate

4.2 Weather

Weather throughout the survey period was cool, cloudy, with low wind speeds. There was no rainfall the duration of the survey period. The weather would have had no significant effect on the noise levels measured.

4.3 Survey Results

The results of the noise survey are provided in full within Appendix B, and plotted on a time history graph in Figure 3.

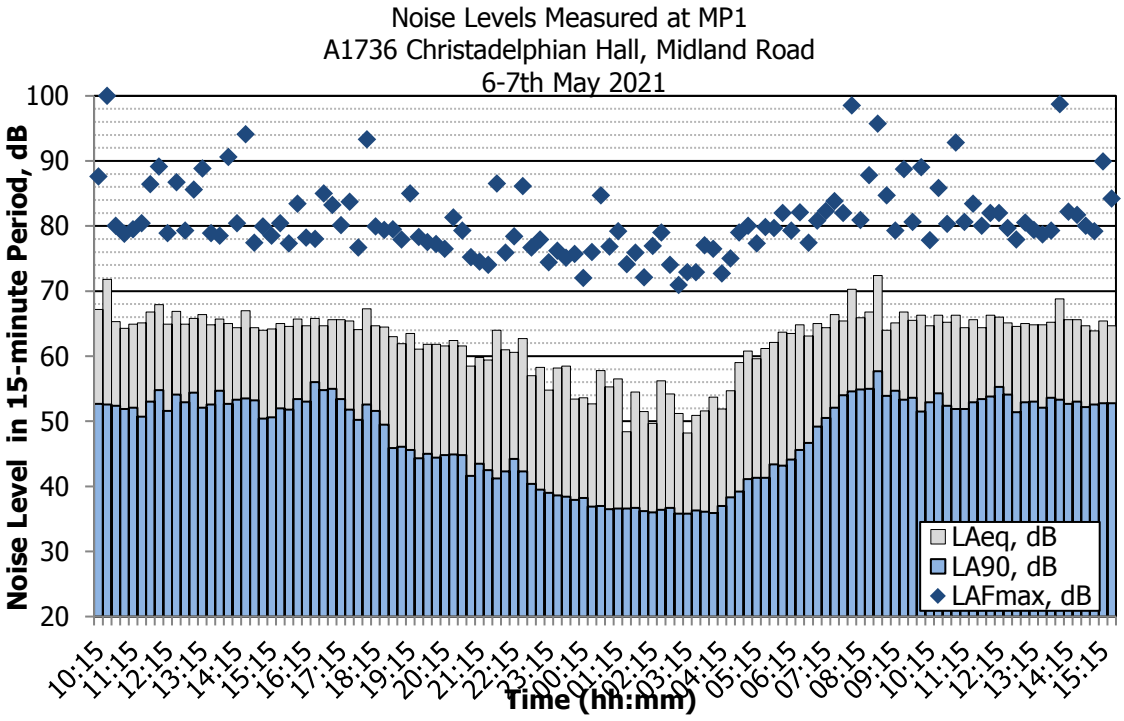

Figure 3: Measured Noise Levels at MP1

The time history graph above demonstrates that noise levels are moderately high in absolute terms during the day, however average noise levels drop during the night when less traffic passes. The main contribution to noise was traffic on Midland Road at the front of site, and therefore the rear and sides of the development will benefit from screening, distance, and angle of view corrections.

The noise levels follow the pattern typical of city centre locations with both the L_{Aeq} and L_{A90} increasing in line with traffic flow, greater traffic flow during the day, peaks at rush hour, and lower noise levels during the night when traffic reduces. The L_{AFmax} remains fairly constant indicating that traffic passes during all time periods. The L_{AFmax} doesn't increase with quantity of traffic as only a single traffic pass event is required in order to generate a high L_{AFmax} value.

