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THE RAILWAY, WEST HAMPSTEAD

ACOUSTIC PLANNING REPORT

02/12/2013

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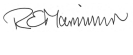
Signature	 Marriner, Robert AUTHOR 2013.12.02 17:21:48 Z			
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THE RAILWAY, WEST HAMPSTEAD

ACOUSTIC PLANNING REPORT

02/12/2013

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1 Introduction

A redevelopment/refurbishment project is proposed at 100 West End Lane, to provide office and residential accommodation across three floors of an existing building. The ground and basement floors of the building are occupied by a public house, which will remain.

WSP Acoustics has been appointed to provide advice relating to the acoustic aspects of the project which, at the planning stage, includes the following:

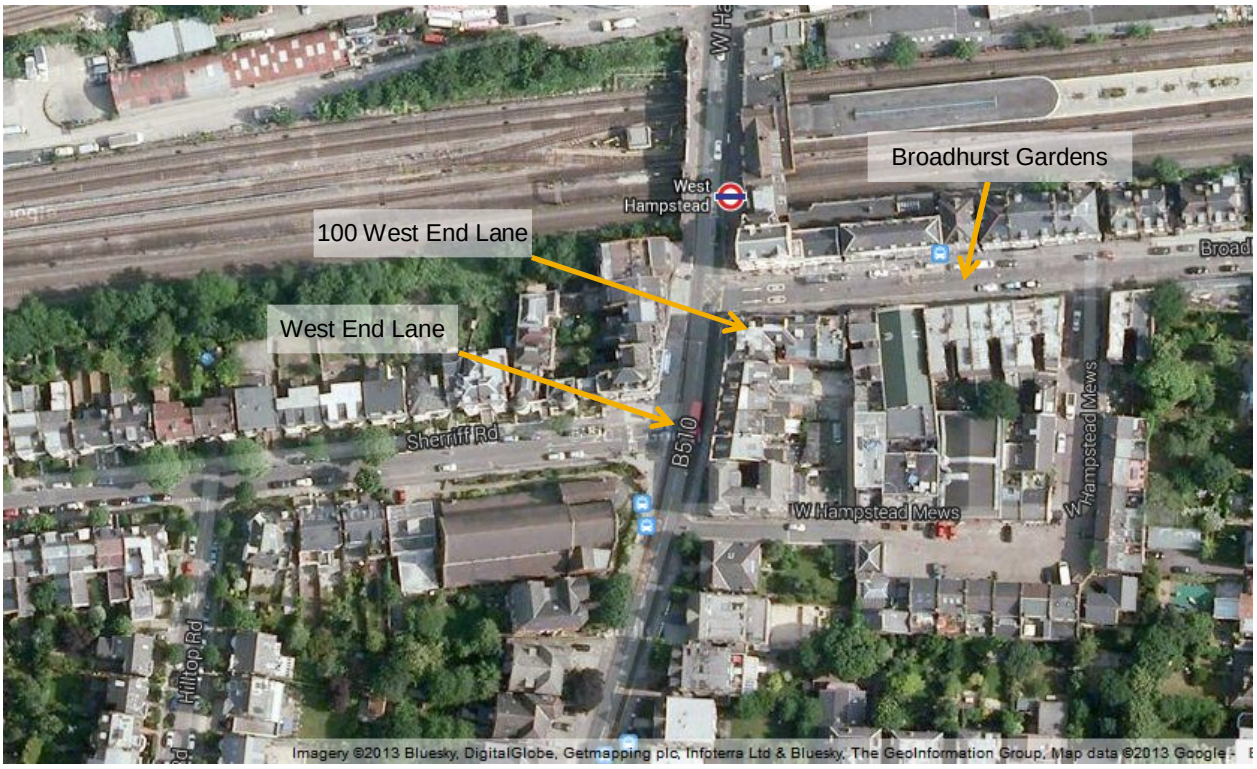
- Atmospheric noise emissions from new proposed building services plant serving the pub's kitchen, offices and residential accommodation
- Controlling ambient noise levels inside the proposed dwellings, including contributions from existing ambient noise sources, and events held in the ground floor public house
- Existing sources of vibration present at the site

This report presents the methods and findings of surveys and assessments undertaken to investigate the above points. A glossary of technical terminology is provided in Appendix A.

2 Site Description

100 West End Lane lies within the London Borough of Camden (LBC). The site is located in a mixed residential and commercial area on the corner of Broadhurst Gardens and West End Lane, as shown in Figure 1. The site is in close proximity to West Hampstead underground and rail station. *The Railway* public house operates between 11:00 – 23:00 Monday to Friday, 11:00 – 24:00 hours on Saturdays and 12:00 – 22:30 on Sundays.

Figure 1: Plan showing site location



3 Environmental Noise Survey

Two environmental noise surveys have been undertaken at 100 West End Lane in connection with the current proposals for redevelopment. The first was undertaken by Hepworth Acoustics in March 2012, as detailed in their report 31119.1v1 issued in May 2012.

This has since been supplemented by an additional survey undertaken by WSP Acoustics, as described below. The results of both surveys have been used in the assessments detailed herein.

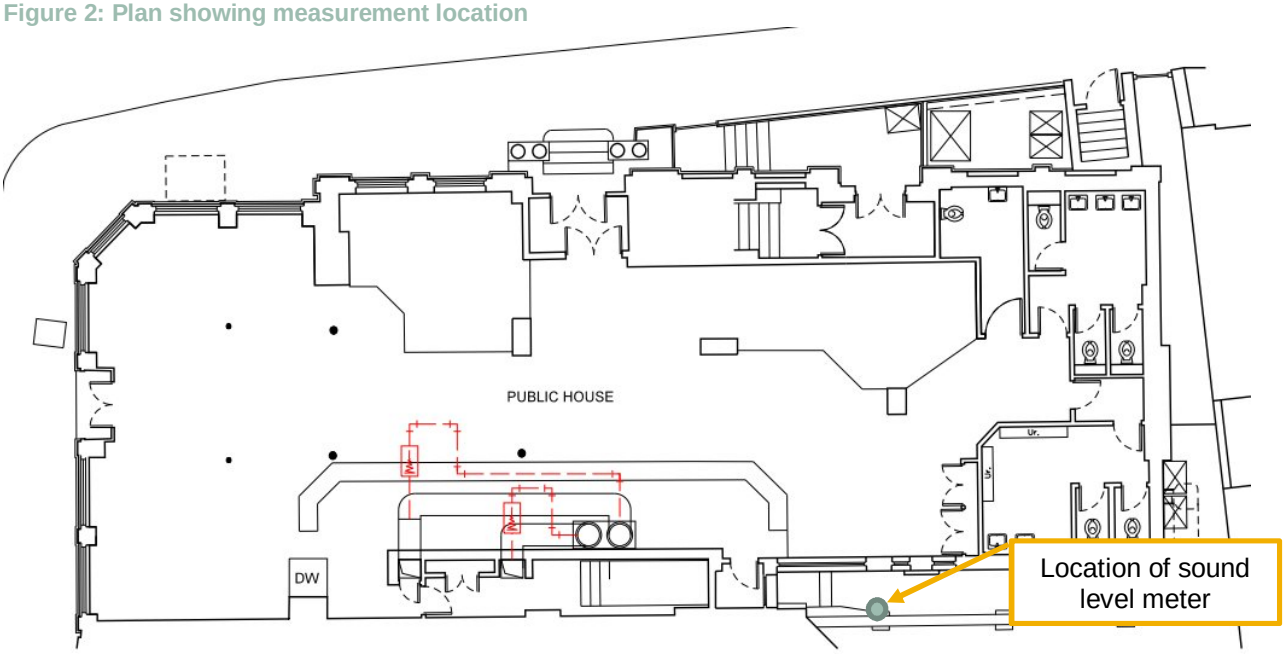
3.1 Method

An un-attended environmental noise survey was undertaken from approximately 14:00 on Tuesday 30th April 2013 to 14:00 on Wednesday 1st May 2013, to determine the lowest noise levels at noise sensitive windows near to the proposed plant area.

