Georgiana Street, London NW1 0QS

Bangor Wharf

Report to accompany planning application:

Environmental Noise & Vibration Report
Sharps Redmore

February 2017

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Report

Bangor Wharf, Camden, NW1 0QS

Environmental Noise and Vibration Planning Report

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1.0 Introduction

1.1 This report has been commissioned on behalf of One Housing Group for a mixed commercial and residential scheme on the land at Bangor Wharf, Georgiana Street, Camden, London, NW1 0QS. Sharps Redmore (SR) has been asked to help with the noise and vibration related issues of the application.

1.2 The scheme is proposed to encompass the "*Demolition of all buildings on-site and new buildings of 1-6 storeys in height to include 40 residential (C3) units (16 x 1 bed, 15 x 2 bed and 9 x 3 bed) of which 34 would be market units and 6 affordable, 813 sq.m (GEA), of new office floorspace (B1a), 55 sq.m (GEA) storage and distribution floorspace (B8) and associated works to highways and landscaping*".

1.3 This report assesses the noise and vibration affecting the site and recommends mitigation measures necessary to provide the required noise levels inside habitable rooms.

1.4 Automatic noise and vibration measurements were taken to establish the extent to which road traffic noise and potential distant rail traffic vibrations affect the site. The site is bounded by the Grand Union Canal to the North, St Pancras Way to the East, Georgiana Street to the South and residential dwellings to the West and Northwest.

1.5 An assessment of noise break-in, and required mitigation, has been undertaken using the survey results, the local authority's and national guidance standards. These assessments are based on typical room and window sizes and ventilation requirements, and are to be confirmed when final details have been developed. It is highly unlikely, however, that the recommendations will change significantly.

1.6 The report also sets limiting noise levels for mechanical services plant based on local authority's guidance.

1.7 A guide to the assessment methodology and criteria used within this report is included in section 2.0. Details of the noise survey to establish the existing noise climate is presented in section 3.0. Section 4.0 outlines the sound insulation requirements and specifications for the proposed building envelopes. Limiting noise levels for mechanical services plant is included in section 5.0. Section 6.0 provides details of the vibration survey undertaken and compares the results with those from the guidance criteria.

1.8 A guide to the acoustic terminology used in this report is displayed in Appendix A.

2.0 Assessment Methodology

Noise

Local Policy

2.1 The site lies within London Borough of Camden's (LBC) jurisdiction. LBC have strict noise and vibration criteria with regards to new schemes within their borough and this is detailed within their Development Policy 28 'Noise and Vibration' adopted in 2010. The entire text of DP28 can be found in Appendix B of this report.

National Policy

2.2 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 123 of the NPPF states the following:

Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of condition;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.3 The NPPF reinforces the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

> *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

2.4 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

2.5 These do not contain technical advice; however, there is the existence of technical design standards contained within the World Health Organisation Guideline Values and British Standard (BS) 8233:2014. These documents support the current national policy guidance contained within the NPPF and Noise Policy Statement for England 2010 (the WHO guidelines are specifically referenced in the Noise Policy Statement for England.)

2.6 Both the above documents focus on the achievement of acceptable living standards for future developments when the development is complete, rather than the PPG 24 approach that concentrated only on the open site external noise environment before development and before any mitigation measures are introduced.

2.7 The WHO guideline values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological, physiological or sociological effect. They are, as defined by the NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), but do not define the Significant Observed Adverse Effect Level (SOAEL). Compliance with the LOAEL should therefore, be seen as a robust aim.

2.8 The World Health Organisation LOAEL guideline values are summarised in the following table:

Value	Guidance	Location
L_{AeqT} = 55 dB	Few seriously annoyed, Daytime and evening.	Continuous noise, outdoor living areas
L_{AeqT} = 50 dB	Few moderately annoyed, Daytime and evening.	Continuous noise, outdoor living areas
L_{AeqT} = 35 dB	Acceptable level to avoid speech interference, daytime and evening.	Continuous noise, Dwellings, indoors
L_{AeqT} = 30 dB	To avoid sleep disturbance at night.	Continuous noise, Bedrooms, indoors
L_{AMAX} = 45 dB	To avoid sleep disturbance at night.	Noise peaks, Bedrooms, indoors

2.9 The national interpretation of the WHO guidelines is contained in BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'. BS 8233:2014 recommends the following. This recommends design to the following standard:

Activity	Location	Period	
		Day (0700 to 2300 hours)	Night (2300 to 0700 hours)
Resting	Living Room	35 dB $L_{Aeq16hr}$	-
Dining	Dining Room	40 dB $L_{Aeq16hr}$	
Sleeping	Bedroom	35 dB $L_{Aeq16hr}$	30 dB L_{Aeq8hr}

2.10 Combining the two sets of guidance would give the following design targets for new dwellings, which would represent compliance with the robust LOAEL:

Gardens	L_{AeqT}	=	55 dB
Living rooms	$L_{Aeq(day)}$	=	35 dB
Bedrooms	$L_{Aeq(day)}$	=	35 dB
	$L_{Aeq(night)}$	=	30 dB
	$L_{Amax(night)}$	=	45 dB

2.11 With regards to the night-time maximum level of 45 dBA, the WHO guidance states that this level should not be exceeded more than 10-15 times during the night period 2300-0700 hours.