Average summary noise levels are provided in Table 2 below:

Table 2 – Summary of noise indices measured at MP1 during the day and night

Time	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB	L_{AFmax} dB
Day: T – 16hr 07:00-23:00	65	52	-
Night: T - 8hr 23:00-07:00	58	37	79[1]

[1] L_{AFmax} value is the level not exceeded more than 10 times during the night period.

Spectrum	*Octave Band (Hz)*						
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*
Day L_{eq}	*2.9*	*-1.9*	*-2.9*	*-4.1*	*-3.1*	*-8.7*	*-14.2*
Night L_{eq}	*1.0*	*-3.5*	*-4.4*	*-4.9*	*-2.6*	*-8.3*	*-14.5*
Night L_{Fmax}	*2.1*	*-5.7*	*-6.1*	*-5*	*-3.5*	*-7.3*	*-10.1*

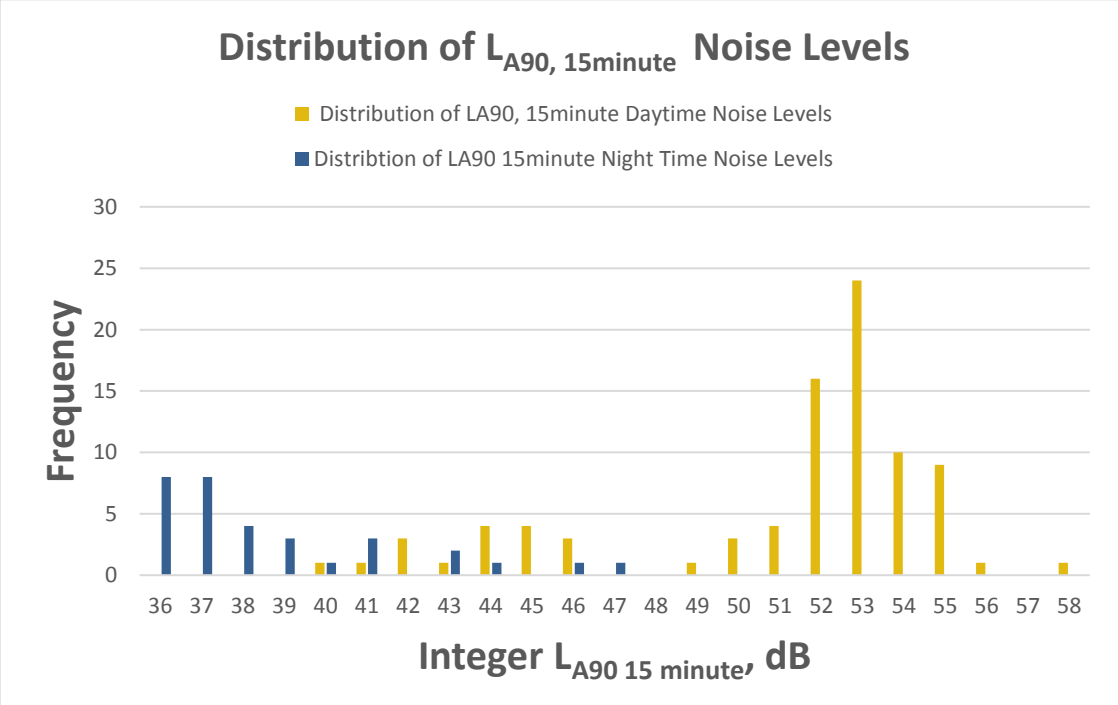

Figure 4 – Distribution of LA90 measurements at MP1

The absolute noise levels measured are moderate to high during the day, however low background noise levels are present overnight when traffic is at its lowest. The values in MP1 are representative of noise levels at the façade line on Midland Road, and noise levels at the rear are expected to benefit from increased screening, and distance losses from the values shown above.

Typical losses through an open window for free-field noise values is 13 dB, and therefore the internal day and night L_{Aeq} would be 52 dBA and 45 dBA respectively and 66dB LAmax at night. These internal noise levels would be over the standard noise criteria for noise sensitive areas and therefore whilst windows can be operable for purge ventilation, background ventilation requirements must be met by other methods. These levels also exceed the AVOG guidance levels for overheating control, and so the form of overheating control will also need to be considered if necessary, with openable windows to control overheating alone not acceptable.

