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REPORT

of

SOUND MEASUREMENTS AND RECOMMENDATIONS

at

PROPOSED RESIDENTIAL DEVELOPMENT AND CONVERSION OF OFFICES TO APARTMENTS, 76 DONCASTER ROAD, BARNSLEY S70 1TW.

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1.0 Summary and Conclusions

It is proposed to convert the existing Old Vicarage building at 76 Doncaster Road, Barnsley into residential apartments and to erect 5 dwellings on land to the rear. The property receives noise from road traffic and the adjacent railway and is adjacent to retail shops and other commercial premises. For this reason the Local Planning Authority has called for a survey of the existing sound levels affecting the development. The objective of this report is to describe sound measurements at the premises during periods of daytime and night and to compare the results with the usual acceptance criteria.

1.1 The sound levels outdoors at the premises were measured up to 63 dB LA_{eq} during the daytime and 61 dB LA_{eq} at night.

1.2 Road traffic was the only significant noise source affecting the front of the development and the railway was the only source affecting the rear during our survey periods.

1.3 The usual acceptance standards on interior sound levels inside the proposed residential rooms can be achieved by fitting double glazing using 4mm and 6mm plate glass (eg. 4-12-6, 4-16-6, etc.) or the acoustic equivalent to bedroom windows facing Doncaster Road and conventional double glazing using two panes of 4mm plate glass (eg. 4-12-4, 4-16-4, etc) to the windows of all other habitable rooms. No bedrooms are currently proposed in the rear elevation of new dwellings facing the railway but if there is a later requirement for bedrooms in this elevation they should also be fitted with 4-12-6 glazing or the acoustic equivalent.

1.4 Background ventilation can be achieved within the interior sound level criteria by using conventional trickle vents in all rooms.

1.5 Bedroom ceilings on the upper floors may be constructed from a single layer of 12.5mm plasterboard.

1.6 The usual requirement for outdoor sound levels in private gardens can be achieved by ensuring that the boundary fence proposed towards the railway is constructed to an acoustic standard with no airgaps.

2.0 Planning Requirements on Noise

No formal requirements have been received at this stage on the noise acceptance criteria adopted by the Local Planning Authority at this development. As a starting point this report uses the general guidance on interior sound levels inside dwellings given in BS 8233 and by the World Health Organisation. These documents are summarised below.

2.1 BS 8233: 1999

BS 8233 provides guidance on interior sound levels inside various building interiors. The recommendations for dwellings are:

Living rooms	30 dB LA_{eq}	for good resting conditions
	40 dB LA_{eq}	for reasonable resting conditions
Bedrooms	30 dB LA_{eq}	for good sleeping conditions
	35 dB LA_{eq}	for reasonable sleeping conditions

2.2 World Health Organisation: 2000

Guidance from the WHO adopts similar acceptance criteria and also gives values for sleep disturbance:

Indoors generally	35 dB LA_{eq}	for speech intelligibility and moderate annoyance
Bedrooms	30 dB LA_{eq} }	to avoid sleep
	45 dB LA_{max} }	disturbance

3.0 Sound Sources

Road traffic on Doncaster Road provided the dominant sound source affecting the existing Old Vicarage during our survey periods. The proposed development of five new dwellings to the rear of the site is shielded from Doncaster Road but receives noise from the railway which passes in a cutting at 20m distance. There are adjacent retail shops and a tool hire shop but there was no significant sound from any of them during our survey periods.

Road Traffic

The site is located adjacent to a junction in Doncaster Road where through traffic turns off the former direct route to use the Taylor Row link to the A61 road into Barnsley centre. This results in the site being spaced away from the direct impact of main road noise, and ensures that traffic speeds are relatively low as vehicles turn off Doncaster Road. Traffic along the main part of Doncaster Road was frequent during our daytime survey period and intermittent at night. Traffic along the truncated part of Doncaster Road which passes the development site was infrequent during all survey periods.