2.12 This is considered a robust but balanced view in the context of current policy towards supporting residential development. These criteria have been discussed with a number of local authorities and have been considered robust design targets. Where a development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal targets may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

2.13 BS 8223:2014 considers outdoor areas and external amenity areas (gardens and patios) and the revision recognises that where design standards cannot be achieved for these traditional amenity spaces then the 'lowest practical levels' should be achieved. A robust aim would be to achieve the WHO guidelines for daytime, outdoor living areas, although in some developments these absolute limits may not be achievable.

2.14 The Planning Practice Guidance on Noise, published on planningportal.gov.uk, gives further consideration relating to mitigating the impact of noise on residential developments and considers that noise may be partially off-set if residents of the dwellings have access to:

- A relatively quiet façade (containing windows to habitable rooms as part of their dwelling;
- A relatively quiet external amenity space for their sole use such as a balcony which is generally considered as desirable;
- A relatively quiet nearby external space for use by a number of residents as part of the amenity of their dwellings, and/or;
- A relatively quiet external, publicly accessible amenity space that is nearby (e.g. within a 5 minute walk).

Changes in noise level

2.15 Changes in noise levels of less than 3 dBA are not perceptible under normal conditions and changes of 10 dBA are equivalent to a doubling of subjective loudness. This guidance has been accepted by inspectors, at inquiry, to encompass changes in noise levels in the index L_{AeqT}.

2.16 The following table shows the response to changes in noise (known as a semantic scale); this table has been developed from general consensus opinion of acousticians.

Response to a change in noise level

Change in noise level L_{AeqT} dB	Response	Impact
<3	Imperceptible	None
3 – 5	Perceptible	Slight/moderate
6 – 10	Up to a doubling	Moderate/significant
11 – 15	More than a doubling	Substantial
>15	-	Severe

2.17 Where the existing ambient noise level is already above the criteria developed from the various guidance documents, it may be considered unreasonable to adopt such criteria. It would be reasonable, however, given the above statement, to consider criteria which do not exceed the existing noise climate, thus giving rise to an overall 3 dB increase i.e. the minimum perceptible. If it is less than the minimum perceptible it cannot be described as disturbing or to affect the amenity of residents.

Assessment using BS 4142:2014

2.18 In BS 4142:2014 the scope of the Standard is quoted as describing "methods for rating and assessing sound of an industrial and/or commercial nature." This Standard compares the new resultant noise level with the baseline (existing) background noise level (L_{A90}).

2.19 The standard covers noise from industrial and manufacturing processes, noise from fixed installations which comprise mechanical and electrical plant and equipment, noise from loading and unloading of goods and materials at industrial and/or commercial premises and noise from mobile plant that is an intrinsic part of the overall sound emanating from premises or processes.

2.20 BS 4142 establishes the 'likely effects' as follows:

i) Establish the background noise levels in terms of the index L_{A90} at the receptor locations of interest;

ii) Establish the specific noise level of the source being assessed, in terms of L_{AeqT} (T = 1 hour for day or 15 minutes for night) at the receptor location of interest;

iii) Add a correction factor to the specific noise level if the source noise contains certain acoustic features (tonality, impulsiveness, intermittency). The resultant noise level is called the rating noise level; and

iv) Compare the rating noise level with the background noise level; the greater the difference between the two, the greater the magnitude of the impact. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on context. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context. Where the rating level does not exceed the background level, this is an indication of the specific sound having a low impact, depending on the context.

2.21 The general intent of the planning system is to ensure that a development does not result in "significant environmental impact". The avoidance of significant impact is achieved, in our judgement, by compliance with the BS 4142 criterion of +10 dB. However, in order to reduce the level further in the circumstances of this case, it is considered that a criterion where the noise equals the background would be more appropriate and in the context of the relatively quiet urban acoustic environment, this target should ideally be sought.

2.22 However, LBC's DP28 states that where plant does not exhibit any tonality or impluses, the plant noise criterion is more onerous still, compared to 2.21 and requires that plant be controlled to 5 dBA below background. This onerous requirement is due to DP28 having been devised and implemented before BS 4142:2014 was published.

Vibration

2.23 For vibration dose value (VDV), BS 6472-1:2008 provides guidance on the vibration in buildings with respect to human annoyance or complaints about interference with activities. VDVs relate to the levels of vibration of an event and the number of occurrences of events in a period of time. For residential buildings, BS 6472-1:2008 states, in Section 6, the following VDV ranges which might result in various probabilities of adverse comment:

Table of BS 6472-1:2008 VDV Criteria for Residential Buildings

Vibration Dose Value ranges ($m/s^{1.75}$) which might result in various probabilities of adverse comment within residential buildings			
Place and Time	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hour night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

2.24 BS 6472-1:2008 states that "*These values ….. may be used for both vertical and horizontal vibration*" and explains they are "*presented as ranges rather than discrete values* [due to] *the widely differing susceptibility to vibration evident among members of the population* [and] *the differing expectations of the vibration environment*".