4.4 Calculated Noise Levels At Rear

In order to calculate the noise levels present on the rear façade of the development, distance correction, screening and angle of view corrections have been applied to the averaged values in Table 2. Because the main noise source is traffic CRTN guidance has been followed for distance and angle of view corrections for the L_{Aeq} values, however a simplified screening loss has been applied. Should the full CRTN screening values be applied even greater losses would occur. The L_{AFmax} is generated by a point source, so the distance loss has been calculated on the basis of 6dB/doubling of distance. A summary of the losses and calculated values has been provided in Table 3 below:

Table 3 – Calculated noise levels at rear façade

Noise indices	Distance Loss			Screening (dB)	Angle of View Correction		Corrected level at rear façade (dBA)
	MP1 ref distance to kerb (m)	Rear façade distance to kerb (m)	Distance loss (dB)		Angle (Degrees)	Correction (dB)	
L_{Aeq} Day	3	16	-4.8	-10	38	-6.8	43.5
L_{Aeq} Night				-10	38	-6.8	36.5
L_{AFmax}			-9.5	-10	-		59.8

The calculated noise levels at the rear façade indicate that the external garden amenity level of 50 dBA $L_{Aeq,16hour}$ during the day will be met, and internal noise levels with windows open (assuming 13dB losses) would comply with the proposed internal noise criteria for both day and night L_{Aeq} noise levels. So to control road noise, no specific measures are required at the rear beyond standard forms of construction. It is also expected that at the rear of site overheating control could be provided by opening windows without impact to amenity.

5 Noise from Manor Scrap

Manor Scrap was closed at the time of the survey and remains closed at the time of writing. This is a small scrap yard (not the main facility for Manor Scrap which is elsewhere). The proposed residential development is not immediately adjacent to Manor Scrap and there is a three storey residential building between Manor Scrap and this new scheme. There are also other recently developed residences with rear facing windows along Horton St which have a similar, or even less shielded, view of Manor Scrap. So in general terms we do not expect that Manor will be a significant issue in respect of impact on the new residential scheme.

We have been provided by David Cahill Design Consultants with a noise survey carried out by others inside the rear of 11 Horton Street by Gemini Acoustics. That building directly overlooks Manor Scrap and would be potentially more affected than the 28 Midland Rd site as it is closer and less shielded.

The Gemini report does not fully represent some aspects of how we would wish to carry out such an assessment, but is nevertheless useful to indicate the general noise levels experienced from Manor Scrap. Their measurements were performed inside with windows closed, but we understand no specific sound insulation measures were imposed on the glazing or ventilation. They measured noise from the exterior of 30-33dBA during a period they considered to be "*representative of normal operation of the metal reclaim yard*" and including some contribution of noise from the occupants of the dwelling. This falls within the L_{Aeq} 35dB limit from BS 8233:2014 for daytime in habitable rooms.

Therefore, lower noise levels would be expected at the rear of 28 Midland Road and this indicates, along with our site observations, that noise from Manor Scrap is unlikely to be significant.

6 Building Envelope Assessment

6.1 Assessment Details

The external building façade is expected to be cavity masonry construction with render or brick finish and with tiled roof. The development is expected to be located in fairly close proximity to Midland Road, and the plans used within assessment have been provided by David Cahill Design Consultants Ltd. The plans have been used for room volumes, glazing areas, façade areas etc, in order to complete the building envelope assessment. It is expected that the external façade will provide a minimum R_w 51 dB, with the actual value much greater. It is expected that the roof construction will provide a minimum Rw of 44 dB, with the actual value greater.

