Philip Acoustics Ltd.

Consultants in Noise and Vibration

REPORT TITLE: NOISE & VIBRATION SURVEY AND ASSESSMENT INCLUDING SCHEME OF NOISE MITIGATION MEASURES FOR A PROPOSED RESIDENTIAL DEVELOPMENT AT 195 FORDWYCH ROAD, LONDON NW2 3NH

REPORT REF: 16208-002

ISSUED TO: de Metz Forbes Knight Architects Limited
The Old Library
119 Cholmley Gardens
London
NW6 1AA

ISSUED BY: Matt Hine BSc (Hons)

DATE: December 2016

PHILIP ACOUSTICS LTD

107 Bancroft, Hitchin, Hertfordshire SG5 1NB Tel: 01462 431877

Email: admin@philipacoustics.co.uk

Member of The Association of Noise Consultants Registered in England No.: 4560265

CONTENTS

SUMMARY

- Noise and vibration surveys and associated assessments have been carried out and included within this report for a proposed new residential flats development at 195 Fordwych Road, London NW2 3NH. The report is to accompany a planning application for the development to the Local Planning Authority which is Camden Council.

NOISE SURVEY & ASSESSMENT

- Overall noise levels to the development site comprise principally of contributions from passing rail traffic on the adjacent Thameslink main-line route and occasional road and pedestrian traffic on Fordwych Road.

- Using results of a 24 hour survey it is established that noise to the development site does not exceed the thresholds of Camden Council Policy DP28 Table A and therefore it is not considered that Camden Council would refuse planning permission for the development with regard to noise from the adjacent railway lines. Noise levels to the development site (particularly the rear elevation) do however marginally exceed the thresholds of Camden Council Policy DP28 Table B thus requiring noise mitigation (attenuation) measures to be implemented as part of the scheme design. This is normal for this type and location residential development.

- Using results of a full twenty-four hour noise survey at the development site, a scheme of noise insulation measures is established to ensure that noise levels to inside rooms of the new dwellings comply with criteria set with reference to British Standard BS8233:2014 *"Guidance on Sound Insulation and Noise Reduction for Buildings".*

- Details of the noise survey, assessment and scheme of noise insulation measures are included in the report, verified by composite sound reduction indices calculation of the overall residential building envelope. The scheme of noise insulation measures includes specification for acoustic performance glazing and ventilation, particularly for the rear and side elevations facing the railway lines.

VIBRATION SURVEY & ASSESSMENT

- Subjectively no significant ground-borne vibration from passing trains was perceptible to the author when standing at various positions around the development site. Notwithstanding this, results of the vibration survey indicate (as normal and expected) that some ground-borne vibration from passing trains is present at the site.

- Using results of a 24 hour vibration survey it is established that vibration to the development site does not exceed the day and night period vibration threshold limits of Camden Council Policy DP28 Table C and therefore it is not considered that Camden Council would refuse planning permission for the development with regard to vibration from the adjacent railway lines.

- In addition, vibration levels to the development site are at or below the lower end of the low probability of adverse comment range as advised in BS6472-1:2008 *"Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting*".

- It is considered that no vibration mitigation treatments (such as specialist resilient bearings as part of the structural foundations of the dwelling) necessarily need be incorporated within the development's scheme design to comply with Camden Council Policy DP28.

1. INTRODUCTION

Philip Acoustics has been commissioned to carry out a noise and vibration survey and assessment for a proposed new residential development at 195 Fordwych Road, London NW2 3NH. The survey and assessment is to accompany a planning application for the development to the Local Planning Authority which is Camden Council. This report presents results of the survey and assessment and includes:

- Description of the proposed development and surrounding area;
- Noise and vibration requirements of Camden Council, as contained within Policy DP28 – Noise and Vibration of Section 3 of Camden Development Policies 2010-2025;
- Details of noise and vibration survey carried out including subjective observations;
- Noise and vibration assessments;
- Scheme for noise mitigation measures and any vibration reduction treatment as necessary to ensure compliance with the requirements of Camden Council.

2. DEVELOPMENT DESCRIPTION

The development site is located to the north-eastern side of the Fordwych Road adjacent to the Thameslink main-line rail route serving rail traffic in, out and through Cricklewood London Overground railway station, which is situated approximately 1km away.

The proposed development is for four new residential flats formed by conversion of the existing building together with a new ground floor extension to the rear of the property. A site location plan and layout drawings for the proposed development are provided in Appendix A.

It is noted that the existing two story building has received prior approval from Camden Council for a roof extension to the existing dwellinghouse under Permitted Development Proposal reference 2016/4267/P.

Noise levels to the development site comprise principally of contributions from passing rail traffic on the adjacent Thameslink main-line route. Fordwych Road to the front of the site has occasional road traffic which appears mostly to be used by local vehicles and occasional passing pedestrian traffic.

During observed parts of the survey it was noted that subjectively, no significant ground-borne vibration from passing trains (including local commuter and freight type) was perceptible to the author when standing at various ground floor positions around the site.

3. CAMDEN COUNCIL NOISE & VIBRATION POLICY REQUIREMENTS

The required noise and vibration assessment plus scheme of noise mitigation measures and any vibration reduction treatment needs to be in accordance with Policy DP28 – Noise and Vibration of Section 3 of Camden Development Policies 2010-2025. Full copy of Policy DP28 – Noise and Vibration is provided in Appendix B.

The guidance and thresholds of Policy DP28 for noise and vibration to proposed residential development sites are summarised in the following sections.

3.1 Noise

The noise assessment methodology and thresholds of Policy DP28 represent an interpretation of the procedures and details in Planning Policy Guidance Note 24: Planning and Noise (referred to as PPG24).

It is noted that National Planning Policy Guidance including PPG24 has been withdrawn by The Department for Environment, Food and Rural Affairs (DEFRA) and replaced by the Noise Policy Statement for England (referred to as NPSE) and the National Planning Policy Framework (referred to as NPPF). NPSE was published in March 2010 and NPPF was published in March 2012.

However, both of these national policy documents are "high level" documents that define noise management aims, objectives and outcomes in terms of achieving sustainable development rather than numerically defining or categorising acceptable noise levels as included within PPG24.

It is therefore considered that despite the withdrawal of PPG24, the noise assessment methodology and thresholds of Policy DP28 remain valid. Thus, assessment of noise to a proposed residential development site still requires a noise survey and assessment of the site to be carried out in accordance with the procedures and principles of PPG24, albeit with reference to the specific noise level thresholds of Camden Council Policy DP28.

The noise level thresholds of Camden Council Policy DP28 provide guidance for scenarios where high external noise levels require noise mitigation (attenuation) measures (Table B of Policy DP28) and also for scenarios where external noise levels are sufficiently high that planning permission would potentially be refused (Table A of Policy DP28).

The noise level thresholds of Camden Council Policy DP28 Table A and Table B are allocated into three separate time periods (day, evening and night), rather than the two time periods used in PPG24 (day and night). Policy DP28 advises this is to provide a greater degree of control over noise during the evening when noise is often an issue.

In providing guidance for suitable limits of external noise into residential properties, PPG24 makes reference to British Standard BS8233:1999 "*Sound Insulation and Noise Reduction for Buildings – Code of Practice".*

Note that although PPG24 and the noise policy requirements / criteria of many Local Planning Authorities refer to BS8233:1999, this standard has now been withdrawn and replaced with BS8233:2014 "*Guidance on Sound Insulation and Noise Reduction for Buildings"* which came into effect on 28 February 2014.

The guidance contained within BS8233:2014 for noise to residential dwellings is broadly as that in the previous version BS8233:1999, albeit the concept of "good" and "reasonable" conditions noise targets is now removed and the day period guidance for living rooms is a single value L_{Aeq} 35dB. Also BS8233:2014 does not provide any specific guidance on night-time L_{Afmax} values for bedrooms. Guidance in BS8233:2014 advises it is desirable that ambient noise levels to residential dwellings do not exceed the guideline values shown below:

- Living Rooms: ≤35dB $L_{Aeq,16hr}$ day period 07:00-23:00;
- Bedrooms: ≤35dB $L_{Aeq,16hr}$ day period 07:00-23:00 & ≤30dB $L_{Aeq,8hr}$ night period 23:00-07:00;
- Bedrooms: ≤45dB L_{Afmax} night period 23:00-07:00 *(guideline value from BS8233:1999, BS8233:2014 does not provide any specific guidance on night-time L_{Afmax} values for bedrooms).*
- External Amenity: Desirable ≤50dB $L_{Aeq,\,T}$ & upper guideline value ≤55dB $L_{Aeq,\,T}$.

In accordance with normal acoustic design practice and definition it is taken that:

- The internal noise level guideline values are due to external noise sources such as environmental and transportation sources (for this site principally railway noise) and are to be achieved inside unoccupied but completed and normally furnished rooms of residential properties;
- The guideline value for living rooms is also applicable for any dining rooms and/or kitchens that are open plan to living room areas (i.e. living/kitchen/diners etc.);
- The L_{Afmax} guideline value for bedrooms at night is that individual noise events should not regularly exceed L_{Afmax} 45dB, i.e. it is not intended that the guideline be applicable to infrequent night-time very high noise level events such as sirens of passing emergency vehicles;
- The guideline values for external amenity spaces relate to noise to private residential gardens, patios and similar, applicable during the day period (07:00-23:00) as $L_{Aeq,\,T}$ values typically over period $_T$ = 1 hour.

In advising guideline values for external amenity spaces and as considered potentially relevant to this proposed development site, then BS8233:2014 also states the following:

> *"However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."*

3.2 Vibration

Table C of Camden Council's Policy DP28 sets vibration level thresholds for various use developments, including residential dwellings, where planning permission would potentially not be granted.

The Policy DP28 vibration level thresholds for residential dwellings are as those for "low probability of adverse comment" from British Standard BS6472:1992 *"Guide to Evaluation of Human Exposure to Vibration in Buildings"*.

BS6472:1992 is now withdrawn from use and superseded by BS6472:2008 which includes two parts:

- BS6472-1:2008 *"Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting*";
- BS6472-2:2008 *"Guide to Evaluation of Human Exposure to Vibration in Buildings Part 2: Blast Induced Vibration"*. BS6472-2:2008 is considered not relevant in this instance.

The guidance on levels of vibration which may cause adverse comment to residential dwellings within the now superseded BS6472:1992 (upon which the vibration level thresholds of Camden Council's Policy DP28 are based) are very similar to those in the current version of the standard BS6472-1:2008. Thus in assessing vibration to the development site (principally from passing trains through Cricklewood London Overground railway station) it is not of significant consequence which version of BS6472 be used.

Notwithstanding this, summary details of the guidance of the current BS6472-1:2008 are provided below.

For the scenario of intermittent vibration potentially affecting residential buildings, as in the case of passing trains; BS6472-1:2008 recommends that vibration is assessed in terms of separate day period and night period VDV (Vibration Dose Values). This takes account of the severity of vibration for each event (trains passing), the frequency and also the duration of vibration events to give separate day and night period VDV for comparison with guideline limits.

The BS6472-1:2008 guideline limits for vibration potentially affecting residential dwellings are shown in Table 1.

Description	**Low Probability Of Adverse Comment VDV m/s$^{1.75}$**	**Adverse Comment Possible VDV m/s$^{1.75}$**	**Adverse Comment Probable VDV m/s$^{1.75}$**
Day period 16hr (07:00 – 23:00)	0.2 to 0.4 m/s$^{1.75}$	0.4 to 0.8 m/s$^{1.75}$	0.8 to 1.6 m/s$^{1.75}$
Night period 8hr (23:00 – 07:00)	0.1 to 0.2 m/s$^{1.75}$	0.2 to 0.4 m/s$^{1.75}$	0.4 to 0.8 m/s$^{1.75}$

Table 1: BS6472-1:2008 VDV guideline limits for residential dwellings

The BS6472-1:2008 VDV guideline limits in Table 1 are applicable for both horizontal (X & Y axis) vibration as well as vertical (Z axis) vibration. Where vibration is below the range for low probability of adverse comment then BS6472-1:2008 advises adverse comment is not expected. Similarly, where vibration is above the range for adverse comment probable then BS6472-1:2008 advises adverse comment is very likely.