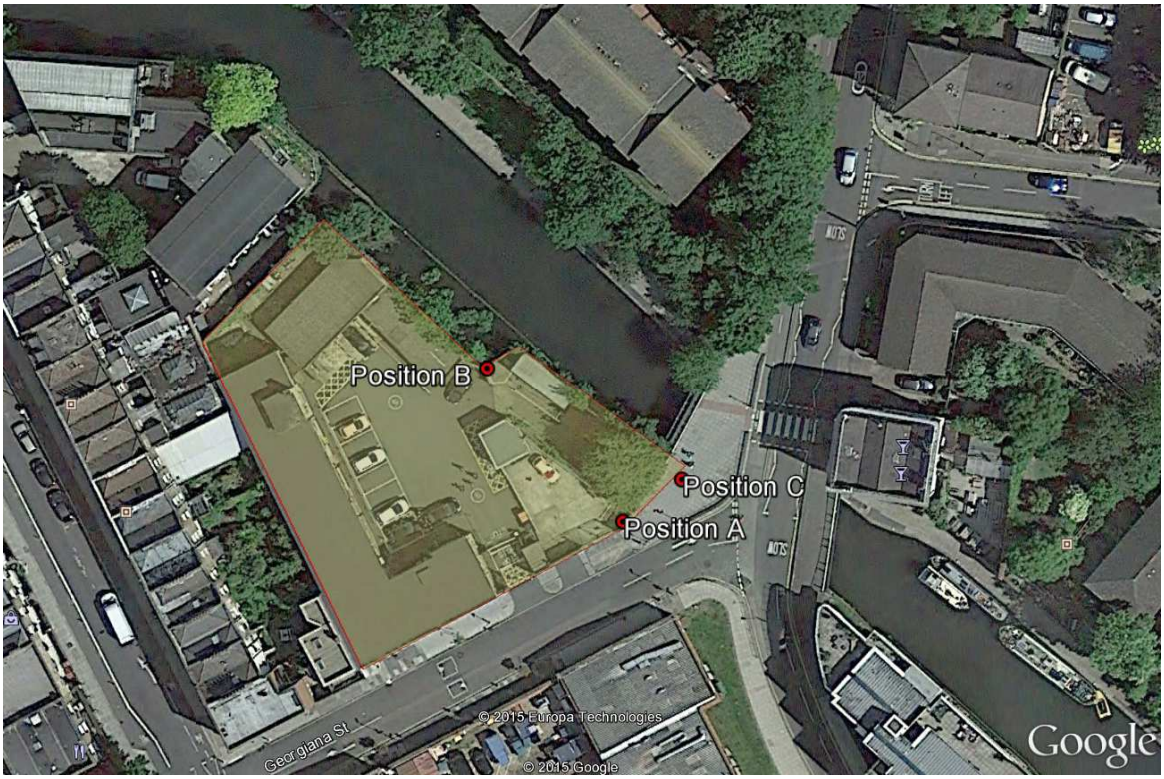
2.25 This assessment uses the lower value of each criteria range to be robust. This also ties in with LBC's DP28 criteria in 'Table C' (Appendix B).

3.0 Noise Survey Details

3.1 An unmanned noise survey of existing environmental noise levels was carried out between Friday 23rd and Monday 26th October 2015 at two monitoring locations shown in Figure 1. The data was used to establish the worst case daytime and night-time ambient dB $L_{Aeq(16hrs)}$ and dB $L_{Aeq(8hrs)}$ noise levels and typical night-time maximum L_{Amax} levels, in addition to being representative of the typical background dB L_{A90} noise levels at adjacent noise sensitive properties.

3.2 Monitoring Position A was located approximately 2.5 metres above street level and approximately 7 metres from the centre of Georgiana Street and 18 metres from the centre of St Pancras Way. Monitoring Position B was located approximately 2.5 metres above ground level and approximately 27 metres Northwest of Position A, overlooking the canal.