The sound level meter was installed at ground floor level at the rear of the site; the microphone was tripod mounted 1.5 metres above the ground, approximately 1 metre from reflective surfaces. This location was chosen to avoid any contribution from existing plant currently installed.

The location used for the survey can be seen in Figure 2 below and the annotated photograph in Appendix B.

Figure 2: Plan showing measurement location



The measurement location was selected to obtain representative measurements of the lowest background noise levels present at the nearby noise sensitive property, and the typical ambient noise levels at the rear of 100 West End Lane for subsequent use in specifying the glazing and ventilation strategy for the proposed dwellings.

3.1.1 Equipment Details

Details of the equipment used to undertake the environmental noise survey are presented in the table below.

Table 1 Equipment calibration details

Equipment description	Manufacturer and model	Serial number
Sound level meter	Svantek Hand-held Noise and Vibration Analyser Type 948	6534
Pre-amplifier	Svantek Pre-amplifier Type SV12L	10673
Microphone	Svantek Pre-polarised Condenser Microphone Model: SV22	4010518

The sound level meter had been calibrated to traceable standards within the preceding two years, and the acoustic calibrator within the preceding 12 months.

The sound level meter was located inside a weatherproof case and connected to its microphone via an extension cable. The microphone was tripod mounted at 1.5 meters above the ground level and at least 1 meter from reflecting surfaces; this is considered to be free field conditions.

The entire signal chain, including cable, was calibrated prior to, and on completion of, the survey. No significant deviations were found to have occurred.

The microphone was fitted with a Svantek windshield.

3.1.2 Weather Conditions & Noise Climate

At the beginning and end of the survey, the weather was fine and dry. Available historical information shows that the weather during the survey was dry throughout the survey period.

The environmental noise climate on the north and west sides of the site is dominated by road traffic noise from West End Lane and Broadhurst Gardens. The rear of the pub has a service access road with car parking spaces accessible off West Hampstead Mews. The noise levels in this area are considerably lower than the front due to lack of direct traffic noise from West End Lane which is screened by the building itself and neighbouring buildings.

3.1.3 Results

The full results of the environmental noise surveys are presented in the time history graphs in Appendix C.

3.1.3.1 Ambient Noise Levels

Based on the results of the environmental noise surveys, the following free-field ambient noise levels have been obtained. As the levels were measured at 1 metre from their respective façades, the following levels have been adjusted with a 3 dB correction.

Table 1: Free-field ambient noise levels

Position	Day (07h00 – 23h00) dB $L_{Aeq,12hr}$	Evening (07h00 – 23h00) dB $L_{Aeq,4hr}$	Night (23h00 – 07h00) dB $L_{Aeq,8hr}$	dB L_{Amax} (range)	dB L_{Amax} (90^{th} percentile)
Front	71	70	65	78 – 85	84
Rear	50	50	45	45 – 69	65

3.1.3.2 Lowest Background Noise Levels

For the purposes of setting plant noise emission limits, it is considered appropriate to determine the lowest $L_{A90(15min)}$ noise levels measured during the environmental noise surveys.

Since future items of building services plant serving the various elements of the scheme will operate over various time periods, it is most appropriate to establish lowest background levels during the periods of expected operation of the plant.

The following plant operational hours are considered in this assessment, although it is considered preferable that none of the plant should be restricted to these hours:

- **'Typical ' Daytime (07:00 – 23:00):** Commonly taken to be a typical daytime period, which includes the hours of opening of the public house (except Saturdays)
- **'Extended' Daytime (07:00 – 24:00):** Extended daytime period, to include the later opening hours of the public house on a Saturday night
- **Office hours (06:00 – 22:00):** This time period reflect anticipated hours of operation for plant serving the proposed commercial office.
- **'Typical' night (23:00 – 07:00):** Commonly taken to be a typical night-time period. Plant from the public house will not be in operation during this period (except Saturdays)

The lowest background noise levels measured during the environmental noise surveys have been corrected for façade reflections and are summarised as follows.

Table 2: Lowest $L_{A90(15min)}$ background noise levels (corrected to free-field levels)

Position	'Typical' Day (07:00 – 23:00)	'Extended' Daytime (07:00 – 24:00)	Office hours (06:00 – 22:00)	Night (23:00 – 07:00)
Front	54	52	52	39
Rear	39	39	39	37

4 Plant Noise Impact Assessment

An environmental noise survey and plant noise assessment have been undertaken to enable the building services design to meet the local authority's planning requirements.

4.1 Nearest Noise Sensitive Façades

The three closest noise sensitive façades to the proposed plant locations have been identified as followed:

- **East:** Existing commercial windows immediately to the east of the site, approximately 8 metres from the proposed VRF units, 15 metres from the kitchen supply duct and 16 metres from the kitchen extract duct.
- **West:** Existing residential properties immediately to the west of the site, approximately 6 metres from the kitchen supply duct, 8 metres from the kitchen extract duct and 13 metres from the VRF units.
- **South elevation of 100 West End Lane:** The proposed apartments at levels 2 and 3 are located very close to the proposed plant, but benefit from significant screening due to the locations of their doors and windows. A door is located on the east façade, at approximately 6 metres from the VRF units. Windows are located approximately 2 metres and 6 metres from the proposed kitchen supply and extract ducts respectively.

These noise sensitive façades are indicted in the annotated photograph in Appendix B.

Additionally, mechanical ventilation and heat recovery (MVHR) units will be installed around the building, but their exact positions are subject to confirmation in the detailed design stage. Therefore, for the purposes of this assessment, it has been assumed that the nearest noise sensitive windows to these grilles will be 1.5 metres directly above or below them.