In addition to the vibration level thresholds for various use developments, and as a footnote to Table C of Camden Council's Policy DP28, it states *"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".* For the avoidance of doubt and as clarification It is taken that reference to 35dB(A)max is as normal convention L_{Asmax} 35dB.

4. NOISE SURVEY & ASSESSMENT

4.1 Survey Details & Procedure

A noise survey has been carried out at the development site using a logging type sound level meter over a five day period from Friday 11 November 2016 to Tuesday 15 November 2016. The full 24 hour period on Monday 14 November was used for analysis as no noise-contaminating demolition work was carried out on site during this period.

A primary noise survey measurement position was selected as representative of the rear elevation of the proposed new dwellings facing north-east towards the railway lines. The measurement position was as worst-case scenario for the proposed new development with highest incident noise levels from passing trains.

The position was achieved by positioning the measurement equipment at first floor height circa 3m above ground level on a tripod and microphone extension cable arrangement to provide 1m façade levels. Noise measurements were recorded in terms of 5 minute samples of overall L_{Aeq} and L_{Afmax} values continually over 1 hour periods for the entire survey duration.

It is noted that noise levels for assessment to residential development sites are generally measured at 1.2 to 1.5m above ground level; however for this development site it is considered necessary to measure noise levels at first floor level for reason of security of the noise survey instrumentation. The difference in measured noise levels at ground and first floor of the development site is negligible (less than 0.5dB) and therefore measurements at first floor level are considered valid for noise assessment of the site.

In addition to the primary position 24 hour survey, shorter term noise samples were also concurrently recorded on Tuesday 15 November 2016 at other secondary positions all around the development site to establish and verify the magnitude of noise to other areas relative to the primary noise measurement position. Noise measurements to other secondary positions were equivalent free-field sound pressure levels at 1.5m above ground level.

Samples of octave band values including during multiple train pass events were also obtained to provide frequency content information of noise levels used for acoustic calculations in establishing a scheme for noise insulation measures for the building envelope.

Locations of the primary and secondary noise measurement positions are indicated on the aerial location plan in Appendix A.

4.2 Instrumentation

Details for the noise survey instrumentation used are provided in Appendix C. The sound level meters were calibration verified before and after the survey measurements using the UKAS certified calibrator.

4.3 Survey Results & Observations

Noise levels to the proposed development site comprise principally of contributions from passing rail traffic on the adjacent Thameslink main-line route and occasional road and pedestrian traffic on Fordwych Road.

Complete raw data results for the primary position five day noise survey in terms of overall L_{Aeq} and L_{Afmax} values are provided in graphical format in Appendix D. Summary overall free-field L_{Aeq} results in terms of separate day, evening and night periods for the full 24 hour uncontaminated period on Monday 14 November are shown in Table 2 below.

Description		**Period L_{Aeq}**
24 hour period: Monday 14 November 2016	Day Period 07:00-23:00	61.3dBA (16 hour)
	Night Period 23:00-07:00	52.7dBA (8 hour)
	Camden Day Period 07:00-19:00	61.5dBA (12 hour)
	Camden Evening Period 19:00-23:00	60.3dBA (4 hour)
	Camden Night Period 23:00-07:00	52.7dBA (8 hour)

Table 2: L_{Aeq} noise levels for day, evening and night periods to rear elevation of the site facing railway lines

For the night period 23:00 to 07:00, highest regularly occurring equivalent free-field L_{Afmax} noise levels to the rear elevation of the site facing the railway lines are in the region of 70 - 75dB.

Concurrent short term measurements carried out at secondary noise measurement positions to other parts all around the development site showed noise levels are not any higher (within measurement tolerance +/- 1dB) than at the primary measurement position.

4.4 Noise Assessment

The noise survey results as detailed in Section 4.3 show that noise levels to the development site do not exceed the thresholds of Camden Council Policy DP28 Table A and therefore it is not considered that Camden Council would refuse planning permission for the development with regard to noise from the adjacent railway lines and other sources.

Noise levels to the development site do however marginally exceed the Evening Period (19:00-23:00) threshold of Camden Council Policy DP28 Table B thus requiring noise mitigation (attenuation) measures to be implemented as part of the scheme design. This is normal for this type and location of residential development, mitigation measures typically include acoustic performance glazing and acoustic ventilation.

Most sites for residential conversion or new build development in urban or suburban areas include parts that are exposed to higher noise levels associated with either adjacent railway lines and/or road traffic and are accepted for residential development by the Local Authority providing that an appropriate level of noise insulation measures are incorporated into the scheme design to ensure that noise levels inside rooms of the new residential dwellings are reasonable and comply with the specific requirements of the Authority and/or the requirements of British Standard BS8233.

Also there are existing residential properties in similar locations relative to the railway lines along the length of Fordwych Road that have rear elevations similarly exposed to noise from passing trains. Whilst it is acknowledged that existing residential properties might not be retrospectively assessed for noise intrusion, the presence of such properties does establish the nature and context of the area.

This proposed residential development does not therefore introduce a noise sensitive use (residential) into an area where there are no other existing noise sensitive (residential use) properties.

In summary, it is considered the site be suitable for the proposed residential development providing that an appropriate specification of noise insulation is included within the scheme design to ensure compliance with the criteria for internal noise as detailed in Section 3.1.

5. SCHEME FOR NOISE INSULATION MEASURES

For this development the scheme for noise insulation measures to protect against noise to inside the residential dwellings relates to the acoustic design and specification of elements of the residential building envelope which includes the external walls, glazing (windows), any passive type ventilators and roof/ceiling structures.

The dwellings are proposed to have conventional insulated cavity masonry structure external walls and typical flat/pitched timber joist insulated roof structures with plasterboard ceilings below on the top floors. These constructions will naturally provide a relatively good (high) level of sound insulation and therefore as for most residential sites, the dominant path for external noise to enter rooms of the new dwellings will be principally via glazing and any passive type ventilators.

By following the rigorous calculation procedures outlined in Section G.2 of Annex G (informative) of British Standard BS8233:2014 a specification for the acoustic performance of glazing (windows) and ventilators has been established and an item by item scheme for noise insulation measures for the whole residential building envelope is provided in Sections 5.1 to 5.4 on the following pages. Comment and assessment of noise levels to the external amenity spaces of the dwellings is provided in Section 5.5

Copies of example composite sound insulation acoustic calculations of the building envelope for day and night period (as relevant) noise intrusion into the ground floor rear elevation living / dining room of Unit 2 and first floor side elevation bedroom 2 of Unit 1 of the proposed dwellings are provided in Appendix E. These have been selected as representing the worst-case scenario rooms with windows nearest to (and facing towards) the adjacent railway lines and thus with highest incident noise levels, In addition, the second floor living / dining room and bedroom of Unit 4 have been assessed as they include roof structures.

The calculations use a spreadsheet calculation based on Section G.2 of Annex G (informative) of British Standard BS8233:2014 and BS EN 12354-3:2000, this form of spreadsheet is used by many acoustic consultancy practices.

The calculations confirm that with the scheme for noise insulation measures implemented as Sections 5.1 to 5.4, intrusive noise levels into rooms of the residential dwellings will comply with the criteria for internal noise set with reference to BS8233:2014 and as detailed in Section 3.1.

Note that the bedroom night period L_{Afmax} calculation is based on a typical high range night period L_{Afmax} value 72dB. For majority of the night period, L_{Afmax} levels are at least 5dB lower than this typical high value used in the calculation, and thus for the majority of the night period L_{Afmax} levels will be substantially below the upper limit criterion L_{Afmax} 45dB.

5.1 External Walls

External walls of the dwellings are proposed to be conventional insulated cavity masonry construction, brick/cavity/block. Values in Table 3 show the expected minimum sound insulation performance for this type of wall construction. This wall construction will provide more than adequate sound insulation.

Description	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Wall Sound Insulation Performance Sound Reduction Index R dB	41	45	50	54	58	60*

***** *Note: SI values limited to upper values 60dB. Higher figures might be obtained at these frequencies but are not quoted.*

Table 3: Conventional insulated cavity masonry external wall sound insulation performance

5.2 Glazing

Values in Table 4 show a specification schedule of glazing sound insulation performance for different parts of the development. For purpose of this report the parts are described as Insulation Zone A and Insulation Zone B and are indicated on marked up layout plan drawings of the development in Appendix F.

The specification for glazing applies to windows, roof lights and also any glazed exterior doors (proposed timber sliding bi-fold doors). Also, for the purpose of specification for glazing sound insulation as Table 4, any kitchen and dining areas that are open plan to a living room are also classed as living rooms.

Description	Octave Band Centre Frequency (Hz)						Comments
	125	250	500	1k	2k	4k	
Insulation Zone A (principally to the rear / side elevations of the development facing the railway lines)							
Living Rooms & Bedrooms	20	23	32	36	38	40	Acoustic performance asymmetric double glazing such as 6/airgap/4 configuration ≥ Rw 34dB with effective seals
Other Room Types	*No acoustic performance need be specified*						Any standard/normal double glazing be acceptable and will typically by default have sound insulation performance ≥ Rw 29dB
Insulation Zone B (principally to the front / side elevations of the development facing toward Fordwych Road)							
All Room Types	*No acoustic performance need be specified*						Any standard/normal double glazing be acceptable and will typically by default have sound insulation performance ≥ Rw 29dB

Table 4: Typical specification for glazing sound insulation performance Sound Reduction Index R dB

The performance figures for bedrooms and living rooms to Insulation Zone A corresponds to a moderate to high performance acoustic glazing system normally achievable only through asymmetric double glazed windows such as 6 / airgap / 4 (6mm glass / airgap / 4mm glass) double glazing ≥ Rw 34dB.

Note the glazing specification for bedrooms and living rooms to Insulation Zone B is lower than that to Insulation Zone A due to lower incident noise levels to the front elevations of the development.

For other room types (i.e. not bedrooms and living rooms) a normal/standard good quality double glazing system such as 4 / airgap / 4 (4mm glass / airgap / 4mm glass), with airgap typically between 14 to 20mm would be acceptable.

For all living rooms and bedrooms throughout the development it is recommended that windows frames have effective acoustic seals all round. Effective seals are rubber or neoprene beaded "P" type that compresses all around on closure of the windows. Plastic type or brush type weathering seals are not classed as effective acoustic seals.

Details for several possible glazing suppliers that Philip Acoustics is aware of as supplying acoustic performance glazing for residential developments are included in Appendix G.

5.3 Ventilation

It is anticipated that a ventilation system will need to be incorporated into the scheme design such that residents of the dwellings are able to have background ventilation without necessarily needing to open windows.

This is ordinarily achieved through use of either acoustic (or non-acoustic) passive type "trickle" ventilators or by a room by room or whole house type mechanical ventilation system; which ventilation strategy is adopted generally being decided for non-acoustic reasons.

It is sometimes required by a Local Planning Authority that where a residential development site is in a potentially noise affected location then the building's sound insulation measures shall include provision of mechanical ventilation. However, in locations that are not subject to extremely high noise levels then standard "off the shelf" passive type ventilators provide a moderately good level of sound insulation usually sufficient to comply with the particular noise requirements without the need for mechanical ventilation.

Therefore specification options for either passive ventilators or mechanical ventilation are provided below; it is recommended the developer seeks prior approval with the Local Authority of whichever approach is preferred.

Option 1: Passive Ventilators

Values in Table 5 show a specification schedule of passive type ventilator sound insulation performance for all parts and room types of the development.

Description	Octave Band Centre Frequency (Hz)						Comments
	125	250	500	1k	2k	4k	
Ventilator Sound Insulation Performance Normalised Level Difference Dn,e dB	30	30	30	30	30	28	Standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Table 5: Specification for ventilator sound insulation performance

Option 2: Mechanical Ventilation

This option is typically either a “whole-house” heat recovery type mechanical ventilation system or room by room system.