Figure 1: Monitoring locations

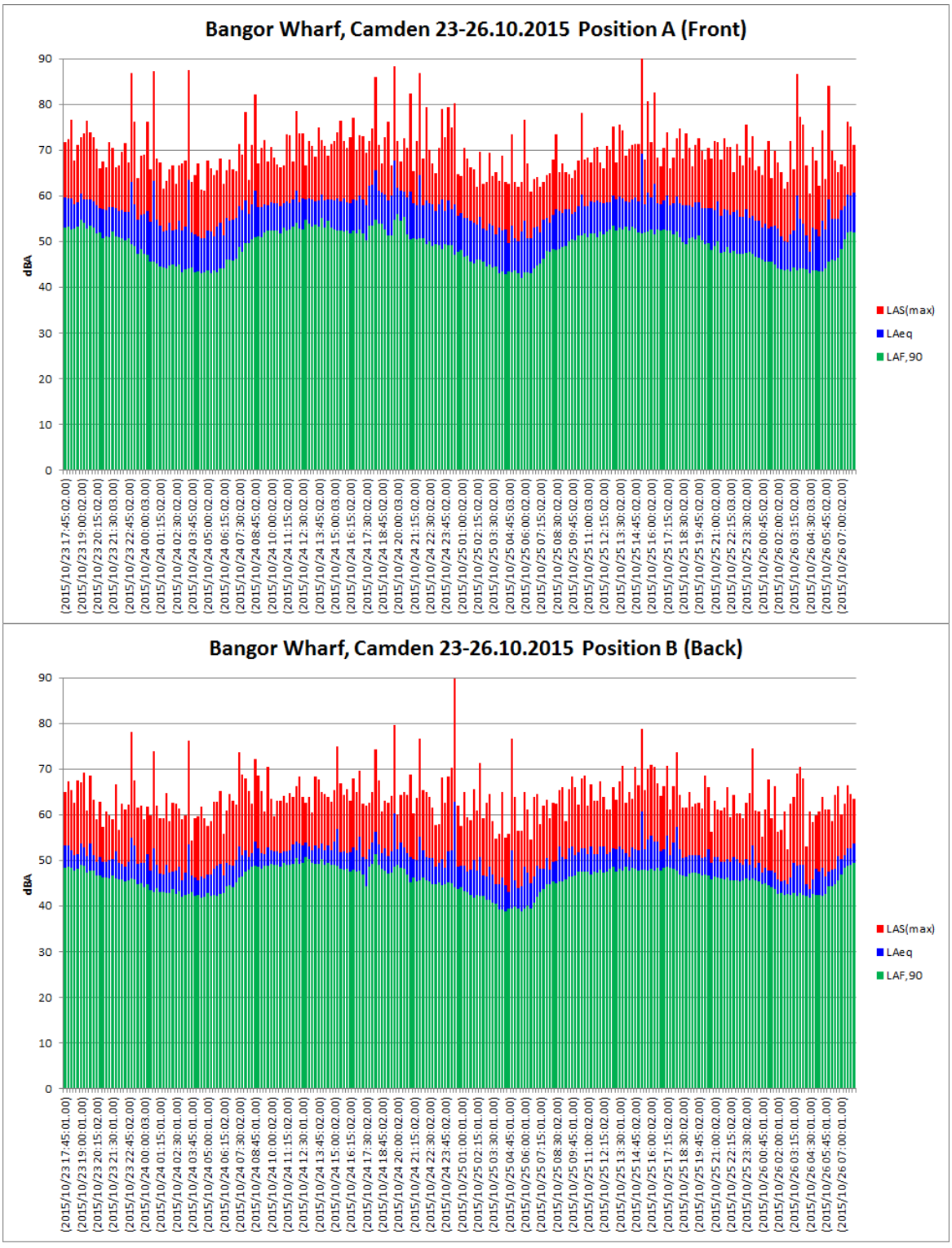


3.3 The weather throughout the survey was clear and dry, except for Monday morning, upon collection of equipment, the weather was overcast with some intermittent drizzle. Wind conditions on all four days were less than 5 mph. Weather conditions were considered suitable for carrying out sound level measurements.

3.4 The measurements were taken using two Norsonic 140, Class 1 precision sound level meters. The sound level meters were calibrated at the start and end of the survey and showed no significant drifts, and have full traceable calibration histories. Sound level measurements were taken automatically at fifteen minute samples over the duration of the survey. Measurements at both Positions A and B were taken in free field conditions.

3.5 The ambient dB $L_{Aeq(5min)}$, background dB $L_{A90(5min)}$ and maximum dB $L_{Afmax(5min)}$ noise levels were recorded during the survey and the results are provided for both positions in Figure 2. Note: although the survey was setup and picked up at 11am on both the Friday and Monday, other onsite surveys were simultaneously being undertaken which knowingly affected the acoustic survey; therefore measurements before 17:30 on the Friday and after 08:15 on the Monday have been omitted from the results and assessments.

Figure 2: Noise Survey Results



3.6 Table 5 summarises the survey results for daytime and night-time ambient dB $L_{Aeq(16hrs)}$ and $L_{Aeq(8hrs)}$, typical background dB $L_{A90(15min)}$ and typical maximum dB $L_{ASmax(15min)}$ noise levels at the site.

Table 5: Survey measurement summary (dB re 20μPa)

Position	Daytime $L_{Aeq,16hrs}$ (dB)	Night-time $L_{Aeq,8hrs}$ (dB)	Typical Background $L_{A90,15mins}$ (dB)	Typical Night-time L_{ASmax}* (dB)
A	59	55	46	76
B	53	50	43	69

* Typical recorded maximum levels not exceeded 10-15 times across each night-time survey period.

3.7 Table 6 provides the octave band levels for the proposed development, which have been used as part of the sound insulation assessment for the residential units.

Table 6: Octave Band Linear Frequency Spectra

Position	**Parameter**	**Octave Band Centre Frequency Hz**								**dBA**
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Position A	Day dB L_{eq}	64	60	57	54	56	52	45	39	**59**
	Night dB L_{eq}	59	57	51	50	52	47	38	40	**55**
	Night typical dB L_{Smax}	79	73	69	71	73	68	62	61	**76**
Position B	Day dB L_{eq}	60	57	52	49	48	44	38	31	**53**
	Night dB L_{eq}	55	51	47	44	45	43	37	33	**50**
	Night typical dB L_{Smax}	70	66	63	60	66	62	57	53	**69**

4.0 Sound Insulation Requirements of the Building Envelope

4.1 The minimum airborne sound reduction performance of the envelope building elements are given ahead in terms of a weighted single figure R_W and octave band 'R' values for specification purposes.

4.2 Suitable products shall provide evidence of compliance in accordance with BS EN ISO 10140/2:2010 and rated in accordance with BS EN ISO 717/1:1997, or equivalent or superseded version of the standard.