6.2 Glazing

In order to meet the proposed internal noise criteria for rooms exposed to the different noise levels three glazing types are proposed. The glazing specification is provided in table 4 below, and the selected glazing system is expected to need to meet the requirements in each octave band value as a minimum (in particular the values in 63-250 Hz bands are the most critical). It is possible that other similar performance glazing configurations with slightly different spectra may achieve the requirements, but alternatives would need to be assessed for compliance.

Table 4 – Octave Band Typical Minimum Glazing Specification

Glazing Type	Rw, dB	Octave band sound reduction value Hz, dB						
		63	125	250	500	1000	2000	4000
Type-A	42	24	30	30	-	-	-	-
Type-B	36	21	27	-	-	-	-	-
Type-C	31	-						
Where '-' shown there is no specific octave band performance requirement								

For informative purposes only, the following glazing configurations would typically achieve the approximate performance of the requirements given above when installed with an appropriate framing system:

Type-A – 10mm glass / 12-16mm airgap / 10mm glass (Acoustic Laminated)

Type-B – 6mm glass / 12-16mm airgap / 10mm glass

Type-C – 4mm glass / 12-16mm airgap / 4mm glass (Standard Thermal Double-Glazing)

It should be noted that the configurations given above are for informative purposes only, and the performance specification is shown in Table 4. It must be ensured that the selected glazing system meets the above requirements as a whole inclusive of frames, door sets etc.

Glazing Type-A is quite onerous and is required for all glazed elements of bedrooms located along the Midland Road façade to control the L_{AFmax} values. Glazing Type-B is required for all glazed elements of living room/lounge areas located along the Midland Road façade. Glazing Type-C is required for all bedrooms and living room/lounge areas at the rear of site which benefit from screening from Midland Road. Glazing type C represents standard thermal double glazing and is acceptable for all rooms on the rear and rooms not sensitive to noise.

6.3 Ventilation

In order to provide passive background ventilation with the windows closed there are different ventilation requirements. The bedrooms on the front façade facing Midland Road have the most onerous noise criteria to meet, during the night, and it is not possible to provide enough passive background ventilation via acoustic trickle ventilation nor sufficient purge/overheating ventilation. It is therefore expected that a mechanical ventilation system (eg MVHR) can be used in order to provide ventilation to bedrooms on the front façade.

For bedrooms on the rear façade, and all living room/lounge areas passive background ventilation can be provided via trickle ventilators, either in frame systems or through wall. The minimum specification of ventilators has been provided below:

- Type 1 – Mech Vent
- Type 2 – 43 dB D_{new} In Wall Acoustic Ventilator (e.g. Ryton AAC125HP)
- Type 3 – 29 dB D_{new} Non-acoustic Trickle Ventilator

Type 1, mechanical ventilation, is required for all bedrooms on the front façade facing Midland Road. Type 2 – ventilation is required for all living room/lounge spaces on the front façade facing Midland Road, however these rooms could be addressed using MVHR instead. Type 3 – non-acoustic trickle ventilator is acceptable for all bedroom and living room/lounge spaces at the rear of site screened from Midland Road. The calculations have assumed one trickle ventilator per

room, should multiple ventilators be required the D_{new} specification must increase by 3 dB for each ventilator.

6.4 Overheating

The front of site overlooking Midland Road has fairly high-performance glazing, however as it faces north-east it is not expected to suffer from significant thermal gains, and overheating may not be a large risk here. However, with open windows used as overheating ventilation the internal levels from maxima would be around L_{AFmax} 66dB and $L_{Aeq,16hr}$ 52dB / $L_{Aeq,8hr}$ 45dB. These exceed the recommended AVOG limits for overheating by a small margin (1-3dB). Therefore, whether alternative cooling methodology is required for the façade overlooking Midland Road may depend on the risk of overheating for these north facing rooms. Mechanical ventilation is required for general noise levels in any case in bedrooms, so whilst that is not a full cooling system, may be adequate to provide sufficient additional air to compensate for the small margin of exceedance. Windows can still be openable.