Mechanical ventilation systems by default have relatively high sound insulation performance (i.e. reduce noise from outside to inside), typically ≥ $D_{n,e,w}$ 45dB and would readily reduce external noise to comply with the internal noise requirements. If a mechanical ventilation system is used then the acoustic specification is that self-noise of the system must not cause internal noise levels within the rooms of the dwellings to exceed the overall noise requirements.

To achieve the requirements it is recommended that noise from any mechanical ventilation system will need to be circa at least 5dBA lower than the day and night period requirements to allow for the accumulation of noise sources.

Therefore it is recommended that the acoustic specification of overall self-noise from any mechanical ventilation system will need to be ≤L_{Aeq} 30dB for living/dining rooms and bedrooms during the day period, plus ≤L_{Aeq} 25dB for bedrooms during the night period.

Where overall self-noise from mechanical ventilation systems could potentially exceed these limits then noise of the systems would be sufficiently reduced typically by using acoustic type flexible ducting as opposed to standard type flexible ducting between the ventilation system unit and individual room grilles.

Details for several acoustic and mechanical ventilator suppliers that Philip Acoustics is aware of are included in Appendix G.

5.4 Roof Structure & Associated Ceilings

The roof structure and associated ceilings are to be pitched / flat timber joist with insulation in loft and with plasterboard ceilings and skim plaster finish internally room-side.

It is recommended that the plasterboard ceilings below roof level be minimum 2 x layers (i.e. double layer) 12.5mm type plasterboard. Values in Table 6 show the expected minimum sound insulation performance for this type of roof and associated ceiling construction.

Description	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
Roof & Ceiling Sound Insulation Performance Sound Reduction Index R dB	27	37	43	49	57	61

Table 6: Roof & ceiling sound insulation performance, Sound Reduction Index R dB

5.5 External Amenity Spaces

External amenity spaces for the proposed development are principally terrace areas allocated individually or communally of the new dwellings.

The primary position noise survey results (see Table 2 Section 4.2) show existing day period noise levels to the development site to be in the region of $L_{Aeq\ (16hr)}$ 61dB.

The noise survey results therefore indicate that noise levels to the rear and side terrace areas of the new dwellings closest to the railway lines may not comply with the upper guidance value of *55dB* $L_{Aeq,T}$ within BS8233:2014 as described previously.

BS8233:2014 recognises that the guideline values may not be achievable in all circumstances including urban areas adjoining the strategic transport network similar to this development site and that development should not be prohibited when taking in to consideration the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met.

6. VIBRATION SURVEY & ASSESSMENT

6.1 Survey Details & Procedure

A vibration survey has been carried out at the development site using a logging type vibration meter over a five day period from Friday 11 November 2016 to Tuesday 15 November 2016. A full 24 hour period on Monday 14 November was used for analysis as no vibration-contaminating demolition work was carried out on site during this period.

A single vibration measurement position was selected at a location representative of the rear elevation of the proposed new dwellings closest to the railway lines. This location was selected as worst-case scenario with potentially highest incident vibration levels from passing trains.

The vibration measurement position was achieved as per normal procedures by rigidly coupling the vibration meter transducer directly to the ground floor concrete slab using a heavy steel mounting block on steel spikes. Location of the vibration measurement position is indicated on the aerial image in Appendix A.

Vibration levels were recorded in terms of rms acceleration (for information) and also Vibration Dose Values (VDV) over concurrent 1 minute samples in the vertical direction (Z axis) and horizontal directions (X and Y axes) throughout the survey duration. The X axis being parallel with the railway lines, the Y axis being perpendicular to the railway lines.

6.2 Instrumentation

Details of the vibration survey instrumentation used are provided in Appendix C.

6.3 Measurement Results & Observations

Complete raw data results of the vibration survey in terms of X, Y and Z axis VDV values are shown in graphical format in Appendix H.

Although subjectively, no significant ground-borne vibration from passing trains was perceptible to the author when standing at various positions around the site, the vibration survey results indicate, as normal and expected that ground-borne vibration from passing trains is present and measurable at the site.

6.4 Vibration Assessment

In accordance with procedures outlined in BS6472-1:2008 and using the vibration survey results as detailed in Appendix H, calculated day and night period worst-case Z axis VDVs of the survey are shown in Table 7.

Description	X Axis VDV	Y Axis VDV	Z Axis VDV	Comments
Day Period (07:00 to 23:00)	0.0071 $m/s^{1.75}$	0.0087 $m/s^{1.75}$	0.0587 $m/s^{1.75}$	Day period vibration at the site is below the BS6472-1:2008 low probability of adverse comment range 0.2 to 0.4 $m/s^{1.75}$ and is below the Table C day period vibration threshold limit of Camden Council Policy DP28
Night Period (23:00 to 07:00)	0.0038 $m/s^{1.75}$	0.0046 $m/s^{1.75}$	0.0234 $m/s^{1.75}$	Night period vibration at the site is below the BS6472-1:2008 low probability of adverse comment range 0.1 to 0.2 $m/s^{1.75}$ and is below the Table C night period vibration threshold limit of Camden Council Policy DP28

Table 7: Day and night period VDVs to the position of the rear elevation of the proposed dwellings

Table 7 shows that day and night period vibration to the proposed new dwellings is below the low probability of adverse comment range as advised in BS6472-1:2008. It is considered that no vibration control treatments (such as specialist resilient bearings as part of the structural foundations of the dwellings) need be incorporated within the development's scheme design.

APPENDIX A

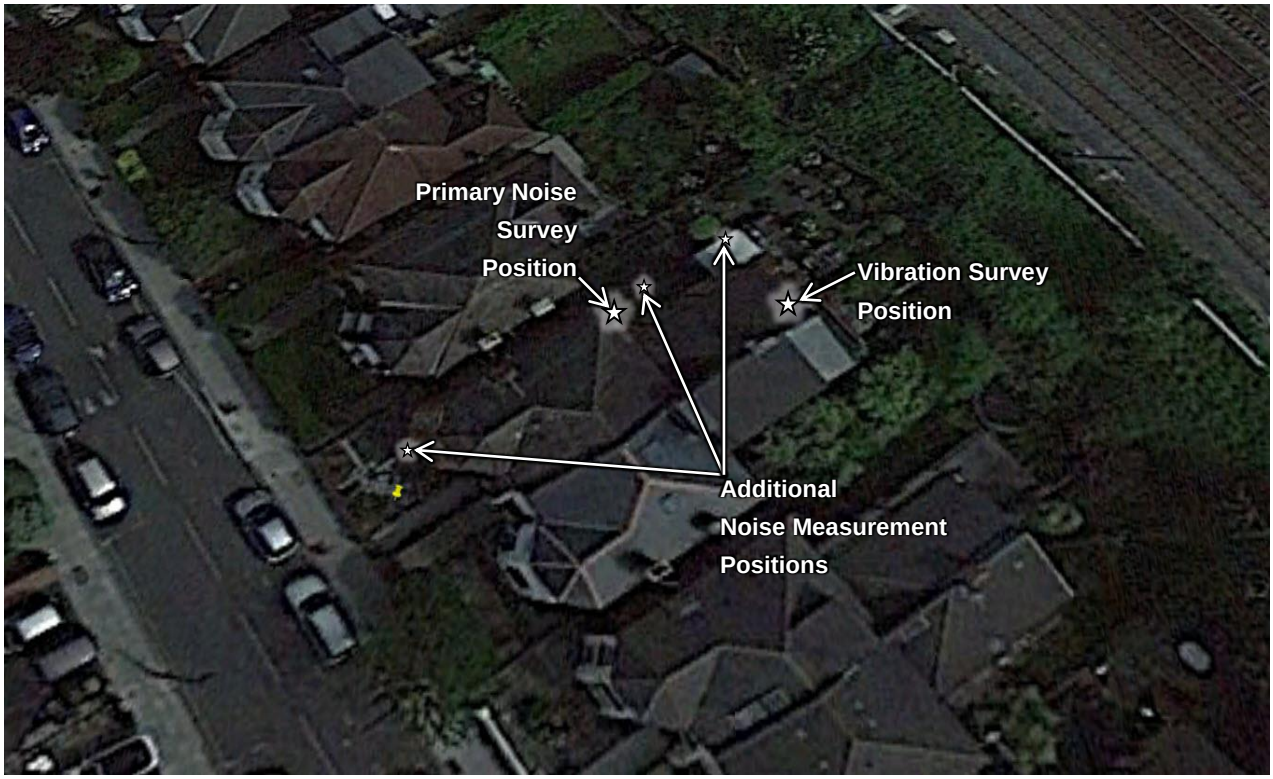
Site Location Plan, Block Plan & Layout Drawings For The Proposed Development

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 1 of 11)*

Date: December 2016

AERIAL LOCATION PLAN INDICATING MEASUREMENT POSITIONS



Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 2 of 11)*

Date: December 2016

PROPOSED SITE LOCATION PLAN

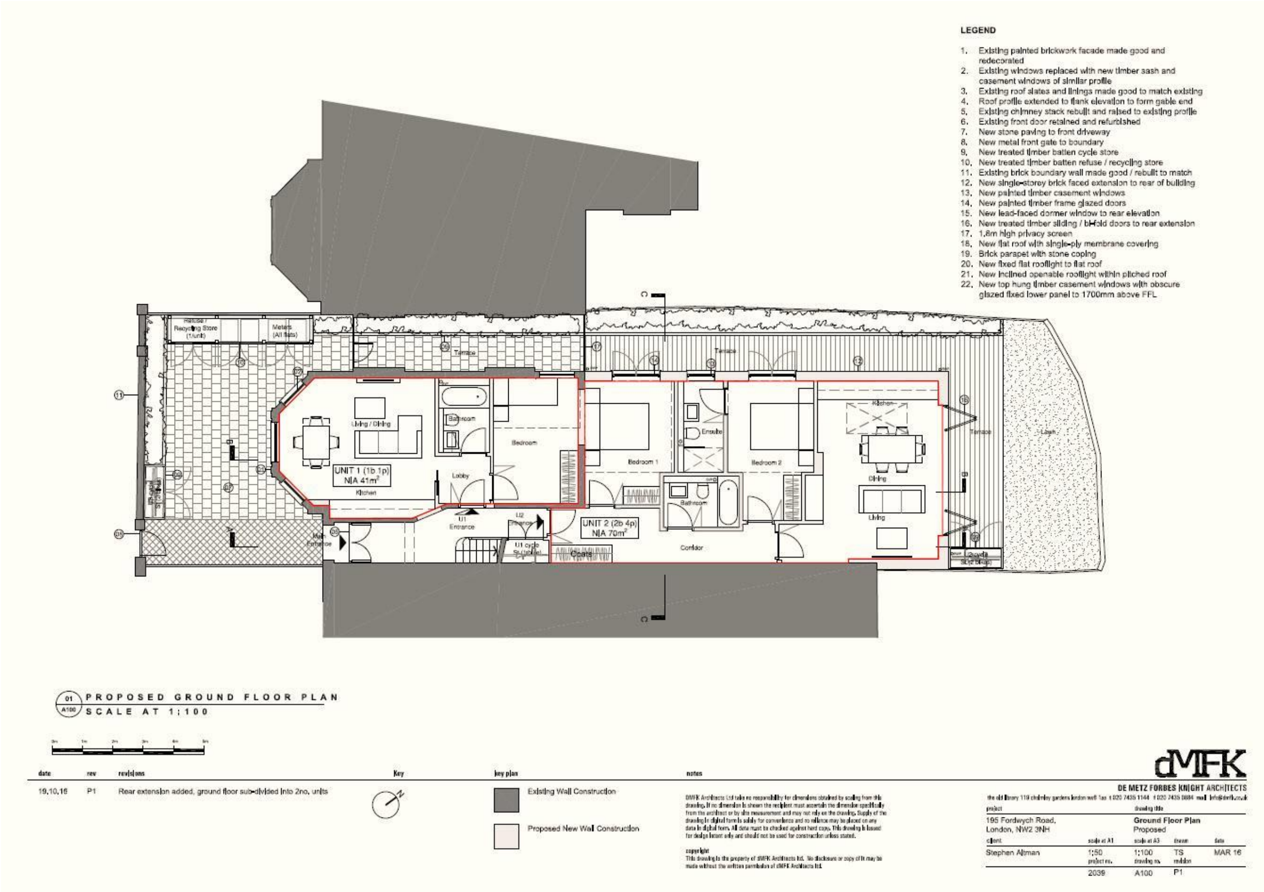
Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 3 of 11)*

