

REPORT TITLE: SCHEME OF ACOUSTIC MITIGATION MEASURES FOR A PLANNING
APPROVED RESIDENTIAL FLATS DEVELOPMENT AT 260-262 LONDON ROAD,
WATERLOOVILLE, HAMPSHIRE PO7 7HG

Havant Borough Council Reference: APP/18/00020 Condition 4
APP/18/01245 Condition 4

REPORT REF: 19008-002

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CONTENTS

SUMMARY

1. INTRODUCTION
2. DEVELOPMENT DESCRIPTION
3. HAVANT BOROUGH COUNCIL CONDITION 4 (*Noise*)
4. ACOUSTIC MITIGATION MEASURES: EXTERNAL NOISE
5. ACOUSTIC MITIGATION MEASURES: INTERNAL NOISE

Appendix A: Site Location Plan & Proposed Layout Drawings For The Flats Development

Appendix B: Noise Survey Instrumentation

Appendix C: Noise Survey Results

Appendix D: Example Building Envelope Sound Insulation Calculations (*BS8233:2014 Rigorous Method*)

SUMMARY

- Havant Borough Council has granted Planning Permission and Prior Approval for a development of residential flats at 260-262 London Road, Waterloo, Hampshire PO7 7HG.
- The Planning Permission decision notice has application reference APP/18/00020 and is for two flats formed by new roof extension at first floor level to the rear part of the existing building. The Prior Approval (permitted development) decision notice is reference APP/18/01245 and is for three flats formed by conversion of previous office use space at first floor level within the front part of the existing building.
- The same Condition 4 is attached to both decision notices and relates to noise. Condition 4 requires a scheme of acoustic mitigation measures for the flats to be submitted to, and approved by, the Local Planning Authority. Reason attached to Condition 4 is to ensure the residential amenity of the property (flats) is not unacceptably impacted upon by external or internal noise levels, including from the ground floor commercial premises below.
- This report provides details of a noise survey and assessment along with scheme of acoustic mitigation measures as required by Condition 4, to protect the flats against external noise and internal noise.

Acoustic Mitigation Measures: External Noise

- A 24 hour noise and observations survey has been carried out to establish day and night period external noise levels to the front and also rear parts of the development site. Full details of the noise survey results and observations are provided in Section 4.2 of this report.
- Using results of the noise survey, a scheme of acoustic mitigation (sound insulation) measures for the residential building envelope is established. The mitigation is to protect the flats against external noise by compliance with the guidance for noise into dwellings of BS8233:2014, and as required by Condition 4.
- The scheme of acoustic mitigation measures is provided in Section 4.3 of this report, verified by composite sound reduction indices calculation of the overall residential building envelope. The scheme includes specification for the acoustic performance of glazing and ventilators to the flats.

Acoustic Mitigation Measures: Internal Noise

- The scheme of acoustic mitigation measures to protect amenity against internal noise relates to sound insulation performance of the separating floor structure between the ground floor commercial use to the flats above. The mitigation is principally to protect the flats against normal trading activity internal noise occurring within the ground floor commercial space, including as use Class A3/A5 (approved by the Council).
- Details for the recommended mitigation measures are provided in Section 5.2 of this report and include the specification for an additional suspended high mass (double layer plasterboard) insulated acoustic ceiling to within the ground floor commercial space.
- The specified overall separating floor structure has a high level of sound insulation and comfortably exceeds (is better than) the minimum requirements of Building Regulations Approved Document E (to which BS8233:2014 makes reference), and also comfortably exceeds (is better than) the uplifted sound insulation criterion set for the development as detailed in Section 5.1 of this report. The specified separating floor sound insulation complies with the requirement of Condition 4 to protect the residential amenity of the flats.

1. INTRODUCTION

Havant Borough Council as Local Planning Authority has granted Planning Permission and Prior Approval for a development of residential flats at 260-262 London Road, Waterlooville, Hampshire PO7 7HG.

The Planning Permission and Prior Approval (permitted development) are both subject to conditions including a same Condition 4 which relates to acoustic mitigation measures for the flats to ensure the residential amenity of the property is not unacceptably impacted upon by external or internal noise levels, including from the ground floor commercial premises below.

This report provides a detailed item by item scheme of acoustic mitigation measures for the residential flats development as required by Condition 4 and includes:

- Description of the development and surrounding area;
- Havant Borough Council Condition 4;
- Noise requirements including reference to British Standard BS8233:2014;
- Details of a noise survey carried out, including procedure, instrumentation, results and subjective observations;
- Scheme of building envelope acoustic mitigation measures for the flats, to ensure compliance with the Condition 4 noise requirement regarding external noise. The acoustic mitigation measures verified using the rigorous calculation procedures outlined in Section G.2 of Annex G (informative) of BS8233:2014;
- Scheme of acoustic mitigation (sound insulation) measures for the separating floor between the ground floor commercial use and flats, to ensure compliance with the Condition 4 noise requirement regarding internal noise.

2. DEVELOPMENT DESCRIPTION

The development is for a total of five new residential flats, formed partly by new roof extension to, and partly by change of use (conversion) within, an existing building at 260-262 London Road.

The roof extension flats and change of use flats have separate Havant Borough Council application references plus associated separate decision notice approvals and are described below:

- Reference APP/18/00020 (*roof extension flats*): 2 x flats formed by new roof extension at first floor level to the rear part of the existing building;
- Reference APP/18/01245 (*change of use flats*): 3 x flats formed by conversion of previous office use space at first floor level within the front part of the existing building.

Ground floor of the building throughout is to be refurbished and retained as commercial use space. Details of the ground floor commercial use as relevant to the scheme of acoustic mitigation measures for the flats required by Condition 4 are provided at the end of Section 3 of this report.