4.2 Plant Noise Emission Criteria

WSP has held discussions with Mario Houska at the Environmental Health department at LBC. Based on our discussions we were referred to the Borough's Local Development Policy DP28, which states that the following planning requirements will apply to the proposed fixed plant:

Table 3 London borough of Camden Noise and Vibration Policy DP28

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	5 dB(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	10 dB(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	10 dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55 dB L_{Aeq}

Based on the plant noise data summarised in 4.3.1 below it is not considered that the noise emissions will be tonal or distinguishable. All plant will be designed to run continuously or to vary its operation gradually, so as not to be audibly intermittent. As such, it is recommended that the plant is designed to achieve a noise level 5 dB lower than the otherwise prevailing $L_{A90(15min)}$ background noise level. On this basis the following plant noise emission limits are proposed:

Table 3: Plant noise emission limits

Noise sensitive receptor location	'Typical' Day (07:00 – 23:00)	'Extended' Day (07:00 – 24:00)	Office hours (06:00 – 22:00)	Night (23:00 – 07:00)
Proposed apartments with view of West End Lane	51	47	47	34
Existing noise sensitive properties at rear (south) of 100 West End Lane	34	34	34	32
Proposed apartments at rear of 100 West End Lane	34	34	34	32

4.3 Plant Noise Impact Assessment

4.3.1 Proposed Plant

The proposed items of mechanical plant consist of kitchen supply and extract fans for the pub kitchen, two condensers for the offices, and six MVHR units for the apartments. Manufacturer's type information and noise data for these units are presented in the table below.

Table 4: Manufacturer's noise data for proposed kitchen supply and extract fans

Description	Manufacturer's ref	Data type	Sound level (dB) at octave band centre frequencies (Hz)							
			63	125	250	500	1000	2000	4000	8000
Office VRF unit	MXZ-8A140VA	SPL at 1m (heating)	60	55	52	51	47	42	36	40
		SPL at 1m (cooling)	57	52	49	49	45	42	36	37
Residential MVHF units	Nuaire MRXBOX95-WH1	Open inlet SWL	48	51	58	49	47	39	25	16
		Open outlet SWL	56	63	67	67	62	60	50	41
Kitchen supply/extract fans	Nuaire - AX56M-213A	SWL	88	91	96	101	103	96	89	84

The attenuators to be installed on the various fans are detailed in Appendix D. These may be revised following final ductwork layouts on a dwelling-specific basis.

Due to the amount of attenuation required in order to control break-out of fan noise and duct-borne environmental noise to habitable rooms, environmental noise emissions from the MVHR units are predicted to be substantially lower than the plant noise emission limits. A combined noise level of 14 dBA is predicted at 1.5 m from the atmosphere side grilles of each unit, and will therefore not contribute to the overall plant noise emissions of the development. These units are therefore not considered further in this assessment.

4.3.2 Proposed Plant Location

4.3.2.1 Kitchen Fans

The proposed kitchen fans are to be installed vertically in the bar cupboard area, with the attenuators on the atmospheric side of both supply and extract ducts. The duct work is proposed to be hidden (horizontally) in the

bar ceiling void with room for an extra attenuator on each duct before rising up and out of the building. The supply duct terminates at first floor level and extract duct at roof level. The location of the proposed duct work can be seen in Figure 3.

Figure 3: Section of proposed kitchen extract duct supply and extract ducts

4.3.2.2 Office Condensers

The VRF condensers serving the offices will be located on the second floor level terrace at the east side of the building, as shown in Appendix B.

In order to attenuate noise from the proposed VRF units, an acoustic screen shall be erected on the north and east sides of the units, to attenuate plant noise to the proposed apartments at 100 West End Lane and existing properties to the east. This screen is to extend to a minimum height of 1.8 metres or 400 mm above the plant (whichever is greater), and at least 2 metres either side of the plant.

The condensers shall be oriented so that the fans point away from the proposed apartment façade.

4.3.3 Noise Impact Assessment to Neighbouring Properties

To predict the noise impact from the proposed plant, an assessment has been made to predict future plant noise emissions at the nearest noise-sensitive properties.

For simplicity, only two periods have been considered – during opening hours and outside opening hours. The lowest relevant criterion for each period is provided below for reference.

Based on the information summarised above, plant noise levels have been calculated as follows.

Table 5: Summary of predicted plant noise emissions

Noise sensitive receptor	Predicted plant noise level (dB L_{Aeq})	Criterion during pub and office opening hours	Criterion after hours
Existing residential properties to the west of 100 West End Lane	27 dBA during opening hours	34 dBA – pass	32 dBA – pass
Proposed apartments on west portion of south façade of 100 West End Lane	31 dBA during opening hours	34 dBA – pass	32 dBA – pass
Proposed apartments on east portion of south façade of 100 West End Lane	32 dBA during condenser operation	34 dBA – pass	32 dBA – pass
Existing properties to east of West End Lane	31 dBA during opening hours 24 dBA after hours	34 dBA – pass	32 dBA – pass

A full summary of calculations can be found in Appendix E.

As the assessment summarised above indicates, the plant is predicted to be compliant with the local authority's planning requirements during the proposed operational periods and also the quieter night-time period. Thus, it is considered that no time restrictions should be placed upon the proposed plant.

5 Internal Noise Levels in Apartments

5.1 Control of Environmental Noise Sources

5.1.1 BS8233:1999 and WHO Guidelines for Community Noise: 2000

BS 8233[1] provides recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which primarily are intended to guide the design of new buildings or refurbished buildings undergoing a change of use. The noise level criteria recommended in BS 8233 for residential space are summarised in Table 6 below.

Table 6: Suitable internal ambient noise levels in dwellings (from BS8233:1999)

Criterion	Typical Situations	Design range $L_{Aeq,T}$	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living room	30 dB	40 dB
	Bedrooms	30 dB	35 dB
* For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax}			

WHO *Guidelines for Community Noise: 2000* gives the following noise limits:

[1] BS 8233:1999 *Sound insulation and noise reduction for buildings – Code of practice*

Table 7: Suitable internal ambient noise levels in dwellings (from WHO Guidelines: 2000)

Specific Environment	Critical Health Effects	L_{Aeq} (dB)	Time base (hours)	L_{Amax} fast (dB)
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside Bedrooms	Sleep disturbance, night-time	30	8	45

5.1.2 Local Authority Requirements

Following discussions with Mario Houska at the Environmental Health department at LBC, it is understood that Camden requires the 'Good' criteria defined in BS 8233 to be achieved in the proposed apartments.

We would consider this to be unnecessarily onerous during the daytime periods, when an indoor ambient noise level of 35dB $L_{Aeq,16hr}$ would usually be considered appropriate. At 100 West End Lane, there is approximately a 5 dB difference between daytime and night-time ambient noise levels. Therefore, designing to achieve a noise level of 30 L_{Aeq} during the day will result in a night-time noise level of 25 dB L_{Aeq}. This could potentially result in a situation in which residents suffer from a lack of inconspicuous background noise, which would otherwise mask more obtrusive sounds, and a consequent reduction in acoustic privacy between dwellings.

However, we confirm that the design has adopted the 'Good' criteria as required by the Local Authority.

5.1.3 External Building Fabric

The majority of the existing façade comprises a 327 mm thick brick construction, except a small area at the south-west corner of the building, which is built from 215 mm thick brick. An additional internal lining is proposed in all residential areas, to improve the thermal efficiency of the building. This will consist of a 70 mm insulated composite board secured to a 25 mm carrier system which in turn will be secured to the inner face of the brickwork.