Date: December 2016

LAYOUT PLANS FOR THE PROPOSED DEVELOPMENT

Ground Floor



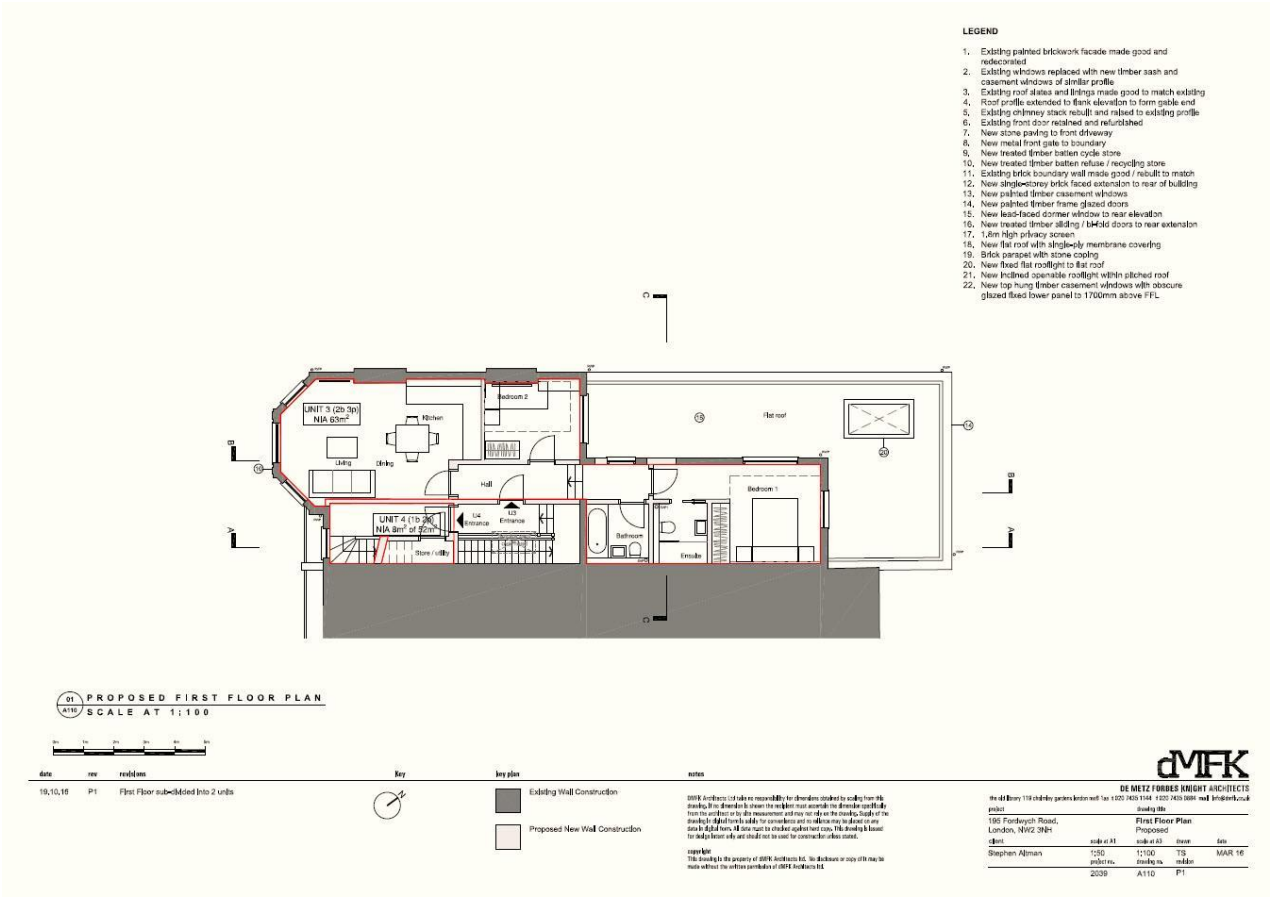
Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 4 of 11)*

Date: December 2016

LAYOUT PLANS FOR THE PROPOSED DEVELOPMENT

First Floor



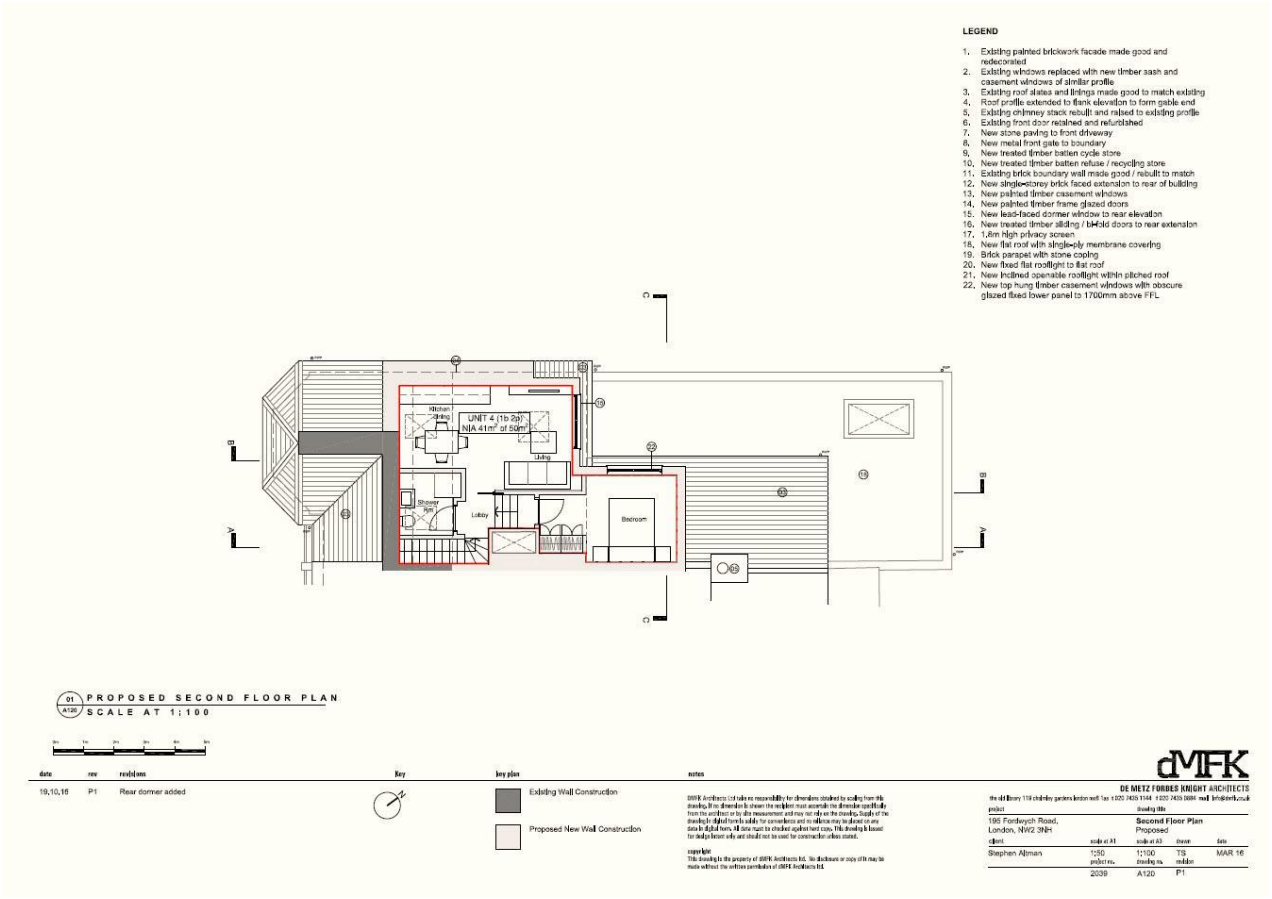
Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 5 of 11)*

Date: December 2016

LAYOUT PLANS FOR THE PROPOSED DEVELOPMENT

Second Floor



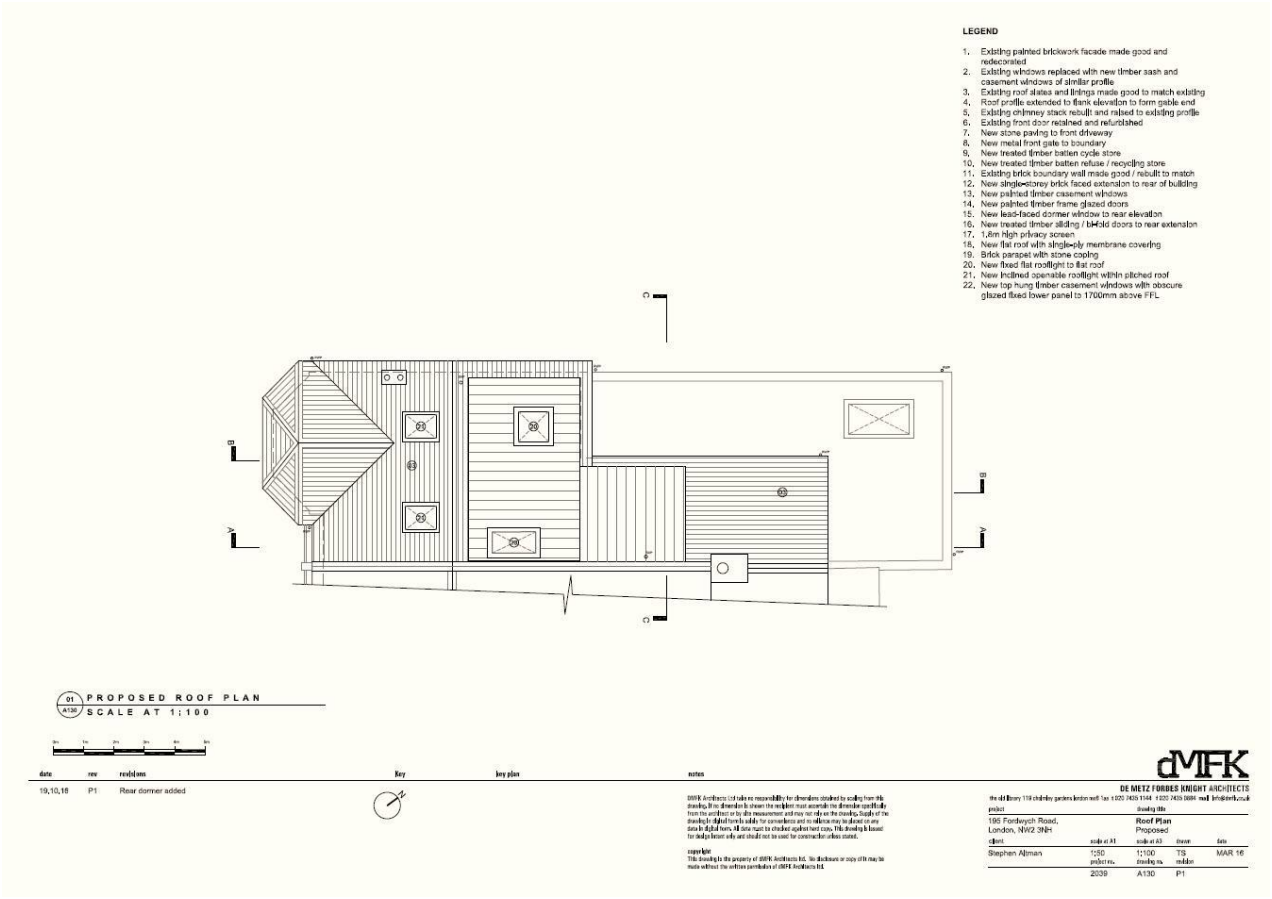
Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 6 of 11)*

