ATSPACE

Total Building Compliance

Norton Mayfield Architects LLP

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42 Caversham Road London NW5 2DS

Revised Acoustic Assessment of Proposed Apartments

April 2015

Reference 3566

1. INTRODUCTION

Following an assessment of potential noise and vibration impact on the proposed residential development, at 42 Caversham Road, London NW5, in December 2013, a revised layout has now been assessed, as requested by Norton Mayfield Architects. A survey of noise and vibration levels was carried out In December 2013, the results of which remain valid.

The measurements and assessment were carried out by John Hyde, acoustics director at Atspace Ltd, a member company of the Association of Noise Consultants. He is a Member of the Institute of Acoustics and the Institute of Physics, and has over 30 years experience as a noise and acoustics consultant and has lectured on acoustics at North East London College.

2. UNITS

It has become practice to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear. It is helpful to remember that a noise level change of 3dB on a sound meter reading would not be readily perceptible, and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequencies. The ear "hears" high frequency sound of a given level more loudly than low frequency sound of the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second. It is clearly impractical to specify the sound level for each second thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

$L_{Aeq,T}$: the equivalent A-weighted continuous sound level over period T.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hr for daytime noise. It contains all the sound energy of the varying sound levels over the same time period, and expresses it as a continuous sound level over that period. The unit is widely used for assessing traffic, transportation and industrial noise for planning purposes.

$L_{A10,T}$: the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the Department of the Environment publication, ‘Calculation of Road Traffic Noise’.

$L_{A90,T}$: the A-weighted level of sound exceeded for 90% of the time period T.

This latter unit is commonly used to represent the background noise, and is used in assessing the effects of industrial noise in UK.

3 ASSESSMENT METHODOLOGY

Planning Guidance

Planning guidance on noise is set out in the ‘Noise Policy Statement for England’ (NPSE) which reinforces the three policy aims of the ‘National Planning Policy Framework’ as follows:

- *Avoid significant adverse impacts on health and quality of life*
- *Mitigate and minimise adverse impacts on health and quality of life*
- *Where possible, contribute to the improvement of health and quality of life*

In order to apply objective standards to the assessment of noise which uphold these policy aims, the effect of introducing a particular noise source may be determined by several methods, as follows:

- The effect may be determined by reference to guideline noise values. BS8233:2014 and WHO ‘Guidelines for Community Noise’ contain such guidelines
- The effect may be determined by considering the change in noise level that would result from the proposal in an appropriate noise index for the characteristic of the noise in question.
- Another method is to compare the resultant noise level against the background noise level of the area, as used in BS4142:2014 to determine the likelihood of complaints from noise of an industrial nature.

Internal Noise Levels

WHO Guidelines suggest internal noise levels by day of 35dB $L_{Aeq\ 16hr}$ and 30dB $L_{Aeq,8hr}$ in bedrooms during the night time (2300 - 0700). In addition it is recommended that peak noise levels (L_{Amax}), should not exceed 45dB(A) inside bedrooms at night. These guidelines are used by most Local Authorities and are considered to be a good design standard.

Noise transmission between dwellings is controlled through the requirements of Building Regulations Part E, 'Resistance to the Passage of Sound'. This document states minimum sound insulation standards for walls and floors which separate dwellings and specifies acoustic treatment for common areas in multi-residential buildings.

External Noise Levels

The WHO Guidelines also recommend that external noise levels in amenity areas, including gardens, should not exceed $L_{Aeq\ 16hr}$ of 50-55dB.

Vibration

BS6472 provides a method of estimating the VDV from measured values of vibration and gives a set of curves relating to levels likely to cause annoyance The standard recognises that human response to vibration depends on a number of factors including the time of day and the use made of occupied space in buildings. Thus, for example, night time is a more sensitive period than during the day

Once values of VDV have been determined for a particular set of conditions, BS6472 provides a table that can be used to assess the resulting degree of adverse comment. The values used in this assessment are 0.2 $ms^{-1.75}$ for a low probability of adverse comment during the day and 0.13 $ms^{-1.75}$ for night time periods.

Criteria for evaluating the effect of vibration on building structures have been summarised in a UK standard, BS7385 (1993). These levels in terms of peak particle velocity (PPV) are very conservative and give an indication of safe limits to prevent the onset of superficial damage such as surface cracking. The guideline recommended for superficial damage was 5 mms^{-1} PPV for standard buildings. However, BS5228:2009 part 2 'Noise and vibration control on construction and open proposed developments', suggests that PPV of 1mms^{-1} is the onset of annoyance from vibration and this level has been used as a criterion in this assessment in addition to the BS6472 criteria.

4 NOISE MEASUREMENTS

Measurements of noise and vibration were carried out on 4th December 2013 at the site of the proposed development. The railway measurement position was at the side of the existing building facing the railway, inside the building supplies yard at first floor level, one metre from the façade at a height of 3m above the ground level, shown as Position 1 in Figure 1. There were occasional vehicle movements within the yard and this noise was included in the measurements.