5.1.3.1 Glazing Specifications

Since noise levels incident upon the façade of the development will vary with location, height, screening, etc., it would be over-simplistic to apply one sound reduction performance specification to the entire development. As such, the proposed development has been separated into 'zones' in order that the varying sound insulation performance requirements for the external building fabric around the different areas of the development may be specified. These zone areas are detailed on the plan in Appendix F.

The two glazing specifications proposed are shown in Table 8.

Table 8: Glazing Configurations

	Sound reduction index at octave band centre frequencies (Hz)								Typical glazing configuration
Ref	63	125	250	500	1000	2000	4000	8000	
A	28	35	41	46	49	51	56	58	Secondary glazed (e.g. 10/150/6)*
B	22	20	29	35	37	35	44	48	Double glazing (e.g. 10/12/6)

* Typically, this will require a secondary double glazed system, in order to comply with thermal efficiency requirements.

It is proposed that glazing type B also be used for the first floor offices. It is predicted that indoor ambient noise levels will comply with the British Council for Offices criteria of NR 40 and NR 38 for open plan and speculative offices, respectively, with the provision of suitable ventilators which will be specified in the detailed design stage.

5.1.3.2 Ventilation

The apartments are to be mechanically ventilated. This will allow windows to remain closed to protect the occupants from noise whilst maintaining a suitable supply of ventilation in accordance with Part F of the Building Regulations. In addition the volume flow rates of the mechanical systems should be designed to consider the control of thermal gain in accordance with Part L of the Building Regulations.

In order that sufficient attenuation of environmental noise sources can be achieved. Attenuators for the MVHR units are specified in Appendix D.

5.2 Noise from Ground Floor Pub

5.2.1 Event Noise Levels

WSP Acoustics undertook sample noise measurements of various activities within The Railway public house over a number of surveys between November 2012 and January 2013.

The following noise levels have been measured inside the pub by WSP Acoustics during typical events:

Table9: Noise levels measured inside *The Railway* during typical entertainment events

Event type	Sound pressure level inside pub (dB L_{Aeq})	Source of data
Televised sports events	80 – 81 dB L_{Aeq}	WSP Acoustics survey 13 January 2013
Karaoke	89 dB L_{Aeq}	WSP Acoustics survey 13 November 2012
Amplified live band with drum kit	99 – 102 dB L_{Aeq}	WSP Acoustics survey 22 December 2012

5.2.2 Guidance

5.2.2.1 Daytime Entertainment Noise

Section DP28 of the Camden Statement of Licensing Policy 2008 contains the following example condition relating to noise from entertainment premises affecting residential premises during the daytime:

> *"Up to 2300 hours applicable to entertainment premises which adjoin or are adjacent to noise sensitive properties:*
>
> > *The noise climate of the surrounding area shall be protected such that the A-weighted equivalent continuous noise level (L_{Aeq}) emanating from the application site, as measured 1 metre from any façade of any noise sensitive premises over any 5 minute period with entertainment taking place shall not increase by more than 5dB as compared to the same measure, from the same position, and over a comparable period, with no entertainment taking place; and the unweighted equivalent noise level (L_{eq}) in the 63Hz octave band, measured using the "fast" time constant, inside any living room of any noise sensitive premises, with the windows open or closed, over any 5 minute period with entertainment taking place, should show no increase as compared to the same measure, from the same location(s) , and over a comparable period, with no entertainment taking place."*

5.2.2.2 Night-time Entertainment Noise

Further guidance for entertainment noise occurring during night-time periods is provided in example condition 1.4:

"After 2300 hours applicable to all premises:

The noise climate of the surrounding area shall be protected such that the A-weighted equivalent continuous noise level (L_{Aeq}) emanating from the application site, as measured 1 metre from any facade of any noise sensitive premises over any 5 minute period with entertainment taking place shall not increase by more than 3dB as compared to the same measure, from the same position, and over a comparable period, with no entertainment taking place; and the unweighted equivalent noise level (L_{eq}) in the 63Hz octave band, measured using the "fast" time constant, inside any living room of any noise sensitive premises, with the windows open or closed, over any 5 minute period with entertainment taking place, should show no increase as compared to the same measure, from the same location(s), and over a comparable period, with no entertainment taking place. No sound emanating from the establishment will be audible within any noise sensitive premises between 2300 and 0700 hours."

5.2.2.3 Guidance Relating to Inaudibility

It is difficult to quantify 'inaudibility' due to the differences that individuals perceive sound. However, it is generally accepted that the following advice contained in a technical contribution entitled *"Good Practice Guide on the Control of Noise from Pubs and Clubs: Criteria and Measurement Guidelines"* by John Hinton (Birmingham City Council) and Alistair Somerville (Edinburgh Borough Council) in the Acoustic Bulletin Nov/Dec 2003 provides suitable criteria:

"A2. 3 Venues where entertainment takes place more than once per week or continues beyond 2300 hours

Criteria applicable for both external and internal assessments at noise-sensitive properties:

The L_{Aeq} of the entertainment noise should not exceed the representative background noise level L_{90} (without entertainment noise), and

The L_{10} of the entertainment noise should not exceed the representative background noise level L_{90} (without entertainment noise) in any 1/3 octave band between 40Hz and 160Hz.

If the above criteria are met entertainment noise will be virtually Inaudible inside noise-sensitive property."

5.2.3 Design Criteria

On the basis of the guidance presented above, and the levels of noise ingress of external sources, noise criteria for the pub are presented in Table 10.

Table 10: Entertainment noise criteria to be achieved at residential properties

Measurement location	Daytime criterion (07:00 – 23:00)	Night-time criterion (23:00 – 07:00)
1 metre outside residential façade	$L_{Aeq,5min}$ with entertainment not to be more than 5 dB greater than the otherwise prevailing $L_{Aeq(5min)}$	$L_{Aeq,5min}$ with entertainment not to be more than 3 dB greater than the otherwise prevailing $L_{Aeq(5min)}$
Inside living space	$L_{Aeq,5min}$ with entertainment not to be more than 5 dB greater than the otherwise prevailing $L_{Aeq,5min}$ and $L_{eq(63Hz),5min}$ of entertainment to be at least 10 dB lower than the otherwise prevailing $L_{eq(63Hz),5min}$	$L_{Aeq,5min}$ with entertainment not to exceed the otherwise prevailing $L_{A90,5min}$ and $L_{Aeq(5min)}$ of entertainment noise to be at least 10 dB lower than the otherwise prevailing $L_{eq(63Hz),5min}$ and Entertainment noise $L_{10,5min}$ in each third-octave band (40 Hz – 160 Hz) to be equal to or less than the otherwise prevailing $L_{90,5min}$ level in that same band

In order to adequately control noise transmitted from *The Railway* to the proposed flats immediately above, we propose the following noise control strategy consisting of upgrades to the existing separating floor, and noise reduction measures to be adopted in the public house.

5.2.4 Measures to Improve Internal Sound Insulation

In order to maintain the existing entertainment use of the ground floor public house, whilst meeting the local authority's requirements, a high degree of sound insulation must be achieved between the public house and the proposed apartments.