Date: December 2016

LAYOUT PLANS FOR THE PROPOSED DEVELOPMENT

Roof Level



Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 7 of 11)*

Date: December 2016

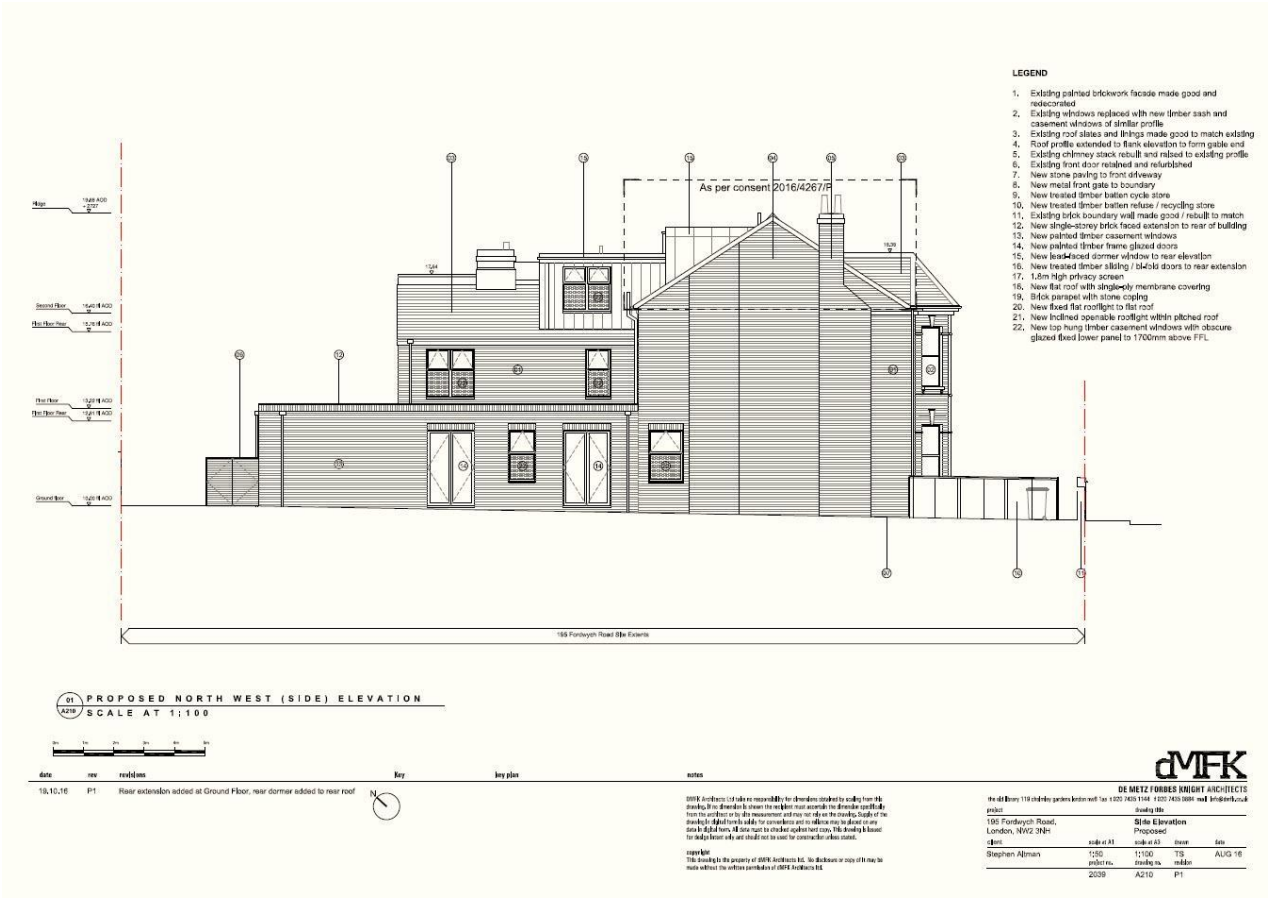
ELEVATION PLANS FOR THE PROPOSED DEVELOPMENT

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 8 of 11)*

Date: December 2016

ELEVATION PLANS FOR THE PROPOSED DEVELOPMENT

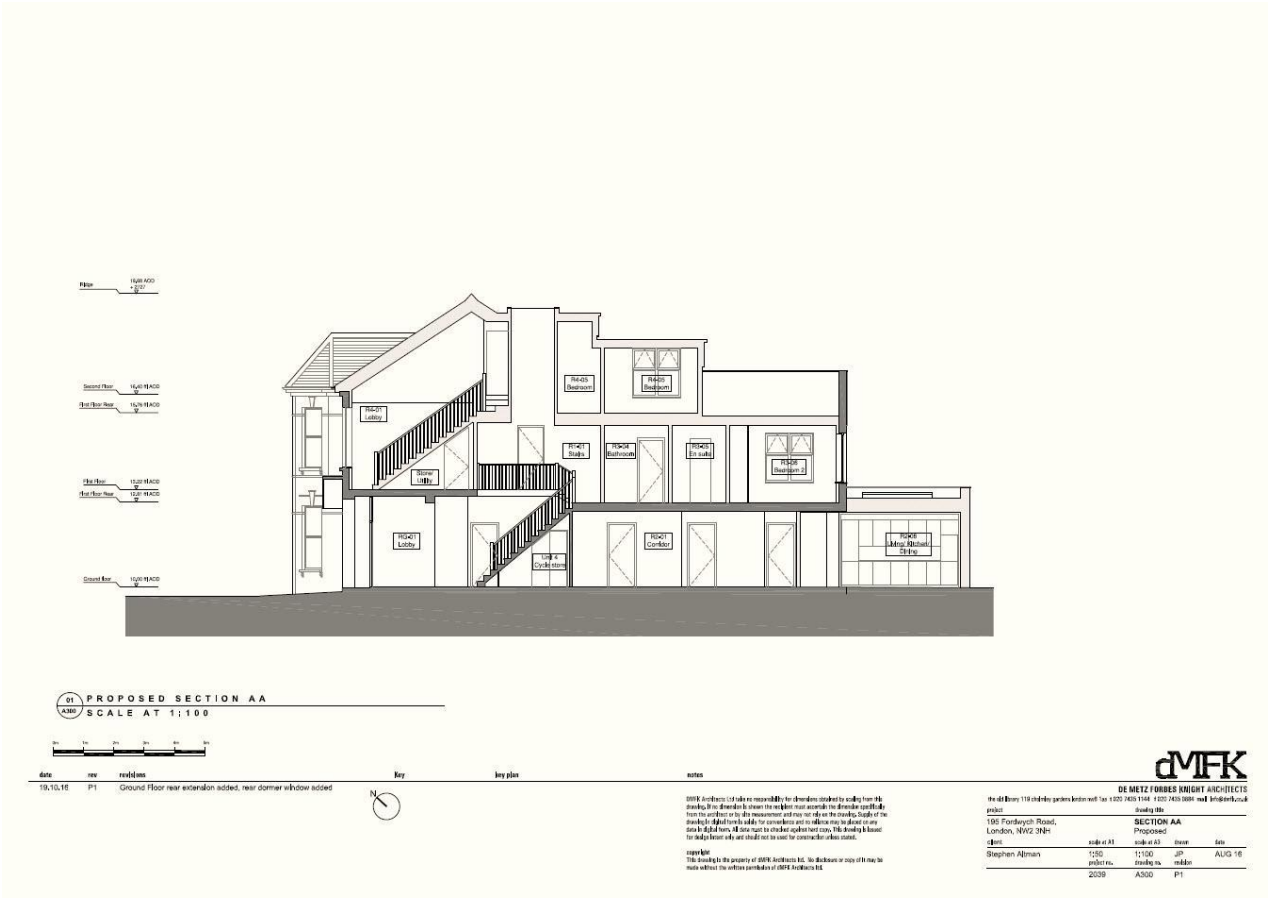


Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 9 of 11)*

Date: December 2016

SECTION PLANS FOR THE PROPOSED DEVELOPMENT



Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 10 of 11)*

Date: December 2016

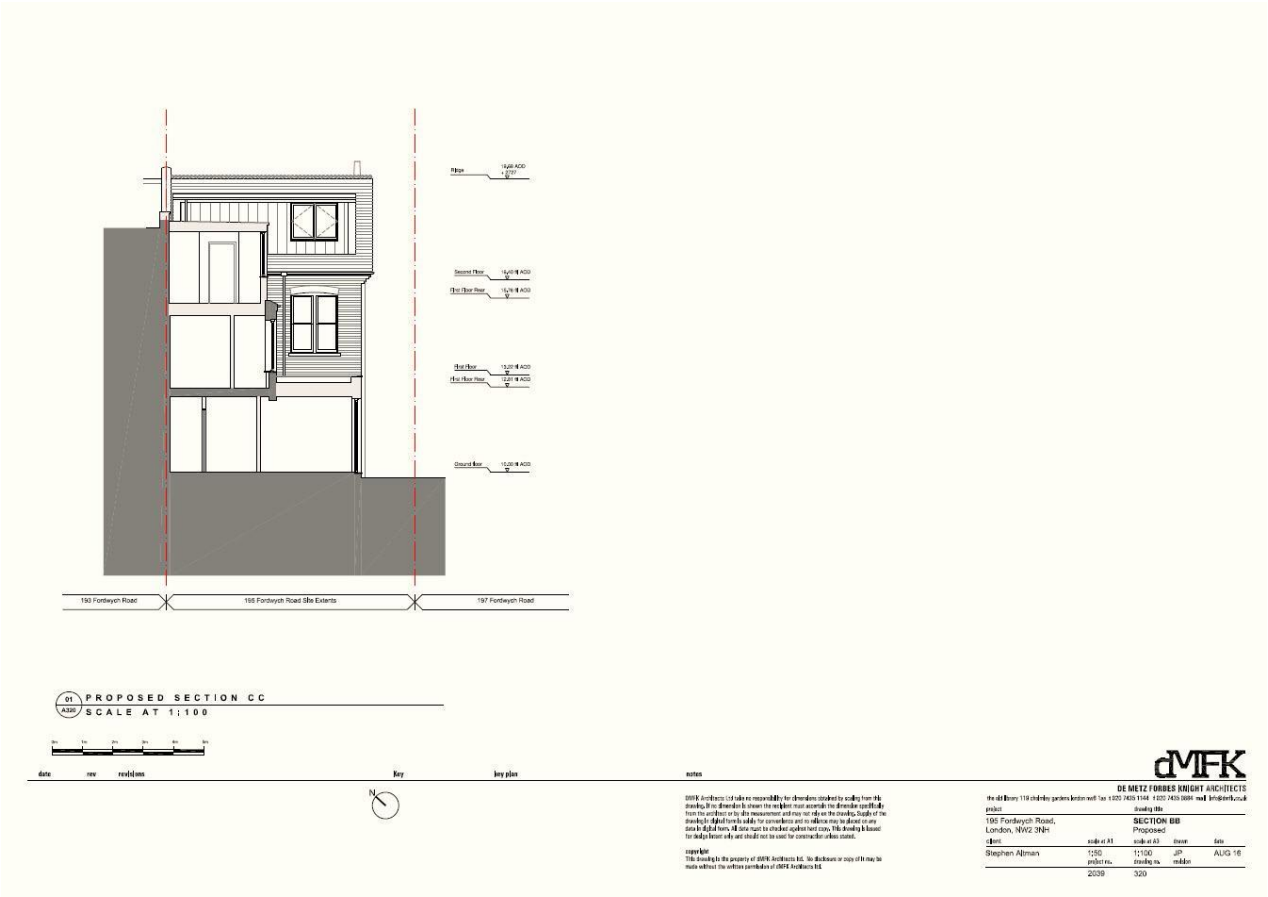
SECTION PLANS FOR THE PROPOSED DEVELOPMENT

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix A *(page 11 of 11)*

Date: December 2016

SECTION PLANS FOR THE PROPOSED DEVELOPMENT



APPENDIX B

Policy DP28 – Noise & Vibration of Section 3 of Camden Development Policies 2010-2025

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix B *(page 1 of 4)*

Date: December 2016

POLICY DP28 – NOISE & VIBRATION FROM SECTION 3 OF CAMDEN DEVELOPMENT POLICIES 2010-2025

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

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix B *(page 3 of 4)*

Date: December 2016

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

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix B *(page 4 of 4)*

Date: December 2016

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

Noise & Vibration Survey Instrumentation

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix C *(page 1 of 1)*

Date: December 2016

NOISE AND VIBRATION SURVEY INSTRUMENTATION

Twenty-four Hour Noise Survey At Primary Measurement Position:

- Rion sound level meter type NL-31 Class 1 serial number 00903983 plus Rion preamplifier type NH-21 serial number 33991 plus Rion microphone type UC-53A serial number 317502 complete with weatherproof and lockable outdoor environmental kit, microphone extension lead and tripod arrangement;
- Brüel & Kjær calibrator type 4231 serial number 2454786 (UKAS certified).