At the rear of site noise levels are expected to be low because of screening, distance losses, and angle of view from the noise source, Midland Road, and therefore if open windows are necessary to control temperature at times, internal noise criteria is still expected to be met at all times.

6.5 Results

Example calculations have been provided in Appendix C. With the glazing and ventilation requirements as specified above the proposed internal noise criteria is expected to be met at all times in all noise sensitive spaces.

7 Conclusion

A noise assessment has been carried out as required by Condition 5 of Planning permission 19/02785/F for the former Christadelphian Hall site at 28 Midland Road.

A noise survey has been carried out at the proposed development site which found that the noise levels from traffic on Midland Road are relatively noisy at the closest façade, and therefore building envelope sound insulation has been carefully considered. Maximum noise levels during the night are especially high, however this is typical for fast moving traffic on a road in close proximity to dwellings. In order to achieve the internal noise criteria proposed within condition 5, high performance glazing is necessary, along with mechanical ventilation for bedrooms overlooking Midland Road. Living room/lounge areas overlooking Midland Road have less onerous criteria to meet, as they are not expected to be used for sleep, however good double glazing is still necessary, as there is a large amount of glazing proposed, including a double door-set. The rear of site is expected to be well screened from Midland Road, and calculations indicate that criteria for external amenity spaces will be met, as shown in section 4.4. With the glazing and ventilation measured installed as specified in this report all noise criteria of Condition 5 are expected to be met, and therefore it is expected that condition 5 can be discharged.

Glossary of Acoustic Terms

dB – Decibel. The unit used to describe noise levels. It is a logarithmic ration of the sound pressure.

A Weighting – A frequency weighted applied to the measured sound spectrum which corrects the level to simulate the frequency response of the hearing system to sound levels of varying frequencies. A weighted sound levels are referred to as dBA.

L_{eq}– This is a quasi-average noise level which includes all the sound energy during the measurement period averaged out across the period. It is typically used to describe the ambient noise level. The A weighted value is the L_{Aeq}.

L_{90} – This is the level exceeded for 90% of the measurement period and indicates the steady underlying background noise level. The A weighted Level is the L_{A90}.

L_{01} – This is the level exceeded for 1% of the measurement time. This is used to indicate more typical maxima. The L_{max} is the highest level during a measurement period, but can often be a very short-term single event (and is not always representative of the typical maxima.

R_w - Weighted sound reduction index of a single element only: dB. This is generally tested in a laboratory and does not account for any flanking or other sound paths.

D_w - Weighted level difference: dB. This is the sound level difference between two rooms and also includes the effect of flanking, other sound paths, workmanship, on site construction and absorption in the receiver room.

RT - Reverberation Time: seconds. This is the time taken for reverberant sound in the room to decay by 60 dB. A dead space with many soft finishes would have a short RT whereas a lively space, comprising mainly hard surfaces, would have a long RT.

NR - The Noise Rating, NR, is used to describe steady noise levels such as mechanical services noise. A family of curves is defined in octave frequency bands and the NR rating for a particular noise is the lowest NR curve which is entirely above the spectrum of the noise under consideration.