Measurements of traffic noise on Caversham Road were taken at a distance of 5m from the kerbside shown as Position 2 in Figure 1. Weather conditions throughout both sets of measurements were dry and cold with a light easterly wind.

The railway noise measurements were carried out using a Svan 955 Type I integrating sound level meter, Serial No. 27330, and the traffic noise levels were measured using a Norsonic 118 analyser, Serial No. 31501, calibration certificates are available for both instruments. The analysers were calibrated before and after each set of measurements; no drifting of the calibration signal was detected. Railway noise measurements were undertaken for a 24 hour period and the traffic noise measurements for 4 hours. The following parameters were recorded:

- L_{Aeq} The equivalent continuous noise level, a measure of the average noise energy for the 1 hour period
- L_{Amax} The maximum noise level during the measurement
- L_{A90} The level exceeded for 90% of the time, the background level
- L_{A10} The level exceeded for 10% of the time, used for the traffic noise measurement.

The results are shown in Tables 1 and 2.

Table 1: Hourly Railway Noise Levels

Time	LA90	LAeq	LAmax
	dB	dB	dB
1100	53.9	62.1	78.3
1200	53.2	61.8	79.6
1300	52.6	63.8	77.0
1400	53.5	62.3	78.2
1500	54.2	62.5	77.1
1600	55.5	62.8	79.6
1700	55.2	63.2	78.7
1800	53.7	63.5	78.7
1900	55.1	64.4	80.3
2000	52.8	64.5	80.3
2100	53.3	62.1	79.6
2200	52.5	60.3	77.9
2300	51.1	59.8	76.4
0000	49.3	58.7	74.3
0100	47.5	58.0	76.0
0200	45.1	57.6	75.2
0300	42.6	58.2	71.3
0400	45.3	57.4	74.5
0500	49.8	61.0	76.1
0600	51.4	64.3	75.9
0700	53.7	64.5	79.7
0800	52.7	63.5	77.2
0900	55.0	63.0	79.9
1000	53.4	64.2	79.7

$L_{Aeq,16hr}$ 63.3dB

$L_{Aeq,8hr}$ 60.0dB

Table 2: Traffic noise levels on Caversham Road

Time	LA90	LAeq	LA10	LAmax
	dB	dB	dB	dB
1100	49.6	61.1	63.8	71.9
1200	51.3	60.5	63.1	73.2
1300	50.2	58.6	61.5	70.6
1400	49.2	57.9	60.7	69.0

$L_{Aeq,4hr}$ 60.1dB (day)

5 VIBRATION MEASUREMENTS

Measurements of groundbourne vibration from the railway were taken at Position 1 using a Vibrock V901-2 seismograph, Serial No. 775, two channel recorder, fitted with PPV and VDV transducers. PPV levels from passing trains were recorded for a period of 2 hours and the results are shown in Table 3. The instrument also estimated 8 hour and 16 hour VDV levels, extrapolated from the train movement frequency during the measurement period.

Table 3: Results of vibration measurements

Time	PPV mm/s
1007	0.28
1011	0.34
1017	0.20
1022	0.42
1030	0.11
1038	0.11
1041	0.40
1046	0.13
1047	0.27
1052	0.27
1054	0.40
1059	0.39
1105	0.14
1109	0.17
1110	0.10
1116	0.28
1119	0.22
1125	0.23
1129	0.26
1136	0.14
1144	0.18
1145	0.23
1152	0.27
1158	0.35
1206	0.35
1210	0.09
1211	0.21

Vibration Dose Value (VDV) 16hr estimated by instrument: $0.083 m.s^{-1.75}$

Vibration Dose Value (VDV) 8hr estimated by instrument: $0.051m.s^{-1.75}$

Staff involved with noise and vibration measurements were fully competent, either being Members of the Institute of Acoustics or holding a Certificate of Competence in Environmental Noise Measurement.

6 ASSESSMENT

Railway Noise

The measurement survey resulted in a daytime façade noise level $L_{Aeq,16hr}$ of 63.3dB on the northeast boundary of the site at first floor level. At lower and upper ground floor levels the noise level would be slightly less due to screening by the wall of the adjoining builders' yard. Thus in order to achieve an internal noise level of 30dB, as required by BS8233, a façade reduction of at least 34dB would be needed (rounded up to the nearest dB).

The first floor living area of Unit 08 has been used to determine the composite sound reduction through the windows as this section of the façade is most exposed to railway noise. The calculation takes account of the areas of window and wall on each part of the façade. It was assumed that the wall masonry construction would be brick/block cavity, giving a sound reduction R_w of at least 52dB. On the basis of the calculation, the windows would need to provide a reduction of at least 29dB in order to give an overall façade sound reduction of 34dB. This would be achieved using 6mm/16mm/4mm double glazed units, with a R_w+C attenuation of 30dB.