Railway

The railway passes at 20m distance from the northeast elevation of the five dwellings proposed at the rear of the site. The railway is in a cutting 9m below the ground level of the dwellings but the tracks are visible from the dwelling location. The railway forms the southern approach to Barnsley station with the result that trains pass the site relatively slowly but some are accelerating under power. There were several train passages during our survey periods, which provided the maximum sound levels affecting the proposed dwellings.

Commercial Premises

The site is adjacent to the rear of retail shops on Doncaster Road and a tool hire shop along the southeast boundary. There was no audible sound from any of these premises during our daytime or night survey periods. The tool hire shop has an outdoor storage yard facing the development site, used by customers to park and load/unload their vehicles. We were specifically asked by our client for reasons of confidentiality not to approach any of the businesses occupying adjacent premises or to discuss the purpose of our survey with anyone at the site. This prevented any discussion with the business occupants about potential noise sources at their premises.

4.0 Sound Measurements

Sound levels were measured at the site during the daytime of Tuesday 4th and at night on Wednesday 5th December 2012. Conditions during the survey periods were dry with no wind, being suitable for outdoor sound readings. All results were taken using a Bruel & Kjaer precision sound level meter type 2260 for which current calibration certificates are held.

Sound Descriptor		Daytime 1030-1200	Night 2200-2330
Front of site facing Doncaster Road			
Ambient	LA_{eq}	63.3	53.8
Background	LA_{90}	60.0	46.6
Maximum	LA_{max}	78.5	69.4
Rear facing railway			
Ambient	LA_{eq}	61.1	52.5
Background	LA_{90}	58.0	45.3
Maximum	LA_{max}	68.8	69.2

Sound frequency spectra are shown below of the daytime and night L_{eq} results and the highest L_{max} result at each position.

Front facing Doncaster Road

Sound pressure levels, dB linear:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	70.4	63.8	60.3	58.1	60.1	55.9	48.7	43.2
Night Leq	62.2	52.3	50.5	47.8	49.5	46.1	39.9	34.1
Maximum Lmax	86.0	79.8	75.1	73.7	73.5	71.9	64.4	57.4

Rear facing railway

Sound pressure levels, dB linear:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	67.4	65.2	55.6	56.2	58.2	53.6	43.5	34.1
Night Leq	59.1	55.9	52.0	46.6	48.9	41.6	30.7	25.6
Night Lmax	79.5	84.5	69.9	65.9	66.3	62.3	55.5	42.3

5.0 Sound Insulation of External Fabric

5.1 Interior Sound Levels

The basis of sound insulation is that outdoor noise must not cause indoor sound levels in excess of:

- 30 dB LA_{eq} or 45 dB LA_{max} in bedrooms from 2300-0700 hours,
- 35 dB LA_{eq} in living rooms from 0700-2300 hours.

5.2 Bedrooms in Front Elevation of Old Vicarage

The sound levels inside an interior room are given by the formula:

$SPL_{inside} = SPL_{outside} - R + 3 + 10 \log S - 10 \log A$

For a furnished domestic room the terms 'A' for sound absorption and 'S' for surface area are generally self-cancelling, which is assumed to be the case. It is found that reinforced glazing is needed, for which the following example uses double glazed units with 6mm and 4mm plate glass (eg. 4-16-6, 4-12-6, etc). The sound reduction indices are:

Sound reduction indices dB:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
4-16-6 glazing	19	23	22	27	38	40	41	45
Wall and glazing	25	30	29	34	45	47	48	52

The calculation of maximum sound reaching interiors at night is:

Sound pressure levels dB linear, Lmax:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	86.0	79.8	75.1	73.7	73.5	71.9	64.4	57.4
3dB Reflection	3	3	3	3	3	3	3	3
Wall and Glazing	25	30	29	34	45	47	48	52
Indoor SPL	64	53	49	43	32	28	19	8

The overall level represented by the above spectrum is **45 dB LA_{max}.** The same calculation on the time-averaged results at night predicts an interior sound level of **27 dB LA_{eq}**. These values are within the design targets.

It is recommended that bedrooms in the elevation of The Old Vicarage facing Doncaster Road are fitted with double glazing using 6mm and 4mm plate glass (eg. 4-12-6, 4-16-6, etc.) or the acoustic equivalent.