Noise indices measured at MP1, unattended noise logger

Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB	Time	L_{Aeq} dB	$L_{Amax,F}$ dB	L_{AF90} dB
06/05/2021 10:15	67.2	87.6	52.7	06/05/2021 22:15	60.6	78.4	44.2
06/05/2021 10:30	71.8	100.0	52.6	06/05/2021 22:30	62.7	86.1	42.3
06/05/2021 10:45	65.3	80.0	52.4	06/05/2021 22:45	57.0	76.7	40.4
06/05/2021 11:00	64.3	78.8	51.9	06/05/2021 23:00	58.3	77.9	39.5
06/05/2021 11:15	64.9	79.5	52.1	06/05/2021 23:15	54.8	74.4	39.0
06/05/2021 11:30	65.1	80.4	50.7	06/05/2021 23:30	58.2	76.2	38.6
06/05/2021 11:45	66.8	86.4	53.0	06/05/2021 23:45	58.5	75.1	38.4
06/05/2021 12:00	67.9	89.1	54.8	07/05/2021 00:00	53.4	75.7	37.9
06/05/2021 12:15	64.9	78.9	51.6	07/05/2021 00:15	53.6	72.0	38.2
06/05/2021 12:30	66.9	86.7	54.1	07/05/2021 00:30	52.7	76.0	36.9
06/05/2021 12:45	64.9	79.3	52.9	07/05/2021 00:45	57.8	84.7	37.0
06/05/2021 13:00	65.8	85.6	54.4	07/05/2021 01:00	55.3	76.8	36.5
06/05/2021 13:15	66.4	88.8	52.1	07/05/2021 01:15	56.5	79.2	36.6
06/05/2021 13:30	64.8	78.9	52.6	07/05/2021 01:30	48.4	74.1	36.6
06/05/2021 13:45	65.7	78.5	54.7	07/05/2021 01:45	54.5	75.9	36.7
06/05/2021 14:00	65.0	90.6	52.7	07/05/2021 02:00	51.5	72.1	36.2
06/05/2021 14:15	64.4	80.4	53.3	07/05/2021 02:15	49.7	76.9	36.0
06/05/2021 14:30	67.0	94.1	53.5	07/05/2021 02:30	56.2	79.0	36.4
06/05/2021 14:45	64.4	77.4	53.2	07/05/2021 02:45	54.2	74.0	36.7
06/05/2021 15:00	64.0	79.9	50.4	07/05/2021 03:00	51.2	70.9	35.8
06/05/2021 15:15	64.2	78.5	50.6	07/05/2021 03:15	48.2	72.9	35.8
06/05/2021 15:30	65.0	80.4	52.0	07/05/2021 03:30	50.9	72.9	36.3
06/05/2021 15:45	64.6	77.3	51.8	07/05/2021 03:45	51.6	77.0	36.1
06/05/2021 16:00	65.7	83.4	53.4	07/05/2021 04:00	53.7	76.5	35.9
06/05/2021 16:15	64.7	78.2	53.0	07/05/2021 04:15	51.9	72.7	37.0
06/05/2021 16:30	65.8	78.0	56.0	07/05/2021 04:30	54.7	75.0	38.3
06/05/2021 16:45	64.7	85.0	54.8	07/05/2021 04:45	59.0	79.0	39.2
06/05/2021 17:00	65.6	83.2	55.0	07/05/2021 05:00	60.8	80.0	41.1
06/05/2021 17:15	65.6	80.1	53.4	07/05/2021 05:15	59.6	77.3	41.3
06/05/2021 17:30	65.4	83.7	51.8	07/05/2021 05:30	61.2	79.8	41.3
06/05/2021 17:45	64.1	76.7	50.2	07/05/2021 05:45	62.1	79.7	43.4
06/05/2021 18:00	67.3	93.3	52.6	07/05/2021 06:00	63.7	82.0	43.2
06/05/2021 18:15	64.7	79.9	51.6	07/05/2021 06:15	63.5	79.3	44.1
06/05/2021 18:30	64.5	79.4	49.5	07/05/2021 06:30	64.8	82.1	45.6
06/05/2021 18:45	63.0	79.5	45.9	07/05/2021 06:45	63.1	77.4	46.7
06/05/2021 19:00	61.9	77.9	46.1	07/05/2021 07:00	65.0	80.8	49.2
06/05/2021 19:15	63.5	85.0	45.6	07/05/2021 07:15	64.4	82.3	50.5
06/05/2021 19:30	61.1	78.3	44.3	07/05/2021 07:30	66.4	83.8	52.1
06/05/2021 19:45	61.8	77.5	45.0	07/05/2021 07:45	65.4	82.0	54.0
06/05/2021 20:00	61.8	77.2	44.4	07/05/2021 08:00	70.3	98.5	54.6
06/05/2021 20:15	61.6	76.5	44.8	07/05/2021 08:15	65.9	80.9	54.9
06/05/2021 20:30	62.4	81.3	44.9	07/05/2021 08:30	66.8	87.8	55.0
06/05/2021 20:45	61.6	79.3	44.8	07/05/2021 08:45	72.4	95.7	57.7
06/05/2021 21:00	58.5	75.2	41.6	07/05/2021 09:00	64.0	84.7	53.9
06/05/2021 21:15	59.8	74.5	43.5	07/05/2021 09:15	65.1	79.3	54.7
06/05/2021 21:30	59.4	74.0	42.5	07/05/2021 09:30	66.8	88.7	53.3
06/05/2021 21:45	64.0	86.5	41.2	07/05/2021 09:45	65.5	80.6	53.6
06/05/2021 22:00	61.0	75.9	42.3	07/05/2021 10:00	66.3	89.0	51.5