5.2.4.1 Building Layout

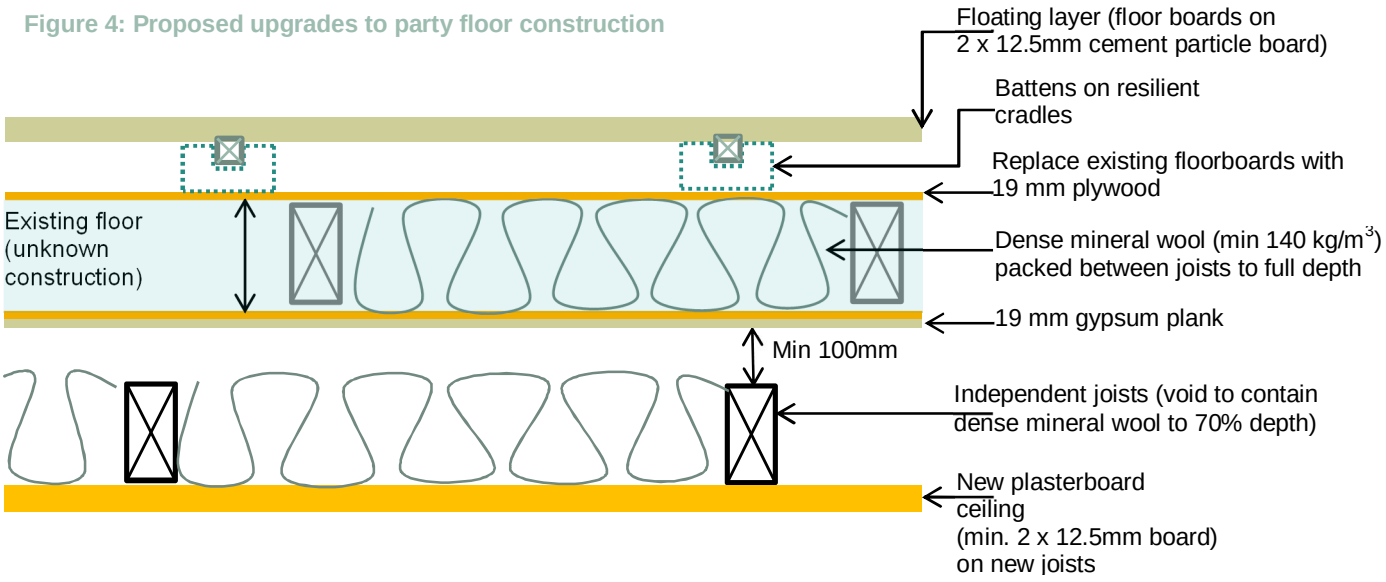
To this end, a design has been adopted which incorporates a less sensitive office use on the first floor, providing a 'buffer' to increase airborne sound insulation between the public house and apartments. As the offices will not be occupied during the events held in *The Railway*, it is not considered to be a sensitive use during these noisier periods.

5.2.4.2 Separating Floor Construction

In addition, structural improvements to the separating floor constructions are proposed. It is expected that a sound insulation performance of up to 55 dB $D_{nTw} + C_{tr}$ may be achievable by refurbishing and improving the existing floor immediately above the pub, adding a floating floor layer above, and adding an independent ceiling below the first floor joists. A performance of around 55 dB $D_{nTw} + C_{tr}$ is considered likely to be the maximum achievable performance given the limitations of the structure and the period nature of the building.

The proposed modifications and additions to the existing first floor construction are shown in Figure 4.

Figure 4: Proposed upgrades to party floor construction



The *in situ* sound insulation between the ground and second floor levels is likely to achieve a sound insulation performance of around 65 dB $D_{ntw} + C_{tr}$ due to the use of the first floor as a buffer.

5.2.5 Measures to Improve External Sound Insulation

There is a possible route for noise to transfer from the ground floor pub to the apartments above, via the windows. However, it is considered that this will be adequately controlled by the high performance windows specified in section 5.1 to control the high ambient noise levels.

5.2.6 Measures to Limit Entertainment Noise at Source

Of the three events held in *The Railway*, the most likely to cause annoyance to other occupants in the building are the karaoke and live bands. Therefore, these will only be held outside office hours, in order to avoid disruption to occupants of the first floor.

For live band performances, it would be necessary to reduce noise levels in the pub to bring them in line with the karaoke events. This would equate to a reduction from approx. 100 dBA to 90 dBA. The following measures would be required to ensure the limits are adhered to:

- Using electronic instruments plugged directly into the P.A. system (including drum kit)
- All instruments to be amplified via a house mixing desk and an octave band limiter (to allow for low frequency suppression), which would be set during a commissioning exercise upon completion of the project

5.2.6.1 Limiting Noise Levels

Based on the entertainment noise criteria presented in Table 10 and the sound insulation performance predicted between ground and second floor levels, the following preliminary limiting sound pressure levels are predicted for the ground floor pub. These will be reviewed upon completion of the refurbishment, based on a commissioning exercise.

Table 11: Preliminary limiting sound pressure levels for events held in The Railway

Limiting sound pressure levels (dB) at octave band centre frequencies (Hz)								
63	125	250	500	1k	2k	4k	8k	dBA
80	83	86	89	84	80	75	79	90

6 Existing Vibration Sources

6.1 Guidance

Camden's Local Development Framework contains requirements for vibration inside dwellings, which reproduced in Table 12 below.

Table 12: Criteria for vibration inside dwellings (from Table C of section DP28 in Camden's Local Development Framework)

Period	Time	Vibration levels
Day and evening	07:00 – 23:00	0.2 – 0.4 VDV $ms^{-1.75}$
Night	23:00 – 07:00	0.13 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		

6.2 Vibration Survey

A vibration survey was undertaken by Hepworth Acoustics from 09:30 on Wednesday 21 March 2012 to 11:15 on Thursday 22 March 2012, in an office at first floor level. Full details of the survey can be found in Hepworth Acoustics' report 31119.1v1 dated May 2012.

A summary of the results obtained is presented below.

Table 13: Results of vibration survey

Axis	Day time (07:00 – 23:00)		Night-time (23:00 – 07:00)
	Day 1 (15 hour measurement)	Day 2 (5 hour measurement)	
X	0.021	0.021	0.018
Y	0.027	0.023	0.018
Z	0.053	0.050	0.033

6.3 Discussion

The above survey results indicate vibration at the site is comfortably below the Local Authority's criteria for vibration.

The nearest significant vibration sources are above-ground Jubilee line train tracks, approximately 30 metres from 100 West End Lane. Trains on this line would be approaching or departing West Hampstead Underground station, and would therefore be travelling slowly. On this basis, and considering the very low VDV results obtained, it is considered that re-radiated noise is unlikely to exceed 35 dB $L_{Amax,s}$.

Based on the above, it is not considered that any building isolation measures are necessary to mitigate against ground-borne vibration.