Noise Survey Samples At Secondary Measurement Positions Including Octave Band Levels:

- Bruel & Kjaer sound level meter type 2260 Class 1 serial number 2497368 plus Bruel & Kjaer microphone type 4189 serial number 2846933 plus tripod;
- Bruel & Kjaer calibrator type 4231 serial number 2454786 (UKAS certified).

VIBRATION SURVEY INSTRUMENTATION

- Rion vibration meter type VM-54 serial number 00360146 plus Rion tri-axial accelerometer type PV-83CW serial number 63644 with steel spike and heavy steel accelerometer mounting block complete with weatherproof and lockable outdoor environmental kit.

APPENDIX D

Noise Survey Results

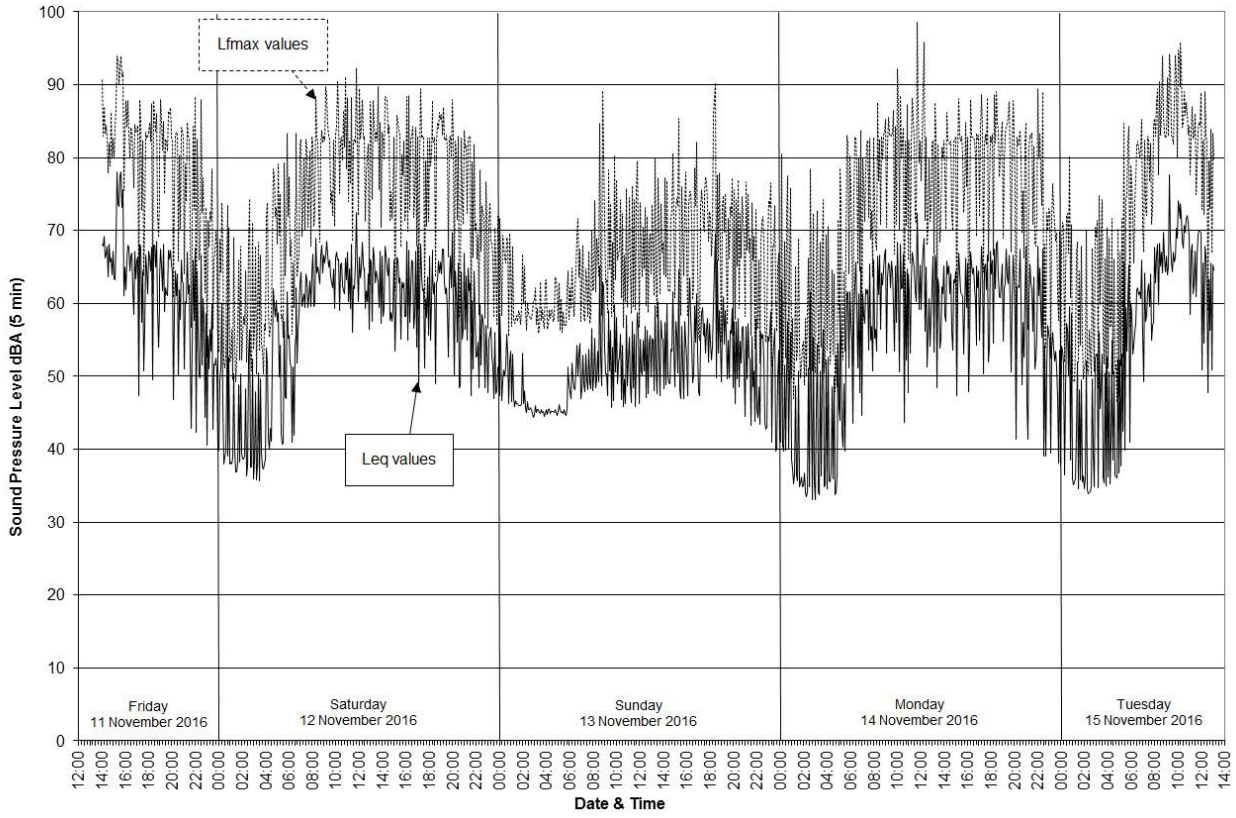
Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix D *(page 1 of 1)*

Date: December 2016

NOISE SURVEY RESULTS

Noise Survey At Primary Position (rear elevation of development site nearest to railway lines)



APPENDIX E

Example Building Envelope Acoustic Calculations

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 1 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 2, Living/Dining
NOISE CONDITION Daytime 16 hour Leq 61.3dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	61.3	57.2	58.7	57.6	57.1	54.6	47.8

Building Envelope Details For Sample Room:		
Element	Area (m^2) or Vent No	Element Specification / Description
Walls	24.6	Composite insulated external walls with brick or block/render outer leaf
Windows	3.6	Acoustic performance 6-18-4 double glazing ≥ Rw 34dB (skylight)
Doors	11.4	Acoustic performance 6-18-4 double glazing ≥ Rw 34dB (patio doors)
Roof & associated ceiling	18.5	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	2	Allow 2 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	24.6	41	45	50	54	58	60
Windows	3.6	20	23	32	36	38	40
Doors	11.4	20	23	32	36	38	40
Roof & associated ceiling	18.5	27	37	43	49	57	61
Ventilators (Dn,e)	2	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-24.5	-27.4	-32.6	-33.7	-34.2	-32.4

Sample Room Volume (m^3):	89.0
Sample Room Building Envelope Surface Area (m^2):	58.1

Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Living Room	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.40	0.40	0.35	0.30	0.30	0.30

Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	**33.4**	**37.8**	**36.5**	**29.5**	**27.2**	**24.3**	**19.3**

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 2 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 3, Bedroom 1
NOISE CONDITION : Daytime 16 hour Leq 61.3dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	61.3	57.2	58.7	57.6	57.1	54.6	47.8

Building Envelope Details For Sample Room:		
Element	Area (m^2) or Vent No	Element Specification / Description
Walls	16.1	Composite insulated external walls with brick or block/render outer leaf
Windows	4.8	Acoustic performance 6-18-4 double glazing ≥ Rw 34dB
Doors	0.0	No external doors to room
Roof & associated ceiling	18.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	1	Allow 1 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	16.1	41	45	50	54	58	60
Windows	4.8	20	23	32	36	38	40
Doors	0.0						
Roof & associated ceiling	18.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-26.2	-29.8	-34.3	-35.2	-35.6	-33.7

Sample Room Volume (m^3):	32.5
Sample Room Building Envelope Surface Area (m^2):	38.9

Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20

Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	**32.5**	**37.5**	**35.4**	**28.1**	**26.6**	**23.8**	**18.8**

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 3 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 3, Bedroom 1
NOISE CONDITION : Night-time 8 hour Leq 52.7dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:

Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	52.7	48.6	50.1	49.0	48.5	46.0	39.2

Building Envelope Details For Sample Room:

Element	Area (m^2) or Vent No	Element Specification / Description
Walls	16.1	Composite insulated external walls with brick or block/render outer leaf
Windows	4.8	Acoustic performance 6-18-4 double glazing ≥ Rw 34dB
Doors	0.0	No external doors to room
Roof & associated ceiling	18.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	1	Allow 1 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:

		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	16.1	41	45	50	54	58	60
Windows	4.8	20	23	32	36	38	40
Doors	0.0						
Roof & associated ceiling	18.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-26.2	-29.8	-34.3	-35.2	-35.6	-33.7

Sample Room Volume (m^3):	32.5
Sample Room Building Envelope Surface Area (m^2):	38.9

Sample Room Characteristics:

		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20

Calculated Internal Sound Pressure Level In Sample Room:

Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	**23.9**	**28.9**	**26.8**	**19.5**	**18.0**	**15.2**	**10.2**

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 4 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 3, Bedroom 1
NOISE CONDITION : Night-time 8 hour Lfmax 72dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,ff	72.0	69.1	69.6	68.1	67.0	66.0	59.7

Building Envelope Details For Sample Room:		
Element	Area (m^2) or Vent No	Element Specification / Description
Walls	3.7	Composite insulated external walls with brick or block/render outer leaf
Windows	0.0	See Doors below
Doors	3.5	Acoustic performance 6-18-4 double glazing ≥ Rw 34dB (patio doors)
Roof & associated ceiling	9.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	1	Allow 1 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	3.7	41	45	50	54	58	60
Windows	0.0						
Doors	3.5	20	23	32	36	38	40
Roof & associated ceiling	9.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-24.1	-27.2	-31.0	-31.6	-31.9	-30.0

Sample Room Volume (m^3):	32.5
Sample Room Building Envelope Surface Area (m^2):	16.2

Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20

Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,2	**42.8**	**47.7**	**45.1**	**38.1**	**36.3**	**35.1**	**30.7**

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 5 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 4, Living/Dining
NOISE CONDITION Daytime 16 hour Leq 61.3dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:

Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	61.3	57.2	58.7	57.6	57.1	54.6	47.8

Building Envelope Details For Sample Room:

Element	Area (m2) or Vent No	Element Specification / Description
Walls	18.0	Composite insulated external walls with brick or block/render outer leaf
Windows	2.2	4-20-4 double glazing ≥ Rw 31dB
Doors	0.0	No external doors to room
Roof & associated ceiling	18.0	Standard flat/pitched timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	2	Allow 2 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:

		dB at Octave Band Centre Frequency					
Element	Area (m2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	18.0	41	45	50	54	58	60
Windows	2.2	19	17	29	39	41	36
Doors	0.0						
Roof & associated ceiling	18.0	27	37	43	49	57	61
Ventilators (Dn,e)	2	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-26.5	-27.5	-32.1	-32.7	-32.8	-30.7

Sample Room Volume (m3):	46.1
Sample Room Building Envelope Surface Area (m2):	38.2

Sample Room Characteristics:

		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Living Room	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.40	0.40	0.35	0.30	0.30	0.30

Calculated Internal Sound Pressure Level In Sample Room:

Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	**35.0**	**36.9**	**37.4**	**31.1**	**29.3**	**26.8**	**22.0**

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 6 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 4, Bedroom
NOISE CONDITION Daytime 16 hour Leq 61.3dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	61.3	57.2	58.7	57.6	57.1	54.6	47.8

Building Envelope Details For Sample Room:		
Element	Area (m^2) or Vent No	Element Specification / Description
Walls	11.8	Composite insulated external walls with brick or block/render outer leaf
Windows	2.9	4-20-4 double glazing ≥ Rw 31dB
Doors	0.0	No external doors to room
Roof & associated ceiling	13.0	Standard flat timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	1	Allow 1 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	11.8	41	45	50	54	58	60
Windows	2.9	19	17	29	39	41	36
Doors	0.0						
Roof & associated ceiling	13.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-25.7	-25.9	-32.9	-34.2	-34.3	-32.2

Sample Room Volume (m^3):	30.9
Sample Room Building Envelope Surface Area (m^2):	27.7

Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20

Calculated Internal Sound Pressure Level In Sample Room:							
Daytime 16hr (7am - 11pm)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	**33.3**	**36.7**	**38.0**	**28.2**	**26.4**	**23.8**	**19.1**

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 7 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 4, Bedroom
NOISE CONDITION : Night-time 8 hour Leq 52.7dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,ff	52.7	48.6	50.1	49.0	48.5	46.0	39.2