Time	$L_{A\,eq}$ dB	$L_{A\,max,F}$ dB	$L_{A\,F90}$ dB	Time	$L_{A\,eq}$ dB	$L_{A\,max,F}$ dB	$L_{A\,F90}$ dB
07/05/2021 10:15	64.7	77.8	52.9	07/05/2021 15:45	0.0	0.0	0.0
07/05/2021 10:30	66.3	85.8	54.3	07/05/2021 16:00	0.0	0.0	0.0
07/05/2021 10:45	65.2	80.3	52.4	07/05/2021 16:15	0.0	0.0	0.0
07/05/2021 11:00	66.3	92.8	51.9	07/05/2021 16:30	0.0	0.0	0.0
07/05/2021 11:15	64.4	80.6	51.9	07/05/2021 16:45	0.0	0.0	0.0
07/05/2021 11:30	65.6	83.4	52.9	07/05/2021 17:00	0.0	0.0	0.0
07/05/2021 11:45	64.4	80.0	53.4	07/05/2021 17:15	0.0	0.0	0.0
07/05/2021 12:00	66.3	82.0	53.8	07/05/2021 17:30	0.0	0.0	0.0
07/05/2021 12:15	66.0	82.0	55.3	07/05/2021 17:45	0.0	0.0	0.0
07/05/2021 12:30	65.1	79.7	54.1	07/05/2021 18:00	0.0	0.0	0.0
07/05/2021 12:45	64.6	77.9	51.4	07/05/2021 18:15	0.0	0.0	0.0
07/05/2021 13:00	65.0	80.5	52.9	07/05/2021 18:30	0.0	0.0	0.0
07/05/2021 13:15	64.8	79.4	53.0	07/05/2021 18:45	0.0	0.0	0.0
07/05/2021 13:30	64.8	78.7	52.1	07/05/2021 19:00	0.0	0.0	0.0
07/05/2021 13:45	65.2	79.3	53.6	07/05/2021 19:15	0.0	0.0	0.0
07/05/2021 14:00	68.8	98.7	53.3	07/05/2021 19:30	0.0	0.0	0.0
07/05/2021 14:15	65.6	82.2	52.7	07/05/2021 19:45	0.0	0.0	0.0
07/05/2021 14:30	65.6	81.7	53.0	07/05/2021 20:00	0.0	0.0	0.0
07/05/2021 14:45	64.7	80.0	52.2	07/05/2021 20:15	0.0	0.0	0.0
07/05/2021 15:00	63.9	79.2	52.6	07/05/2021 20:30	0.0	0.0	0.0
07/05/2021 15:15	65.4	89.9	52.8	07/05/2021 20:45	0.0	0.0	0.0
07/05/2021 15:30	64.7	84.2	52.8	07/05/2021 21:00	0.0	0.0	0.0