7 BREEAM

Four credits are sought in conjunction with the requirements of *BREEAM Refurbishment: Domestic Buildings Technical Manual SD5072-2012-2.0*. As such, Hea 02 states that the design must incorporate suitable party wall and floor constructions to achieve a 5 dB improvement over the relevant Building Regulations requirements.

The exact party wall and floor types have not yet been confirmed, but the following zones have been allowed to accommodate suitable constructions:

- **Party walls:** 250 mm zone allowed
- **Party floors:** 300 mm zone allowed

It is considered that these zones should be able to accommodate suitable constructions, which will be designed in the next stage of the project.

8 Conclusions

Noise impact assessments have been undertaken in connection with the proposed redevelopment of 100 West End Lane, West Hampstead. Noise and vibration surveys have been undertaken at the site by WSP Acoustics and Hepworth Acoustics, the methodologies and results of which are summarised herein.

Noise from the proposed building services plant has been assessed against the Local Authority's requirements and it has been demonstrated that, with the mitigation measures proposed herein, the plant will comply with the relevant criteria for 24-hour use.

Due to the high ambient noise levels at the site, a detailed assessment has been undertaken to determine the sound insulation performance requirements of glazing to the proposed apartments. It is demonstrated that, with the proposed glazing configurations, internal ambient noise levels should comply with the Local Authority's standard planning requirements.

Based on attended noise surveys previously undertaken in the ground floor pub, and discussions with the design team, sound insulation between *The Railway* and the proposed apartments has been considered. Mitigation measures are proposed in order to reduce the noise impact of events held in *The Railway*, by increasing the sound insulation within the building and limiting the noise produced in the pub during events. In order to obtain sufficient sound insulation between the public house and the proposed apartments, it is necessary to use a 'buffer zone' of offices at first floor level as well as substantially improving the floor constructions at first and second floor levels. These additional measures should enable the events to continue, whilst meeting the Local Authority's criteria, and avoiding unnecessary noise nuisance to residents.

A vibration survey previously undertaken by Hepworth Acoustics indicates that vibration levels are low at the site, and that re-radiated ground-borne noise from trains is unlikely to significantly affect the proposed residences.

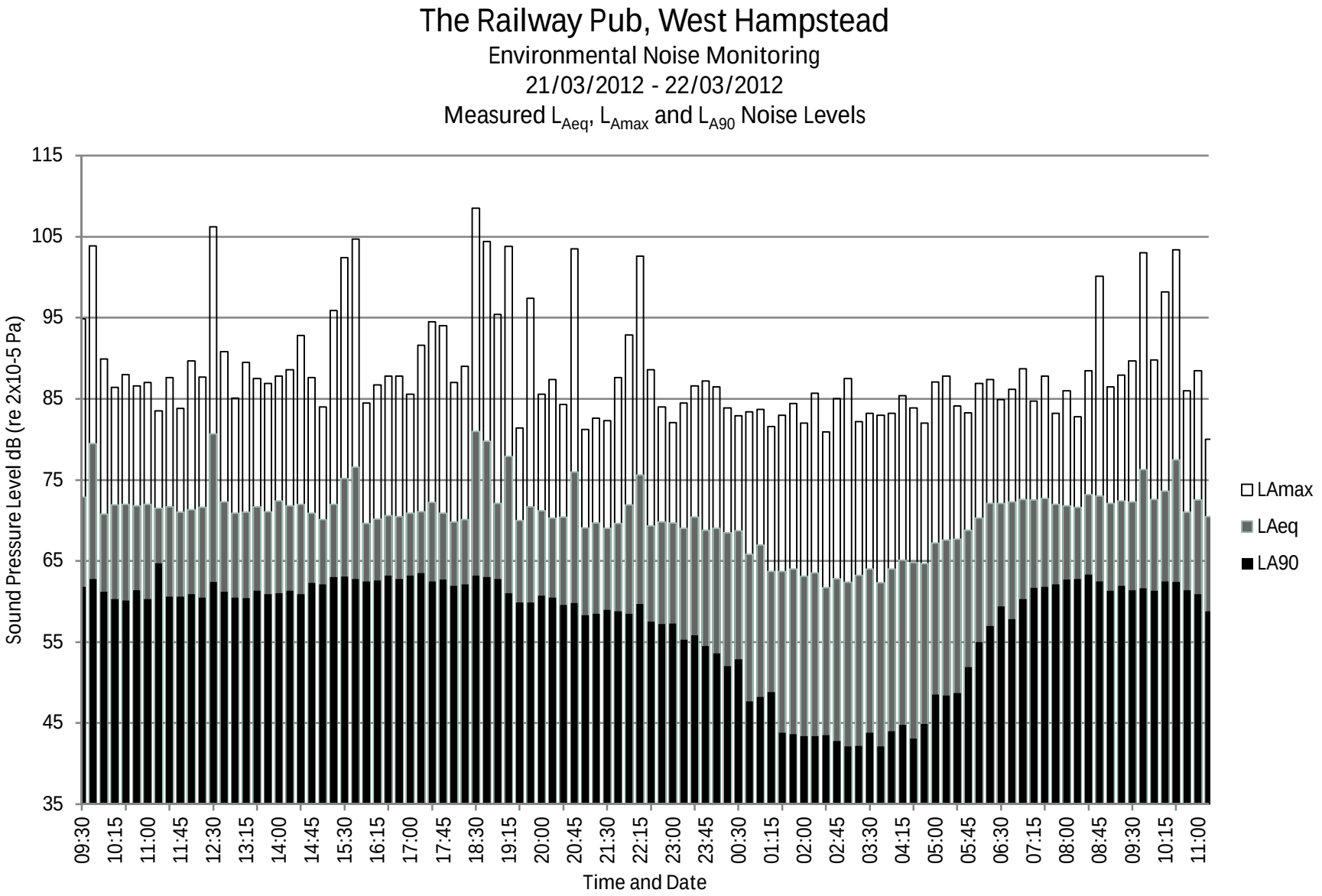
The residential refurbishment element of the project aims to obtain four BREEAM credits for sustainable design, and it is confirmed that the zones allocated for sound insulation between residences should enable these to be achieved.

Appendix A – Acoustic Glossary

Term	Definition
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Sound Power	The sound energy radiated per unit time by a sound source. Measured in Watts (W).
Sound Power Level, L_W	Sound power measured on a decibel scale, relative to a reference value of 10-12 W
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T.L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres.
Façade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS5969.