Building Envelope Details For Sample Room:		
Element	Area (m^2) or Vent No	Element Specification / Description
Walls	11.8	Composite insulated external walls with brick or block/render outer leaf
Windows	2.9	4-20-4 double glazing ≥ Rw 31dB
Doors	0.0	No external doors to room
Roof & associated ceiling	13.0	Standard flat timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	1	Allow 1 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	11.8	41	45	50	54	58	60
Windows	2.9	19	17	29	39	41	36
Doors	0.0						
Roof & associated ceiling	13.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-25.7	-25.9	-32.9	-34.2	-34.3	-32.2

Sample Room Volume (m^3):	30.9
Sample Room Building Envelope Surface Area (m^2):	27.7

Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20

Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Leq,2	**24.7**	**28.1**	**29.4**	**19.6**	**17.8**	**15.2**	**10.5**

PHILIP ACOUSTICS LTD

107 Bancroft, Hitchin, Hertfordshire SG5 1NB Tel: 01462 431877

E-mail: admin@philipacoustics.co.uk

Member of The Association of Noise Consultants Registered in England No.: 4560265

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix E *(page 8 of 8)*

Date: December 2016

BS EN ISO 12354-3 BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM : Unit 4, Bedroom
NOISE CONDITION : Night-time 8 hour Lfmax 72dBA free field level

Equivalent Free-Field External Sound Pressure Level Outside Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,ff	72.0	69.1	69.6	68.1	67.0	66.0	59.7

Building Envelope Details For Sample Room:		
Element	Area (m^2) or Vent No	Element Specification / Description
Walls	11.8	Composite insulated external walls with brick or block/render outer leaf
Windows	2.9	4-20-4 double glazing ≥ Rw 31dB
Doors	0.0	No external doors to room
Roof & associated ceiling	13.0	Standard flat timber joist roof with insulation in loft & plasterboard ceilings
Ventilators	1	Allow 1 x standard non-acoustic trickle ventilator typically ≥ Dn,e,w 30dB

Element Sound Reduction Index:							
		dB at Octave Band Centre Frequency					
Element	Area (m^2) or Vent No	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	11.8	41	45	50	54	58	60
Windows	2.9	19	17	29	39	41	36
Doors	0.0						
Roof & associated ceiling	13.0	27	37	43	49	57	61
Ventilators (Dn,e)	1	30	30	30	30	30	28
Overall Sound Reduction All Elements Combined		-25.7	-25.9	-32.9	-34.2	-34.3	-32.2

Sample Room Volume (m^3):	30.9
Sample Room Building Envelope Surface Area (m^2):	27.7

Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Bedroom	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Reverberation Time In Furnished Sample Room		0.30	0.30	0.20	0.20	0.20	0.20

Calculated Internal Sound Pressure Level In Sample Room:							
Night-time 8hr (11pm - 7am)	Overall dBA	Linear dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Lfmax,2	**44.2**	**48.6**	**48.9**	**38.7**	**36.3**	**35.2**	**31.0**

PHILIP ACOUSTICS LTD

107 Bancroft, Hitchin, Hertfordshire SG5 1NB Tel: 01462 431877

E-mail: admin@philipacoustics.co.uk

Member of The Association of Noise Consultants Registered in England No.: 4560265

APPENDIX F

Sound Insulation Zones For Glazing & Ventilators

Site: 195 Fordwych Road, London NW2 3NH

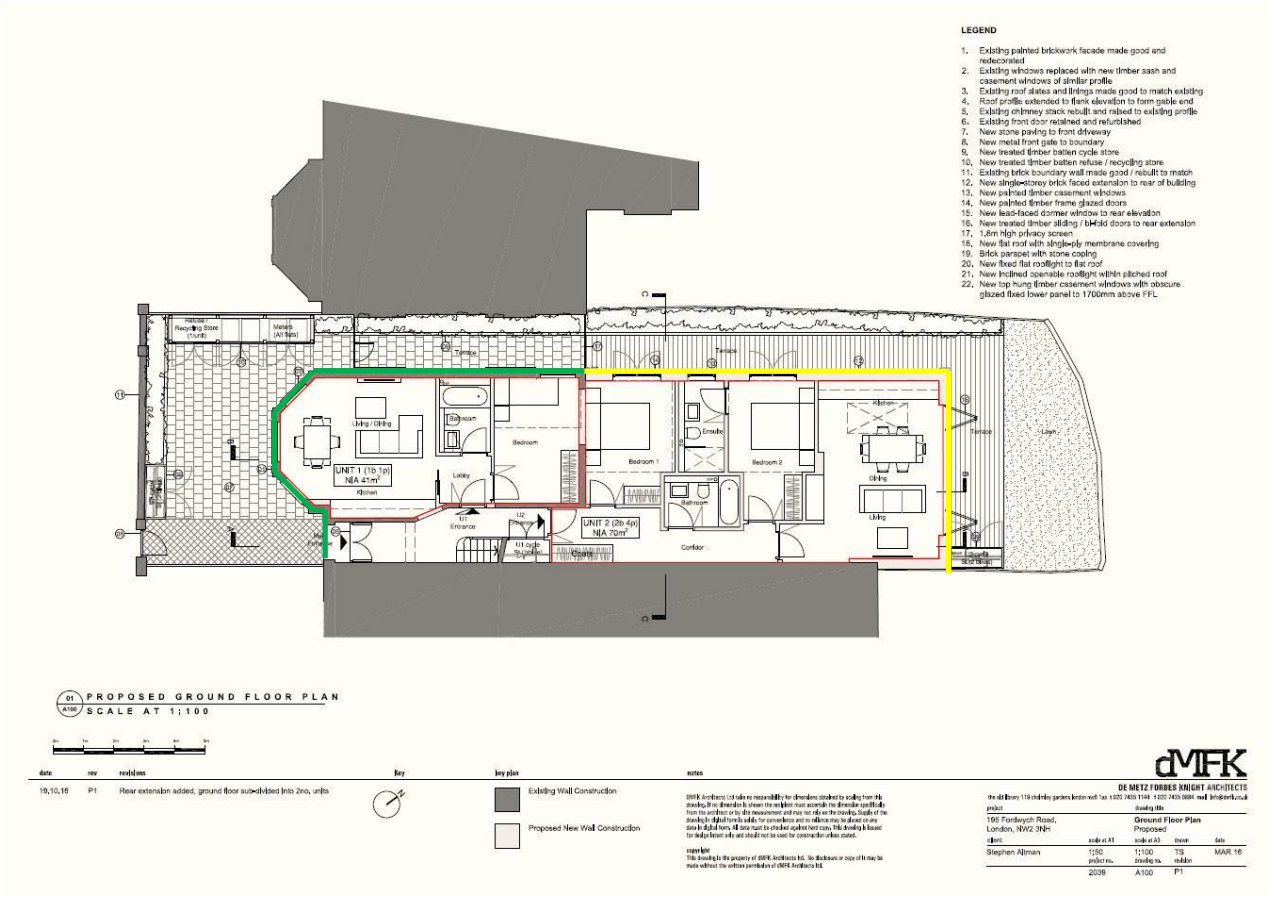
Report: 16208-002 Appendix F *(page 1 of 3)*

Date: December 2016

SOUND INSULATION ZONES

Ground Floor

= Insulation Zone A = Insulation Zone B



Site: 195 Fordwych Road, London NW2 3NH

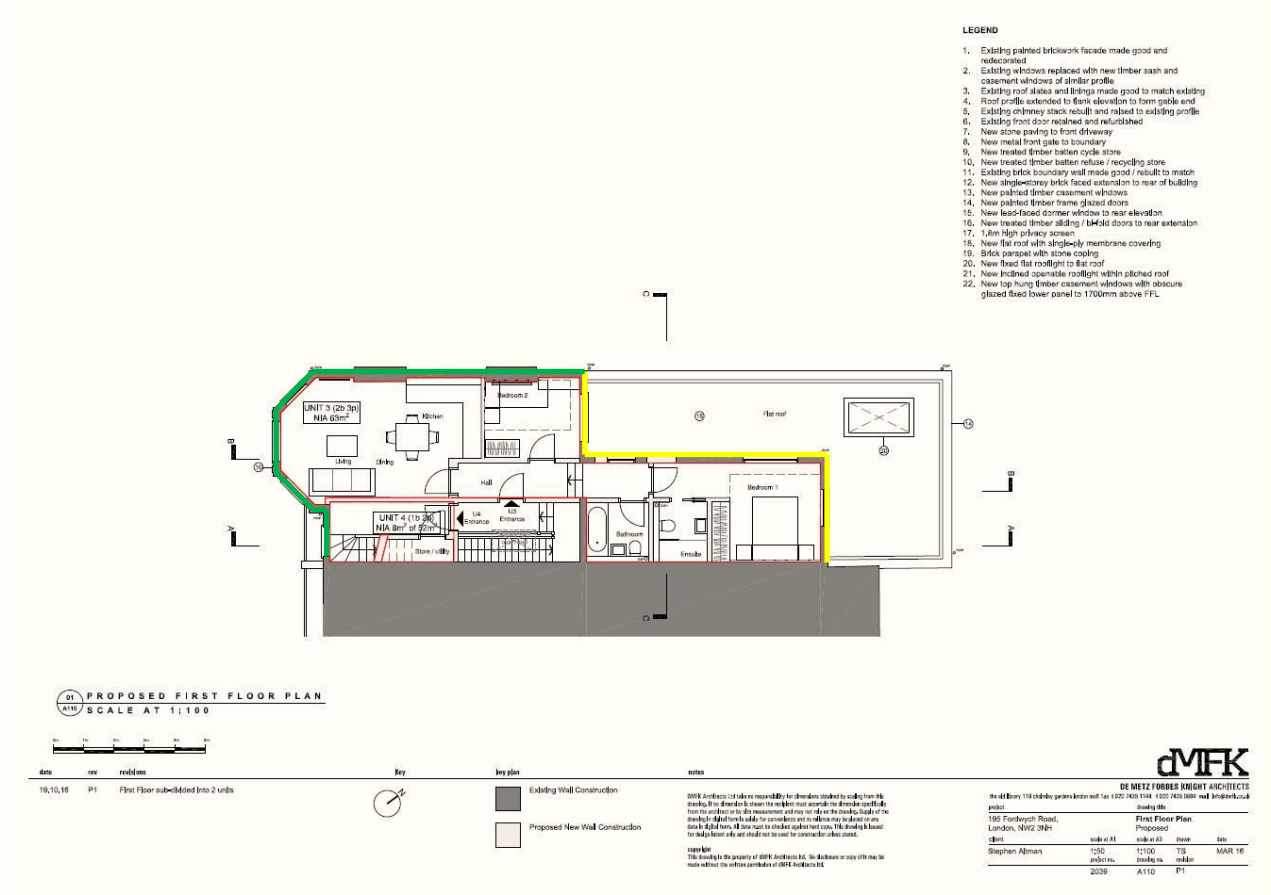
Report: 16208-002 Appendix F *(page 2 of 3)*