Example EN 12354-3 Building Envelope Calculation – Flat 2, Master Bedroom, Night

			63	125	250	500	1000	2000	4000	
Building Envelope Sound Insulation Calculation According to EN 12354-3										
	28 Midland Road	**Date**	13/05/2021							
	First Floor, Flat 2	**Room**	Master Bedroom							
Incident noise levels										
	Term	**Label**	**Octave band centre frequency (Hz)**							**dB(A)**
			63	**125**	**250**	**500**	**1 k**	**2 k**	**4 k**	
$L_{eq,ff}$	Measured L_{eq}	LAeq,8hour Night - Midland Road	1.0	-3.5	-4.4	-4.9	-2.6	-8.3	-14.5	58.0
	Measured spectrun	LAeq,8hour Night - Midland Road: Adj Spectru	59.0	54.5	53.6	53.1	55.4	49.7	43.5	58.0
		K	3	3	3	3	3	3	3	
$L_{max,ff}$	Measured L_{max}	11th Greatest LAFmax Event - Midland Road	2.1	-5.7	-6.1	-5.0	-3.5	-7.3	-10.1	79.3
		Greatest LAFmax Event - Midland Road: Adj S	81.4	73.6	73.2	74.3	75.8	72.0	69.2	79.3
		K	6	6	6	6	6	6	6	
Room Details										
	Term	**Derivation**	**Value**	**Term**			**Derivation**			**Value**
	V	Volume (m^3)	27.6	Sew			Sf - Swi			5.1
	RT	RT (secs)	0.5	Srr			Area of ceiling (m^2)			0.0
	Sf	Facade area (inc. window) (m^2)	7.4	S			Sf + Srr			7.4
	Sd	Door Area	0.0	Ao			Ref Area for Dnew			10.0
	Swi	Window area (m^2)	2.3	Attenuation to roof						0.0
Sound Insulation Calculation elements										
	Term	**Label/element**	**Octave band centre frequency (Hz)**							**Rw**
			63	**125**	**250**	**500**	**1 k**	**2 k**	**4 k**	
vent openings	$D_{n,e}$	Mech Vent	100	100	100	100	100	100	100	101
	$A_0/S \times 10^{-Dn/10}$	B	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		L_{eq} Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		L_{max} Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
window	R_{wi}	10/12/9 Phonip double glazing	24	30	30	39	44	48	51	42
	$S_{wi}/S \times 10^{-Rwi/10}$	C	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
		L_{eq} Internal SPL	35.1	24.6	23.7	14.2	11.5	1.8	-7.4	18.8
		L_{max} Internal SPL	60.5	46.7	46.3	38.4	34.9	27.1	21.3	42.3
Primary wall	R_{ew}	Example Wall from BS8233 (Brick and Block)	36	40	44	45	51	56	58	51
	$_{ew}/S \times 10^{-Rew/10}$	D	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		L_{eq} Internal SPL	26.6	18.1	13.2	11.7	8.0	-2.7	-10.9	13.0
		L_{max} Internal SPL	52.0	40.2	35.8	35.9	31.4	22.6	17.8	36.8
Door	R_{rr}	Example Roof from BS8233	22	28	34	40	45	49	52	44
	$S_r/S \times 10^{-Rrr/10}$	E	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
		L_{eq} Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		L_{max} Internal SPL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Internal Noise Levels										
	10 Log (B+C+D+E)	F	-28.6	-34.3	-34.8	-42.2	-47.5	-51.8	-54.5	
	A (furnished)	Room Absorption	9	9	9	9	9	9	9	
	10 log (S/A)	G	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	
L_{eq}	Calc Tolerance	T	3	3	3	3	3	3	3	
	Internal $L_{eq,2}$	L+F+G+K+T	35.6	25.5	24.0	16.1	13.1	3.1	-5.8	19.8
L_{max}	Calc Tolerance	T	3	3	3	3	3	3	3	
	Internal $L_{max,2}$	M+F+G+K+T	61.0	47.6	46.6	40.3	36.5	28.4	22.9	43.3