4.3 The façades as a whole need to achieve a sufficient sound insulation performance against road traffic and measured environmental noise.

Façade

4.4 It is not known if the wall elements of the façade are to be a lightweight 'Metsec' system or heavyweight blockwork. If lightweight external wall constructions are proposed, careful design and attention will be required and there could be a requirement to include additional layer(s) of cement board to safeguard the sound insulation properties of the façades. Regardless, the systems must meet the minimum sound insulation requirements detailed in Table 8 (See 4.8 for extents of Systems).

Table 8: External wall specification to all rooms

System	Octave band centre frequency Hz - R dB						
	63	125	250	500	1k	2k	4k
Type I	27	32	33	47	49	50	61
Type II	20	25	25	34	45	51	46

Roof

4.5 To control noise ingress to the top floor rooms from rain and to a lesser extent road noise, the roof combined with the ceilings to the top floor bedrooms should provide a sound reduction of at least 50 dB R_W.

Window Systems

4.6 The window systems must be considered as the glazing arrangements, seals and frames combined.

4.7 The chosen window systems should achieve the minimum sound reduction index octave bands as detailed in Table 9.

Table 9: Window system specification

System	R dB Octave band centre frequency Hz					
	125	250	500	1k	2k	4k
Type I - (Red-Hashed Line)	30	28	37	39	40	51
Type II - (Blue Lines)	23	20	24	35	41	36

4.8 The extent of each System Type above, across all elevations are depicted below:
(note that although the below figure depicts the First Floor Level, the extents of the proposed facades [i.e. the pattern] will apply to all floors 1-5):

4.9 The above sound insulation requirements are the overall performances for the window systems (including frame, seal and glass). The manufacturer will need to have laboratory test data to demonstrate that the window system as a whole achieves the requirements. This includes any proposed large glazed sliding doors onto balconies etc.

4.10 The window system specifications have been driven by the night-time maximum levels (L_{AFmax}) across all elevations. As would be expected, the elevations which overlook St Pancras Way and Georgiana Street are particularly affected by road traffic noise. Full calculations of the proposed window and façade systems for daytime and night-time ambient and maximum noise levels can be found in Appendix C.

4.11 Typical elements which could meet the window system specifications given in Table 9 would be comparable to glazing comprising:

- System Type I: Acoustic Double Glazing; 8.8mm (laminate glazing) - 12mm (cavity) - 10mm (glazing)
- System Type II: Thermal Double Glazing; 4mm (glazing) - 12mm (cavity) - 6mm (glazing)

4.12 The specification in terms of the window system relates to acoustic requirements only. Thicker glass or larger air gaps may be required for structural and thermal reasons, which would offer improved acoustic performance.

4.13 If opaque infill glazing panels are to be used these are likely to require to be lined internally with a double acoustic plasterboard layer and insulation to the cavity to ensure that the overall required façade performance is achieved.

4.14 Where large openable/sliding balcony windows/doors are proposed, careful selection of window systems will be required for Type I systems. Simple and typically installed brush seals are ineffective for these high noise insulation requirements and will most likely require a robust compressible seal system.

Ventilation

4.15 Based on the noise levels measured outside, natural ventilation by means of open windows would not achieve the required internal noise criteria where System I has been specified. An open window provides around a 10-15 dB reduction in external noise levels resulting in levels considerably above the proposed internal criteria. Normal ventilation will therefore, have to be provided by alternative methods; either mechanical or acoustically treated trickle and through wall/frame vent systems.

4.16 If natural vents are to be utilised, these would need to provide the following minimum sound reduction specification (D_{ne}) when open (note: the overall $D_{ne'w}$ value is simply an overall indicator, the octave band frequencies is the actual specification):

Octave band centre frequency, Hz	D_{ne} Octave band centre frequency Hz						Indication of typical system:
	125	250	500	1000	2000	4000	
Type A (All Type I Window Systems)	35	35	35	37	38	45	Through wall/frame ventilator $D_{ne}'_{w}$ 43
Type B (All Type II Window Systems)	31	34	35	35	31	32	Trickle ventilator $D_{ne}'_{w}$ 33

4.17 Ensure trickle-ventilation systems offered in relation to the specifications are capable of meeting the requirements in their OPEN condition, as some manufacturers offer data with the units CLOSED, which are of no practical use.

5.0 Mechanical Services Plant

5.1 Should there be a need to include certain items of mechanical services plant as part of this development for potential ventilation or heat recovery purposes, the noise level of these items will need to be controlled to preserve the amenity of existing residential and other noise sensitive properties.

5.2 In order to meet the requirement within Section 2.22, the noise from the combined plant would need to be controlled to a maximum level of 38 dB $L_{Aeq,(5mins)}$ at 1m from the nearest noise sensitive façade(s); which is 5 dBA less than the existing measured typical background noise levels during the night-time.

5.3 The exact details of internal mechanical services, if any, are to be refined during the design phases of the scheme. It is anticipated that internal noise levels due to mechanical services, will be designed and controlled to appropriate NR levels to ensure compliance with appropriate guidelines.

6.0 Vibration

6.1 VDV vibration levels were measured during the same period as the noise survey in 3.0 and at measurement Position C (Figure 1 in 3.2). The measurements were taken over 5-min periods throughout the 72-hr survey. Measurements were taken using a Rion VM-54 Digital Recorder with attached 3-axes accelerometer unit. The meter has full calibration histories.