Date: December 2016

SOUND INSULATION ZONES

First Floor

= Insulation Zone A = Insulation Zone B



Site: 195 Fordwych Road, London NW2 3NH

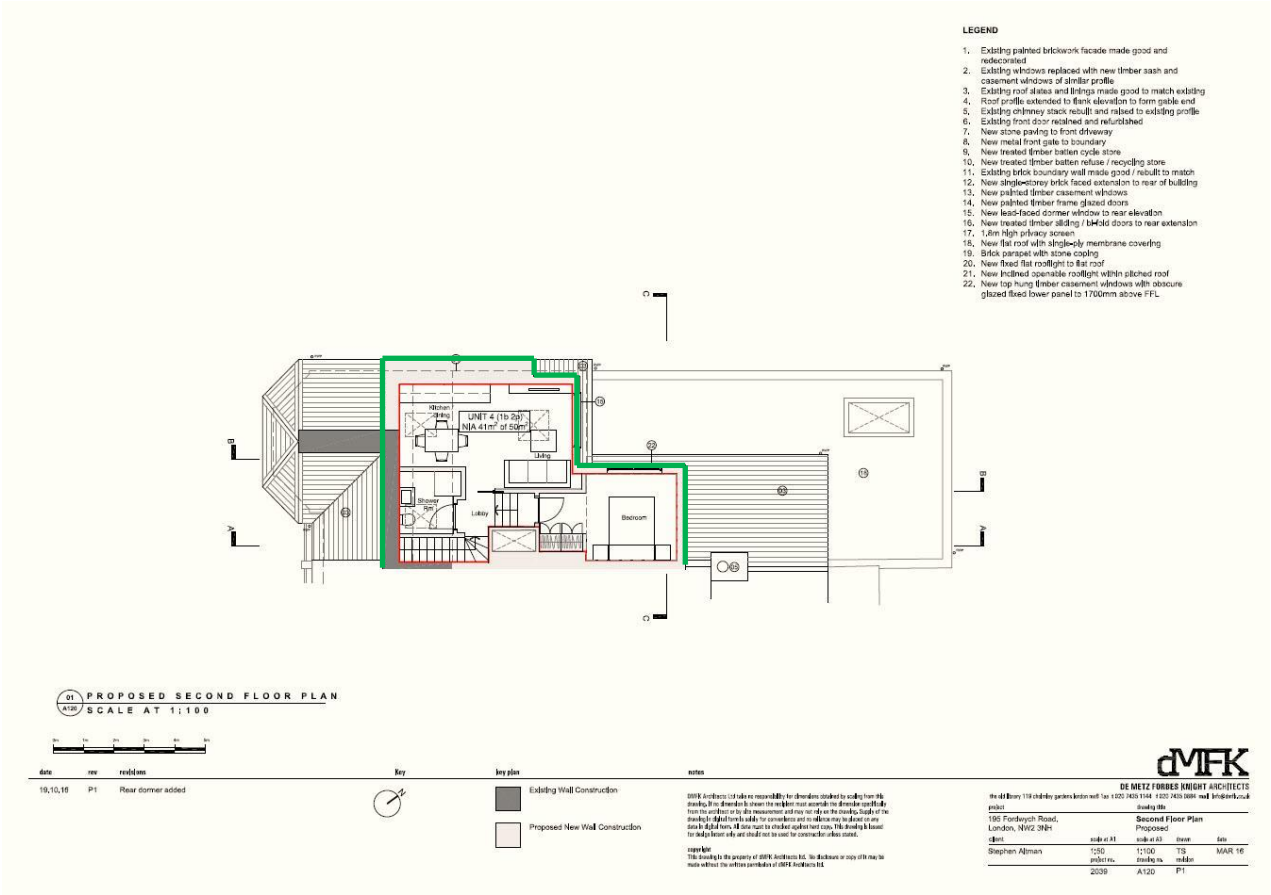
Report: 16208-002 Appendix F *(page 3 of 3)*

Date: December 2016

SOUND INSULATION ZONES

Second Floor

= Insulation Zone A = Insulation Zone B



APPENDIX G

Details Of Possible Glazing And Ventilator Suppliers

Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix G *(page 1 of 1)*

Date: December 2016

DETAILS OF POSSIBLE GLAZING AND VENTILATOR SUPPLIERS

GLAZING SUPPLIERS *(not listed in any order of recommendation or preference)*

- George Barnsdale: Telephone: 01775 823000 Web: www.georgebarnsdale.co.uk
- Ideal Combi: Telephone: 01582 860940 Web: www.idealcombi.com
- Spectrus Window Systems: Telephone: 0800 328 5273 Web: www.spectrussystems.co.uk
- Perfect Glaze: Telephone: 0208 205 4102 Web: www.perfectglaze.co.uk
- Selectaglaze: Telephone: 01727 837271 Web: www.selectaglaze.co.uk
- Slimlite Double Glazing: Telephone: 0131 551 2931 Web: www.slimliteglass.co.uk
- Sunflex UK: Telephone 01603 258649 Web: www.sunflexuk.co.uk

PASSIVE ACOUSTIC VENTILATOR SUPPLIERS *(not listed in any order of recommendation or preference)*

- Ryton Building Products: Telephone: 01536 511874 Web: www.vents.co.uk
- R.W. Simon Ltd: Telephone: 01805 623721 Web: www.rwsimon.co.uk
- Passivent: Telephone: 0161 905 5700 Web: www.passivent.com
- Renson: Telephone: 01622 754123 Web: www.renson.be

MECHANICAL ACOUSTIC VENTILATOR SUPPLIERS *(not listed in any order of recommendation or preference)*

- Passivent: Telephone: 0161 905 5700 Web: www.passivent.com
- Greenwood Air Management: Telephone: 01903 771021 Web: www.greenwood.co.uk
- Silavent: Telephone: 01252 878282 Web: www.silavent.co.uk
- Brook Vent: Telephone: 028 9061 6505 Web: brookvent.co.uk
- Titon: Telephone: 01206 713800 Web: www.titon.co.uk
- Applied Energy Products (Xpelair): Telephone: 0844 372 7761 Web: www.xpelair.co.uk

APPENDIX H

Vibration Survey Results

Site: 195 Fordwych Road, London NW2 3NH

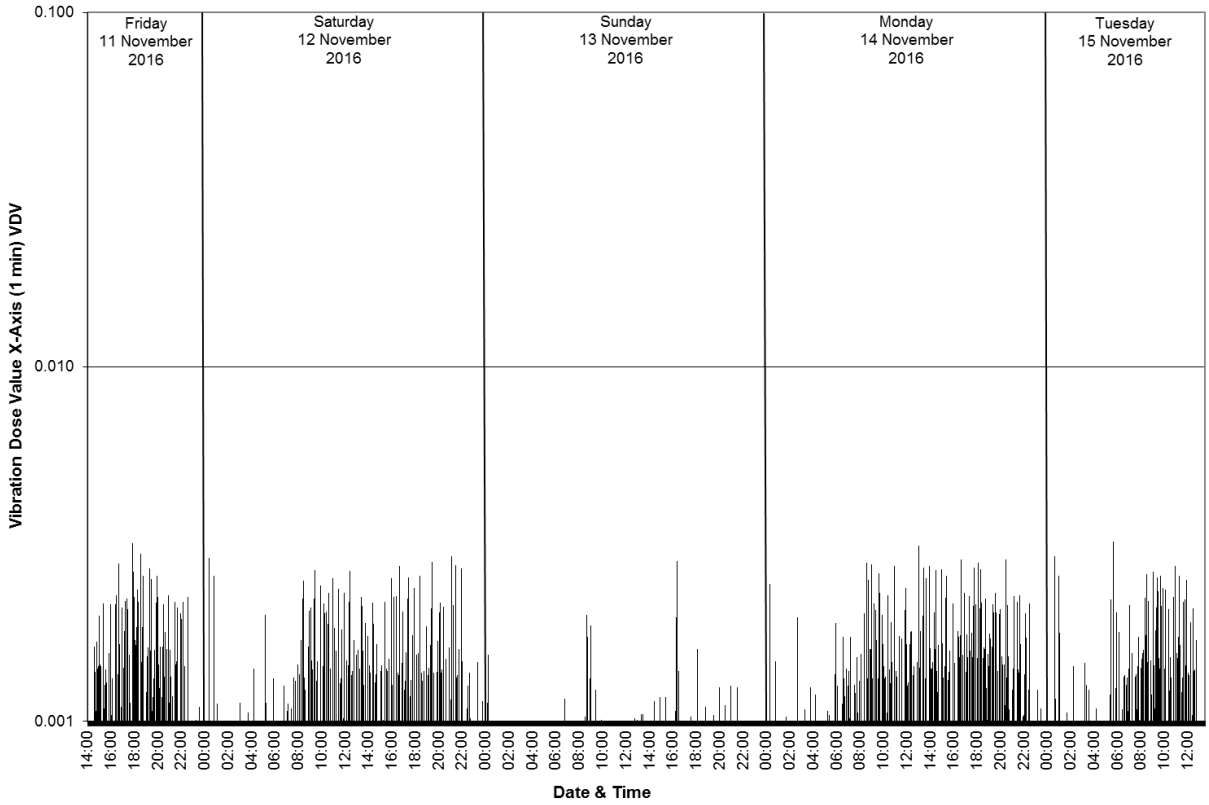
Report: 16208-002 Appendix H *(page 1 of 3)*

Date: December 2016

VIBRATION SURVEY RESULTS

Vibration Survey At Primary Position (rear elevation of development site nearest to railway lines)

X Axis VDV Raw Data



Site: 195 Fordwych Road, London NW2 3NH

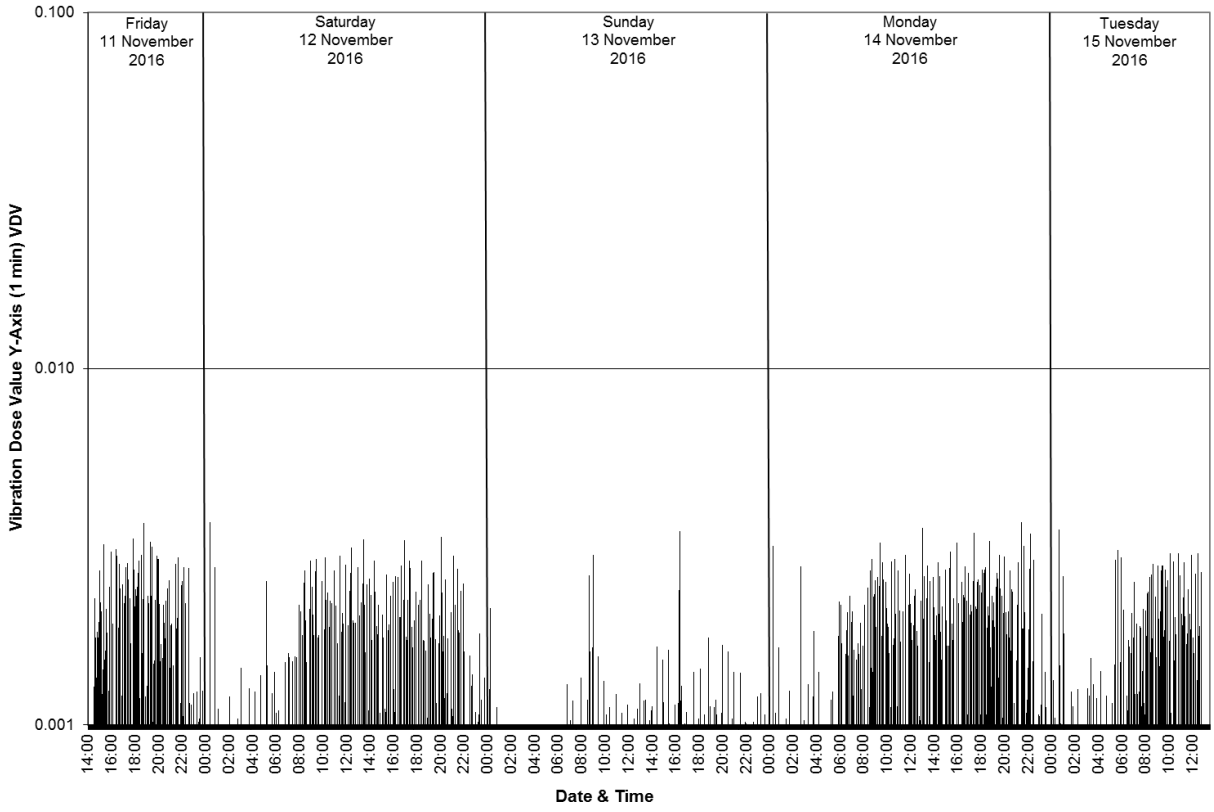
Report: 16208-002 Appendix H *(page 2 of 3)*

Date: December 2016

VIBRATION SURVEY RESULTS

Vibration Survey At Primary Position (rear elevation of development site nearest to railway lines)

Y Axis VDV Raw Data



Site: 195 Fordwych Road, London NW2 3NH

Report: 16208-002 Appendix H *(page 3 of 3)*

Date: December 2016

VIBRATION SURVEY RESULTS

Vibration Survey At Primary Position (rear elevation of development site nearest to railway lines)

Z Axis VDV Raw Data