Appendix B: Annotation of South Façade of 100 West End Lane (Looking North)

Appendix C – Un-attended Noise Survey Results



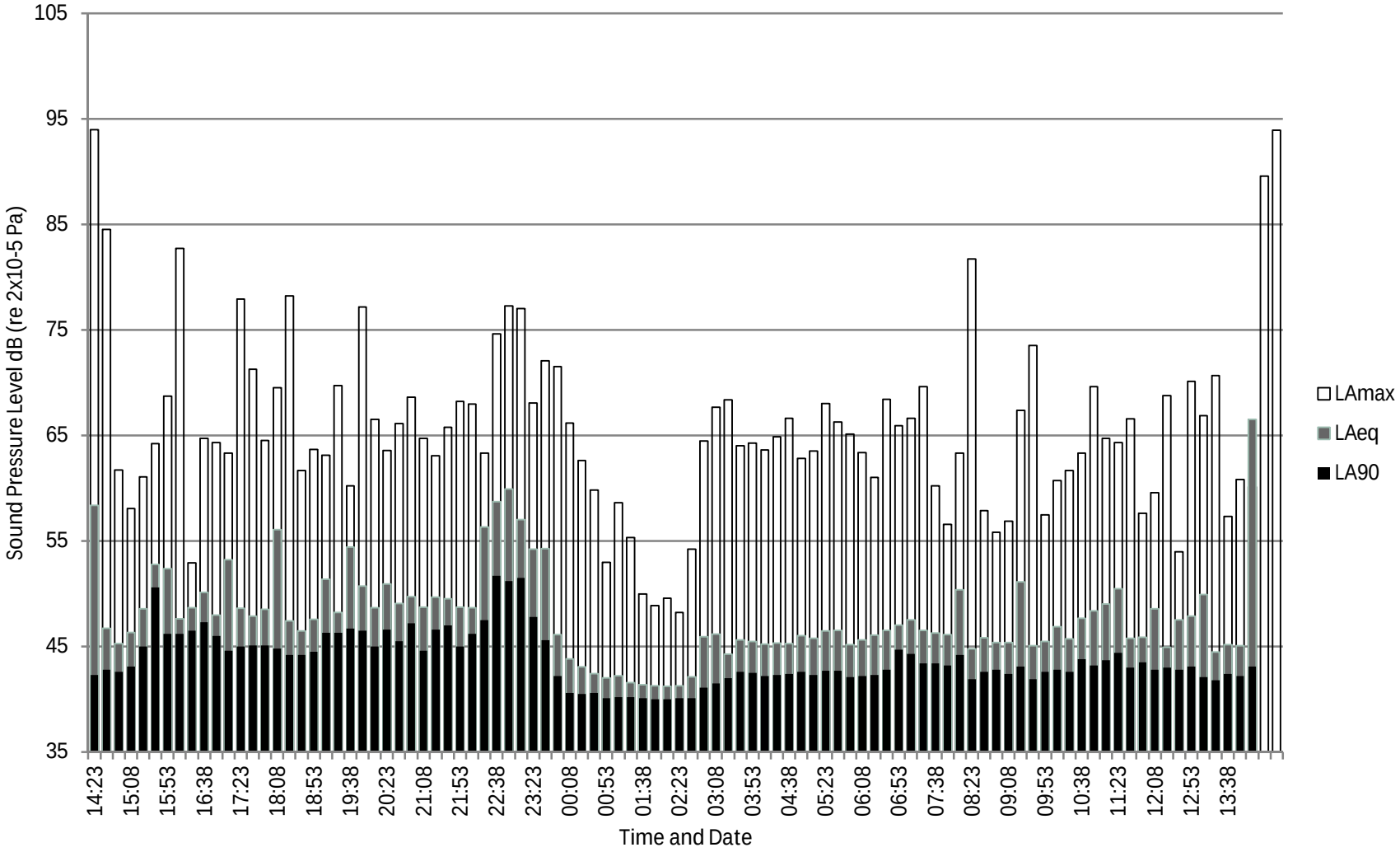
Project number: 34462
Dated: 02/12/2013
Revised:

The Railway Pub, West Hampstead

Environmental Noise Monitoring

30/04/2013 - 01/05/2013

Measured L_{Aeq}, L_{Amax} and L_{A90} Noise Levels



Appendix D – Attenuator Schedule

Plant description	Location	Area served	Attenuator type	Att ref	Vol	Length (mm)	Max. PD (Pa)	Insertion Loss (dB)							
								63	125	250	500	1K	2K	4K	8K
Kitchen supply fan	Grille at high level at rear	Public house kitchen	FAI primary attenuator (Nuaire CA56LP)	ATT-01	TBC	TBC	35	8	8	13	26	34	25	22	18
			Fresh air intake secondary attenuator	ATT-02	TBC	2400	35	11	22	40	50	50	50	50	39
Kitchen extract fan	Grille at high level at rear	Public house kitchen	Exhaust primary attenuator (Nuaire CA56LP)	ATT-03	TBC	TBC	35	8	8	13	26	34	25	22	18
			Exhaust secondary attenuator (Melinex lined)	ATT-04	TBC	1500	35	4	8	7	7	9	10	1	1
Apartment MVHR units	MVHRs located inside apart-ments. Grille loca-tions TBC.	Apart-ments	Fresh air in-take (at at-mosphere grille)	ATT-05	60 l/s	1200	30	7	12	20	33	39	40	35	28
			Fresh air intake (at MVHR unit)	ATT-06	60 l/s	600	30	1	2	7	10	11	9	8	7
			Room-side supply (at MVHR unit)	ATT-07	60 l/s	1800	30	9	17	29	46	50	50	49	34
			Room-side return (at MVHR unit)	ATT-08	60 l/s	1500	30	6	13	23	37	43	44	35	20
			Exhaust (at MVHR unit)	ATT-09	60 l/s	1200	30	5	11	19	29	36	37	29	18
			Exhaust (at atmosphere grille)	ATT-10	60 l/s	1200	30	7	12	20	33	39	40	35	28

Appendix E – Summary of Plant Noise Assessment Calculations

Calculations to Proposed Apartments at West Side of South Façade

	Sound pressure level (dB) at octave band centre frequencies (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
Kitchen supply fan grille	46	43	24	4	-7	-4	-8	2	28
Kitchen extract fan grille	35	38	34	15	-5	-4	1	0	27
Kitchen supply fan duct break-out	46	37	8	0	0	0	0	0	24
Kitchen extract fan ductwork break-out	43	39	26	6	-16	-18	-15	-16	25
Total noise emissions from kitchen fans	47	44	34	15	-3	-1	2	4	31
VRF condenser - SPL at 1m	60	55	52	51	47	42	36	40	53
Correction for 2no units	3	3	3	3	3	3	3	3	
Screening correction	-10	-12	-14	-17	-20	-23	-24	-24	
Distance correction (16m)	-21	-21	-21	-21	-21	-21	-21	-21	
Total noise emissions from condensers	32	25	20	16	9	1	-6	-2	17
Total plant noise emissions at noise sensitive receptor	47	44	35	19	9	3	2	5	31

Calculations to Existing Properties to West of 100 West End Lane South Façade

	Sound pressure level (dB) at octave band centre frequencies (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
Kitchen supply fan grille	36	32	13	-8	-22	-23	-27	-17	18
Kitchen extract fan grille	31	34	30	13	-8	-7	-2	-3	24
Kitchen supply fan duct break-out	33	22	17	0	0	0	0	0	13
Kitchen extract fan ductwork break-out	38	34	21	1	0	0	0	0	20
Total noise emissions from kitchen fans	42	39	31	14	3	4	4	4	26
VRF condenser - SPL at 1m	60	55	52	51	47	42	36	40	53
Correction for 2no units	3	3	3	3	3	3	3	3	
Screening correction	-10	-12	-14	-17	-20	-23	-24	-24	
Distance correction (16m)	-21	-21	-21	-21	-21	-21	-21	-21	
Total noise emissions from condensers	32	25	20	16	9	1	-6	-2	17
Total plant noise emissions at noise sensitive receptor	42	39	31	18	10	6	5	5	27