6.2 The accelerometer was placed directly on the heavy stone slabs within an old viaduct storage room directly below Gray's in Bridge (St Pancras Way). The measurement location was chosen to provide a dense topography on which to potentially pick up vibrations from the distant overground and underground train lines; these were approximately 125m to the North (overground train lines) and approximately 450m West (Northern Line, underground train).

6.2 For VDV levels, the results of the worst-case 16-hour day and 8-hour night periods are provided in the following table for each axes:

Worst-Case Vibration Dose Value ($m/s^{1.75}$)			
Axes	X	Y	Z
16 hour day	0.00	0.01	0.01
8 hour night	0.00	0.01	0.01

6.3 The above demonstrates that VDV vibrations at this site fall comfortably below the criteria of 0.2 $m/s^{1.75}$ for the daytime and 0.1 $m/s^{1.75}$ for the night-time and vibration is therefore not considered to be an issue at the site.

7.0 Conclusions

7.1 An environmental noise survey has been conducted and the noise climate at the site has been established.

7.2 The environmental noise survey proposes internal noise level criteria in line with the local authority and accepted national guidance and British Standards' requirements, together with design specifications to reduce internal noise levels.

7.3 Specifications have been provided for the airborne sound reduction performance of the proposed building's various envelope elements necessary to achieve the required internal levels.

7.4 Maximum noise limits from combined mechanical services plant at the nearest sensitive receiver have been specified so as to minimise adverse noise impacts, in accordance with the local authority's criterion.

7.5 The nearest train line is not visible and at an extensive distance (125+ metres), however for completeness, a vibration survey has been conducted and the vibration climate at the site has been measured.

7.6 Vibration levels have been assessed in accordance with local authority's criteria, which itself is based on British Standard BS 6472-1:2008 VDV levels. It is concluded that levels of vibration are not considered to be an issue at the site.

APPENDIX A

ACOUSTIC TERMINOLOGY

Acoustic Terminology

A1 Noise, defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. 50 dB + 50 dB = 53 dB. Increases in continuous sound are perceived in the following manner:

1 dB increase - barely perceptible

3 dB increase - just noticeable

10 dB increase - perceived as twice as loud

A2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.

A3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).

A4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p. Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p.

A5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.

A6 The main noise indices in use in the UK are:

L_{A90}: The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.

L_{Aeq}: The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.

L_{A10}: The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

$L_{AMAX:}$ The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

A7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB}.$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

A8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \text{ Log } {}^{160}/_{10} = 60 - 24 = 36 \text{ dB}.$$

VIBRATION

A9 Vibration Velocity and Acceleration: Vibration in terms of velocity or acceleration is usually used to assess the effect of vibration on people or structures. Vibration amplitude can be expressed as an absolute value (e.g. in the case of velocity 1 mm/s or in the case of acceleration 1 mm/s2) or as a ratio on a logarithmic scale in decibels.

APPENDIX B

LBC's Development Policy 28 'Noise and Vibration'

DP28. Noise and vibration

28.1 Noise and vibration can have a major effect on amenity and health and therefore quality of life. Camden's high density and mixed-use nature means that disturbance from noise and vibration is a particularly important issue in the borough. Camden's Core Strategy recognises the importance of this issue for Camden's residents and policy DP28 contributes to implementing a number of Core Strategy policies, including CS5 – *Managing the impact of growth and development*, CS9 – *Achieving a successful Central London*, CS11 – *Promoting sustainable and efficient travel* and CS16 – *Improving Camden's health and well-being*.

DP POLICY

DP28 – Noise and vibration

The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:

a) development likely to generate noise pollution; or

b) development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.

The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.

28.2 The effect of noise and vibration can be minimised by separating uses sensitive to noise from development that generates noise and by taking measures to reduce any impact. Noise sensitive development includes housing, schools and hospitals as well as offices, workshops and open spaces, while noise is generated by rail, road and air traffic, industry, entertainment (e.g. nightclubs, restaurants and bars) and other uses.

28.3 The Council will only grant planning permission for development sensitive to noise in locations that experience noise pollution, and for development likely to generate noise pollution, if appropriate attenuation measures are taken, such as double-glazing. Planning permission will not be granted for development sensitive to noise in locations that have unacceptable levels of noise. Where uses sensitive to noise are proposed close to an existing source of noise or when development that generates noise is proposed, the Council will require an acoustic report to ensure compliance with PPG24: *Planning and noise*. A condition will be imposed to require that the plant and equipment which may be a source of noise pollution is kept working efficiently and within the required noise limits and time restrictions. Conditions may also be imposed to ensure that attenuation measures are kept in place and effective throughout the life of the development.

28.4 In assessing applications, we will have regard to the Noise and Vibration Thresholds, set out below. These represent an interpretation of the standards in PPG24 and include an evening period in addition to the day and night standards contained in the PPG, which provide a greater degree of control over noise and vibration during a period when noise is often an issue in the borough.