At night the $L_{Aeq,8hr}$ was 60.0dB thus, as this was lower than the daytime level, the same glazing would ensure that the night time internal noise level criterion of 30dB would also be met. The night time maximum noise level was 76.4dB(A), thus the same glazing configuration would result in an internal level of 41dB(A) which is less than the 45dB(A) required by BS8233.

In order to maintain this level of sound reduction it would be necessary to keep windows closed thus background ventilation would need to be provided. This would need to achieve at least the same sound attenuation as that achieved by the façade. An acoustic airbrick would be suitable to provide the background ventilation when the windows are closed, (such as the AAB-4000 supplied by Greenwood Airvac which provides an attenuation of 47dB), or acoustically treated trickle vents within the widow frames, such as Slotvent, which provide an attenuation of 35dB. Alternatively higher airflows could be achieved using a mechanical ventilator such as the AAF/S acoustic fan also supplied by Greenwood.

Traffic Noise

Traffic noise on Caversham Road measured over a daytime four hour period was found to be $L_{Aeq,T}$ 60.1dB. This value was considered to be a worst case equivalent to the $L_{Aeq,16hr}$ daytime value, as evening noise levels would be lower, thus reducing the 16 hour average figure. This was measured at 5m from the kerbside, thus, as the proposed building is at 10m from the kerbside an attenuation of 3dB would apply, however, there would also be a façade correction of 3dB, the façade noise level would be 60dB.

Using the same glazing as proposed for railway noise, the sound attenuation would be slightly less at 28dB (R_w+C_{tr}) due to the larger component of low frequencies in traffic noise. After taking account of the composite façade sound reduction of 32dB, the internal noise levels in bedrooms/living rooms of first floor units 06 and 09, facing Caversham Road, would be 28dB which is less than the required 30dB.

Ventilation as proposed above for railway noise, would also be needed for all rooms on the south façade, facing Caversham Road.

External Noise

According to WHO Guidelines, noise in amenity areas should not exceed $L_{Aeq,16hr}$ of 50-55dB. This includes terraces and coutyards. The courtyard areas of Units 1, 2, 3, 4 and 5 are below ground level and therefore adequately screened from railway and traffic noise. The screening would provide an attenuation of at least 10dB, thus meeting the Guideline requirement of 50 to 55dB.

The terraces of Units 6, 7, 10, 11 and 12 are enclosed and therefore meet the external noise guideline requirement.

Internal sound insulation

In order to comply with Building Regulations Part E ‘Resistance to the passage of sound’, the sound insulation of party walls and floors have to meet minimum standards. For newly built flats, the airborne sound insulation of walls and floors between flats should not be less than $D_{nT,w}$+C_{tr} 45dB. In addition the impact sound insulation should be a maximum $L_{nT,w}$ +C_{tr} 62dB.

The sound insulation of the walls between flats and staircases should be at least $D_{nT,w}+C_{tr}$ 43dB and the sound insulation floors between flats and staircases should be at least $D_{nT,w}+C_{tr}$ 45dB.

Party walls should be of masonry construction and in order to meet the 45dB standard, should consist of cavity blockwork with a minimum 75mm air gap. The blocks should be 100mm wide and either lightweight (1350-1600 kg/m^3) or dense (1850-2300kg/m^3) with either 13mm render and plaster both sides or plasterboard (8kg/m^2) mounted on dabs on 8mm sand cement render on both sides. (A 8mm parge coat can be used instead of the sand cement render) The same construction detail applies to walls between the staircases and the flats. The addition of insulation to the cavity would increase the sound insulation by 3-5dB.

Metal or timber stud partitions could also be used for party wall construction and further details can be supplied if required.

Internal partitions between rooms within each flat, need to meet the Building Regulations sound insulation requirement of R_w 40dB. This would be achieved using 100mm blockwork plastered both sides. This standard would also be achieved using a single layer of plasterboard on timber or metal stud partitions with 25mm insulation in the cavity.

There is also a Building Regulations (E3) requirement to ensure that reverberation in common areas is reasonable. This applies to staircases, corridors and entrance halls used for common access. Reverberation is controlled by ensuring that the ceilings or staircase walls are covered with an area of Class C absorbent material, at least equivalent to the area of the floor. Most acoustic tiles meet this standard. In addition it is recommended that corridor floors are carpeted.

Vibration

The measured levels of vibration from trains were found to be below the annoyance level of $1mms^{-1}$ recommended in BS5228 and below the threshold levels of BS6472, where there would be a low probability of adverse comment. The estimated daytime level of $0.083m.s^{-1.75}$ was below the criterion of $0.2m.s^{-1.75}$ and the estimated night time level of $0.051m.s^{-1.75}$ was below the criterion of $0.13m.s^{-1.75}$.

7 CONCLUSION

Measures have been recommended that should enable the internal and external noise standards of BS8233 and WHO Guidelines to be achieved following the reconstruction of 42 Caversham Road.

Forms of construction have been described that will meet the sound insulation and reverberation requirements of Building Regulations Part E.

Figure 1: Noise measurement positions