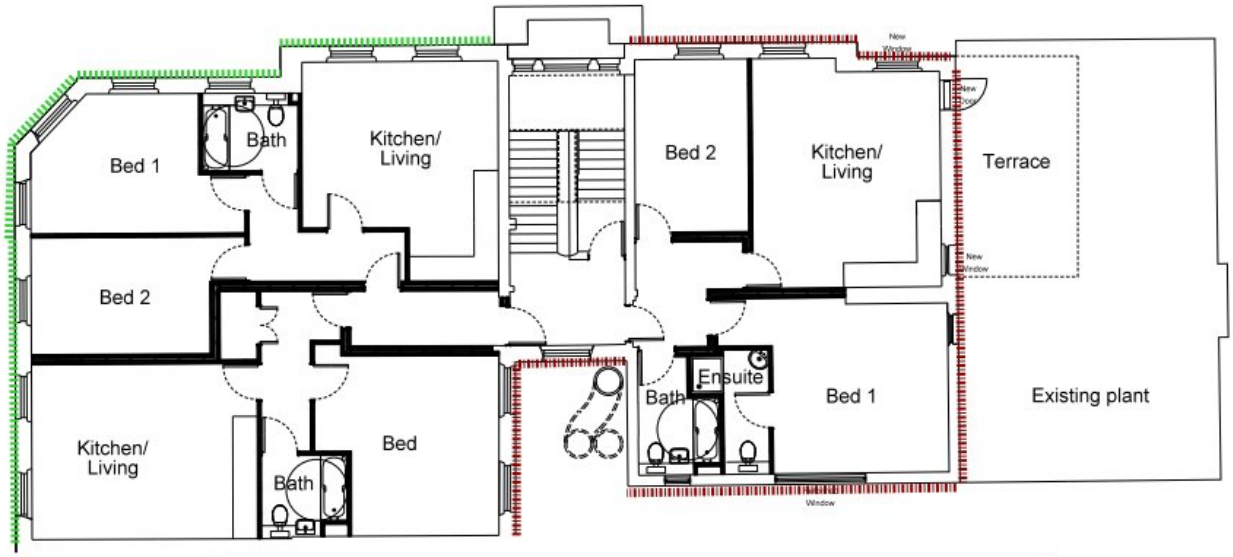
Calculations to Proposed Apartments at East Side of South Façade

	Sound pressure level (dB) at octave band centre frequencies (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
VRF condenser - SPL at 1m	60	55	52	51	47	42	36	40	53
Correction for 2no units	3	3	3	3	3	3	3	3	
Screening correction	-13	-13	-13	-13	-13	-13	-13	-13	
Distance correction (16m)	-6	-7	-8	-10	-12	-15	-18	-21	
Total noise emissions at noise sensitive receptor	44	38	34	31	25	18	9	9	32

Calculations to Existing Properties to East of 100 West End Lane South Façade

	Sound pressure level (dB) at octave band centre frequencies (Hz)								
	63	125	250	500	1000	2000	4000	8000	dBA
VRF condenser - SPL at 1m	60	55	52	51	47	42	36	40	53
Correction for 2no units	3	3	3	3	3	3	3	3	
Screening correction	-15	-15	-15	-15	-15	-15	-15	-15	
Distance correction (16m)	-6	-7	-8	-10	-12	-15	-18	-21	
Total noise emissions from condensers	42	36	32	29	23	15	6	7	30
Kitchen supply fan grille	29	25	6	-16	-30	-31	-35	-25	
Kitchen extract fan grille	26	29	25	8	-13	-12	-7	-8	
Kitchen supply fan duct break-out	26	29	25	8	-13	-12	-7	-8	
Kitchen extract fan ductwork break-out	37	33	20	0	-22	-24	-21	-22	
Total plant noise emissions at noise sensitive receptor	44	39	34	29	23	15	7	7	31

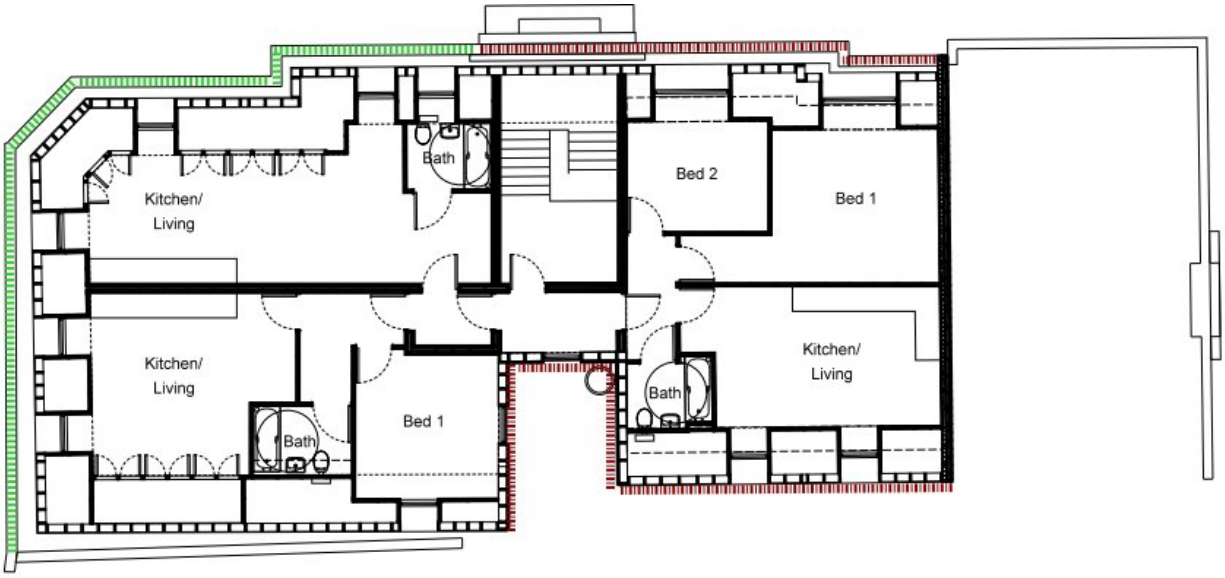
Appendix F: Glazing Zones and Specifications



1 SECOND FLOOR PLAN
005

Ref	Sound reduction index at octave band centre frequencies (Hz) 63	125	250	500	1000	2000	4000	8000	Typical glazing configuration
A	28	35	41	46	49	51	56	58	Secondary glazed (e.g. 10/150/6)*
B	22	20	29	35	37	35	44	48	Double glazing (e.g. 10/12/6)

* Typically, this will require a secondary double glazed system, in order to comply with thermal efficiency requirements.



1 THIRD FLOOR PLAN
006

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