5.3 Bedrooms in Rear Elevation of New Dwellings

The current layout proposal shows no bedrooms in the elevation of the new dwellings facing the railway. To cater for any changed proposal where bedrooms are located in this elevation, the same calculation as 5.2 is applied to the maximum sound levels from railway noise measured at this position. This shows that the design targets can also be achieved by using double glazed units with 6mm and 4mm plate

glass (eg. 4-16-6, 4-12-6, etc). The calculation of maximum sound reaching interiors at night is:

Sound pressure levels dB linear, Lmax:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	79.5	84.5	69.9	65.9	66.3	62.3	55.5	42.3
3dB Reflection	3	3	3	3	3	3	3	3
Wall and Glazing	25	30	29	34	45	47	48	52
Indoor SPL	57	58	44	35	25	18	10	-7

The overall level represented by the above spectrum is **43 dB LA_{max}.** The same calculation on the time-averaged results at night predicts an interior sound level of **20 dB LA_{eq}**. These values are within the sleep disturbance thresholds advised by the WHO and the "good sleeping conditions" recommended in BS 8233.

It is recommended that if bedrooms are later proposed in the rear elevation they are fitted with double glazing using 6mm and 4mm plate glass (eg 4-12-6, 4-16-6, etc.) or the acoustic equivalent.

5.4 Other Bedrooms

Bedrooms in elevations other than The Old Vicarage facing Doncaster Road and the new dwellings facing the railway are spaced further from the road and railway noise sources. The sound decay over the additional distances will provide interior sound levels within the design targets if conventional double glazing is used with two panes of 4mm plate glass.

It is recommended that bedrooms other than those described in 5.2 & 5.3 may be fitted with conventional double glazing using two panes of 4mm plate glass (eg. 4-12-4, 4-16-4).

5.5 Living Rooms

The same calculation as 5.2 applied to the daytime results predicts interior sound levels in living rooms of 32 dB LA_{eq} at the front elevation and 29 dB LA_{eq} at the rear elevation if conventional double glazing is used with two panes of 4mm glass (eg. 4-12-4, 4-16-4, etc). These values are within the design target.

It is recommended that all living rooms may be fitted with double glazing using two panes of 4mm plate glass (eg. 4-12-4, 4-16-4).

5.6 Ventilation

The World Health Organisation advises that the outdoor-to-indoor sound difference across a window with an open casement is around 15 dBA. This suggests that the interior sound levels with windows open for ventilation will exceed the design targets. Interior sound levels within the requirements will be achieved by using conventional trickle vents for background ventilation to all habitable rooms.

5.7 Roof Materials

The sound insulation of a conventional roof with plasterboard ceiling is usually governed by the plasterboard layer since the sound insulation of the outer roof is limited by ventilation apertures. Single 12.5mm plasterboard alone offers sound reductions of 26 & 29 dB at 500 & 1000 Hz being the frequencies of sound which dominate the outdoor noise. There will be a small but unquantified sound reduction from the thermal quilt and the outer roof. It is estimated that the overall sound reduction across the roofs will meet the design targets by using single plasterboard for the ceilings of the upper floors.

It is recommended that bedroom ceilings on the upper floors are constructed from a single layer of 12.5mm plasterboard.

5.8 Gardens

Some Local Planning Authorities call for the sound levels in private gardens not to exceed 50-55 dB LA_{eq}. The sound levels at the northeast side of the site where gardens are proposed were higher than this at 61-65 dB LA_{eq} during the daytime. A 1.8m high fence is proposed along the boundary facing the railway which will provide the necessary attenuation if it is constructed with no airgaps. The basic requirement of a fence erected to provide sound attenuation is that it must be entirely imperforate with no airgaps. A timber fence with overlapped or tongued-and-grooved boards would be suitable. Fences with gaps between boards do not provide any sound attenuation, even if the boards are offset and the angle between them is such that there is no direct sightline through them. There must be no airgap under the fence, usually achieved by fitting the fence onto a low masonry wall or fitting a horizontal board into a gravel trench. Timber such as 12mm softwood (or greater) would provide adequate mass for this application.