Table A: Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	74 dB L_{Aeq},12h	72 dB L_{Aeq},12h
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	74 dB L_{Aeq},4h	72 dB L_{Aeq},4h
Noise at 1 metre external to a sensitive façade	Night	2300-0700	66 dB L_{Aeq},8h	66 dB L_{Aeq},8h

Table B: Noise levels on residential streets adjoining railways and roads at and above which attenuation measures will be required

Noise description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	65 dB L_{Aeq},12h	62 dB L_{Aeq},12h
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	60 dB L_{Aeq},4h	57 dB L_{Aeq},4h
Noise at 1 metre external to a sensitive façade	Night	2300-0700	55 dB L_{Aeq},1h	52 dB L_{Aeq},1h
Individual noise events several times an hour	Night	2300-0700	>82 dB L_{Amax} (S time weighting)	>82 dB L_{AMAX} (S time weighting)

Table C: Vibration levels on residential sites adjoining railways and roads at which planning permission will not be granted

Vibration description and location of measurement	Period	Time	Vibration levels
Vibration inside critical areas such as a hospital operating theatre	Day, evening and night	0000-2400	0.1 VDV ms-1.75
Vibration inside dwellings	Day and evening	0700-2300	0.2 to 0.4 VDV ms-1.75
Vibration inside dwellings	Night	2300-0700	0.13 VDV ms-1.75
Vibration inside offices	Day, evening and night	0000-2400	0.4 VDV ms-1.75
Vibration inside workshops	Day, evening and night	0000-2400	0.8 VDV ms-1.75

Where dwellings may be affected by ground-borne regenerated noise internally from, for example, railways or underground trains within tunnels, noise levels within the rooms should not be greater than 35dB(A)max

Table D: Noise levels from places of entertainment on adjoining residential sites at which planning permission will not be granted

Noise description and measurement location	Period	Time	Sites adjoining places of entertainment
Noise at 1 metre external to a sensitive façade	Day and evening	0700-2300	L_{Aeq}, 5m shall not increase by more than 5dB*
Noise at 1 metre external to a sensitive façade	Night	2300-0700	L_{Aeq}, 5m shall not increase by more than 3dB*
Noise inside any living room of any noise sensitive premises, with the windows open or closed	Night	2300-0700	L_{Aeq}, 5m (in the 63Hz Octave band measured using the 'fast' time constant) should show no increase in dB*

* As compared to the same measure, from the same position, and over a comparable period, with no entertainment taking place

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dBL_{Aeq},

Key evidence and references

- Camden's Noise Strategy, 2002
- The London Plan (Consolidated with Alterations since 2004), 2008
- Planning Policy Guidance 24: Planning and noise

APPENDIX C

External Building Fabric Calculations

Northwest and West Elevations

Project name			Room width	2.5 m		Wall	2.94 m^2			
Bangor Wharf, Camden			Room length	5 m		Glazing	4.6 m^2			
			Room height	2.4 m						
Source type:			Room volume	30.0						
LSmax Night										
	Parameter	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**A'**
Source noise level (dB lin)	LSmax	70	66	63	60	66	62	57	53	69
Wall	SRI	20	25	25	34	45	51	46	46	
Glazing (4-16-4 Thermal Double)	SRI	18	23	20	24	35	41	36	36	
Vent (Titon *Trimvent Select R16)*	Dne	32	31	34	35	35	31	32	37	
Wall contribution		55	46	43	31	26	16	16	12	37
'A' Weighted		29	30	34	28	26	17	17	11	
Glazing contribution		59	50	50	43	38	28	28	24	45
'A' Weighted		33	34	41	40	38	29	29	23	
Vent contribution		48	45	40	35	41	42	35	26	46
'A' Weighted		22	29	31	32	41	43	36	25	
Total from all contributions		60	52	51	43	43	42	36	28	
RT (seconds) Bedroom		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room correction		-4	-4	-4	-4	-4	-4	-4	-4	
Total		**57**	**48**	**47**	**40**	**39**	**38**	**32**	**24**	
'A' Weighted		31	32	38	37	39	39	33	23	**45**

Project name			Room width	2.5 m		Wall	2.94 m^2			
Bangor Wharf, Camden			Room length	5 m		Glazing	4.6 m^2			
			Room height	2.4 m						
Source type:			Room volume	30.0						
Leq Night										
	Parameter	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**A'**
Source noise level (dB lin)	Leq	55	51	47	44	45	43	37	33	50
Wall	SRI	20	25	25	34	45	51	46	46	
Glazing (4-16-4 Thermal Double)	SRI	18	23	20	24	35	41	36	36	
Vent (Titon *Trimvent Select R16)*	Dne	32	31	34	35	35	31	32	37	
Wall contribution		40	31	27	15	5	-3	-4	-8	21
'A' Weighted		14	15	18	12	5	-2	-3	-9	
Glazing contribution		44	35	34	27	17	9	8	4	29
'A' Weighted		18	19	25	24	17	10	9	3	
Vent contribution		33	30	24	19	20	23	15	6	27
'A' Weighted		7	14	15	16	20	24	16	5	
Total from all contributions		45	37	35	27	22	23	16	8	
RT (seconds) Bedroom		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room correction		-4	-4	-4	-4	-4	-4	-4	-4	
Total		**42**	**33**	**31**	**24**	**18**	**19**	**12**	**4**	
'A' Weighted		16	17	22	21	18	20	13	3	**27**

Project name			Room width	2.5 m		Wall	2.94 m^2			
Bangor Wharf, Camden			Room length	5 m		Glazing	4.6 m^2			
			Room height	2.4 m						
Source type:			Room volume	30.0						
Leq Day										
	Parameter	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**A'**
Source noise level (dB lin)	Leq	60	57	52	49	48	44	38	31	53
Wall	SRI	20	25	25	34	45	51	46	46	
Glazing (4-16-4 Thermal Double)	SRI	18	23	20	24	35	41	36	36	
Vent (Titon *Trimvent Select R16)*	Dne	32	31	34	35	35	31	32	37	
Wall contribution		45	37	32	20	8	-2	-3	-10	26
'A' Weighted		19	21	23	17	8	-1	-2	-11	
Glazing contribution		49	41	39	32	20	10	9	2	33
'A' Weighted		23	25	30	29	20	11	10	1	
Vent contribution		38	36	29	24	23	24	16	4	29
'A' Weighted		12	20	20	21	23	25	17	3	
Total from all contributions		50	43	40	32	25	24	17	6	
RT (seconds) Bedroom		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room correction		-4	-4	-4	-4	-4	-4	-4	-4	
Total		**47**	**39**	**36**	**29**	**21**	**20**	**13**	**2**	
'A' Weighted		21	23	27	26	21	21	14	1	**32**

Northeast, East and South Elevations

Project name			Room width	2.5	m	Wall	2.94	m^2		
Bangor Wharf, Camden			Room length	5	m	Glazing	4.6	m^2		
			Room height	2.4	m					
Source type:			Room volume	30.0						
LSmax Night										
	Parameter	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**A'**
Source noise level (dB lin)	LSmax	79	73	69	71	73	68	62	61	76
Wall	SRI	27	32	33	47	49	50	61	61	
Glazing (8.8-12-10 Acoustic)	SRI	25	30	28	37	39	40	51	51	
Vent (Titon Through Frame)	Dne	28	30	30	40	40	47	47	50	
Wall contribution		57	46	41	29	29	23	6	5	37
'A' Weighted		31	30	32	26	29	24	7	4	
Glazing contribution		61	50	48	41	41	35	18	17	45
'A' Weighted		35	34	39	38	41	36	19	16	
Vent contribution		61	53	49	41	43	31	25	21	47
'A' Weighted		35	37	40	38	43	32	26	20	
Total from all contributions		65	55	52	44	45	36	26	22	
RT (seconds) Bedroom		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room correction		-4	-4	-4	-4	-4	-4	-4	-4	
Total		**61**	**51**	**48**	**40**	**41**	**33**	**22**	**19**	
'A' Weighted		35	35	39	37	41	34	23	18	**45**

Project name			Room width	2.5	m	Wall	2.94	m^2		
Bangor Wharf, Camden			Room length	5	m	Glazing	4.6	m^2		
			Room height	2.4	m					
Source type:			Room volume	30.0						
Leq Night										
	Parameter	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**A'**
Source noise level (dB lin)	Leq	59	57	51	50	52	47	38	40	55
Wall	SRI	27	32	33	47	49	50	61	61	
Glazing (8.8-12-10 Acoustic)	SRI	25	30	28	37	39	40	51	51	
Vent (Titon Through Frame)	Dne	28	30	30	40	40	47	47	50	
Wall contribution		37	30	23	8	8	2	-18	-16	18
'A' Weighted		11	14	14	5	8	3	-17	-17	
Glazing contribution		41	34	30	20	20	14	-6	-4	26
'A' Weighted		15	18	21	17	20	15	-5	-5	
Vent contribution		41	37	31	20	22	10	1	0	27
'A' Weighted		15	21	22	17	22	11	2	-1	
Total from all contributions		45	39	34	23	24	15	2	1	
RT (seconds) Bedroom		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room correction		-4	-4	-4	-4	-4	-4	-4	-4	
Total		**41**	**35**	**30**	**19**	**20**	**12**	**-2**	**-2**	
'A' Weighted		15	19	21	16	20	13	-1	-3	**26**

Project name			Room width	2.5	m	Wall	2.94	m^2		
Bangor Wharf, Camden			Room length	5	m	Glazing	4.6	m^2		
			Room height	2.4	m					
Source type:			Room volume	30.0						
Leq Day										
	Parameter	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**A'**
Source noise level (dB lin)	Leq	64	60	57	54	56	52	45	39	59
Wall	SRI	27	32	33	47	49	50	61	61	
Glazing (8.8-12-10 Acoustic)	SRI	25	30	28	37	39	40	51	51	
Vent (Titon Through Frame)	Dne	28	30	30	40	40	47	47	50	
Wall contribution		42	33	29	12	12	7	-11	-17	23
'A' Weighted		16	17	20	9	12	8	-10	-18	
Glazing contribution		46	37	36	24	24	19	1	-5	30
'A' Weighted		20	21	27	21	24	20	2	-6	
Vent contribution		46	40	37	24	26	15	8	-1	32
'A' Weighted		20	24	28	21	26	16	9	-2	
Total from all contributions		50	42	40	27	28	20	9	0	
RT (seconds) Bedroom		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Room correction		-4	-4	-4	-4	-4	-4	-4	-4	
Total		**46**	**38**	**36**	**23**	**24**	**17**	**5**	**-3**	
'A' Weighted		20	22	27	20	24	18	6	-4	**31**