A site location plan and approved layout drawings for the flats development are provided in Appendix A.

The development site is located to the southern side of London Road within the retail town centre of Waterlooville, approximately 150m north-east from the Forest End roundabout junction of London Road with the A3 Maurepas Way / Rockville Drive. London Road past the front of the site is principally pedestrianised and has restricted vehicular access with exceptions only for buses and for loading in marked bays. Consequently the part of London Road past the site has only occasional vehicles.

Rockville Drive pay and display car park is to the rear of the site, plus there is also a vehicular access and parking areas associated with properties along London Road including the site itself. Beyond the car park, Rockville Dive runs broadly east to west past the site at distance.

The surrounding area is mixed, with a variety of commercial use premises and residential properties. Along London Road in the vicinity of the site, buildings are typically arranged with commercial uses at ground floor and with residential flats over upper floors (i.e. as per the approved development). The area beyond Rockville Drive to the rear of the site is predominantly of residential houses.

Noise levels to the front of the development site are predominantly due to occasional passing buses, pedestrians and general activity on London Road, plus with some contribution from other more distant traffic and activity in the wider area generally.

Noise levels to the rear of the site are predominantly due to passing traffic on Rockville Drive, including vehicles to/from the pay and display car park, plus also with some contribution from pedestrians, general activity and plant / equipment serving commercial / retail premises in the vicinity.

More details on noise levels to the site and noise sources are provided in Section 4.2.3 of this report.

3. HAVANT BOROUGH COUNCIL CONDITION 4 (Noise)

Both approval decision notices have the same pre-occupation Condition 4 attached which relates to noise and is reproduced below:

- 4 The development hereby permitted shall not be occupied unless and until details to confirm that the acoustic mitigation measures to be employed with regard to the building envelope, including fenestration and ventilation, will meet BS8233:2014 standards as recommended for indoor ambient noise levels for dwellings, especially in relation to living rooms and bedrooms i.e during the day (07:00 to 23:00) 35 dB L Aeq,16 hour and at night (23:00 to 07:00) 30 dB L Aeq,8 hour for bedrooms have been submitted to and approved in writing by the Local Planning Authority. The approved measures shall be implemented prior to occupation and maintained in accordance with the approved details.

Reason: To ensure the residential amenity of the property is not unacceptably impacted upon by any internal or external noise levels, including from commercial premises below having due regard to policies CS16 and DM10 of the Havant Borough Local Plan (Core Strategy) 2011 and the National Planning Policy Framework.

Reason attached to the condition is with reference to ensure the residential amenity of the property (i.e. flats) is not unacceptably impacted upon by external or internal noise levels, including from the ground floor commercial premises below.

Protection against external noise relates to a scheme of building envelope acoustic mitigation measures for the flats, including the acoustic specification for glazing (windows), ventilators and external wall plus roof structures. An assessment and associated scheme of acoustic mitigation measures to protect the flats against external noise is provided in Section 4 of this report.

Protection against internal noise relates to a scheme of acoustic mitigation (sound insulation) measures for the separating floor structure between the ground floor commercial use and flats at first floor above. An assessment and associated scheme of acoustic mitigation (sound insulation) measures to protect the flats against internal noise is provided in Section 5 of this report.

Condition 4 requires that acoustic mitigation measures for the flats ensure noise levels comply with the standards of British Standard BS8233:2014 *"Guidance on Sound Insulation and Noise Reduction for Buildings"*.

The relevant guidance of BS8233:2014 applicable as noise criteria for the development in terms of protection against external noise and against internal noise is provided respectively in Section 4.1 and Section 5.1 of this report, and includes confirmation of the values of BS8233:2014 for indoor ambient noise in living rooms and bedrooms as stated in Condition 4.

Details of the ground floor commercial use as relevant to the scheme of acoustic mitigation measures for the flats required by Condition 4 are provided below:

The commercial use has recently been granted planning permission by Havant Borough Council for the change of use of 260 London Road from Class A1 (retail units) and 262 London Road from Class A2 (Estate Agents offices) to include Class A3/A5 (restaurants and cafes / hot food takeaways). Havant Borough Council application reference for the approved commercial change of use is APP/18/00059.

The developer has advised it is not known at this stage of the site's re-development what the ground floor commercial use will be or what commercial/retail tenants may occupy the space. Thus the commercial use may be retained as Class A1/A2 (retail / office type use), or it may be Class A3/A5 (restaurants and cafes / hot food takeaways).

Specifically regarding the scenario for if the commercial use is to be Class A3/A5, conditions attached to the Council's Grant of Planning Permission for application APP/18/00059 include conditions to protect the amenity of residential properties and thus including the flats at first floor of the development site itself.

The Grant of Planning Permission includes a pre-occupation condition for the commercial use requiring that details of acoustic mitigation measures to mechanical services plant / equipment for the use be submitted to and approved by the Local Planning Authority.

Thus, if a tenant / user of the ground floor commercial use space proposes to install plant / equipment such as ventilation system extract fans or air conditioning condenser units etc. then this would be subject to a discharge of condition type approval by Havant Borough Council.

This report as specifically providing a scheme of acoustic mitigation measures for the residential flats development as required by Condition 4 attached to approval references APP/18/00020 and APP/18/01245, does not therefore include any consideration of noise (or vibration) from mechanical services plant / equipment as may be installed to serve the ground floor commercial use.

Notwithstanding this, the scheme of acoustic mitigation measures to protect the flats against internal noise (i.e. separating floor sound insulation between the commercial use and flats above), as detailed in Section 5 of this report is cautiously / robustly and as "worse-case" based on the commercial use being Class A3/A5 (restaurants and cafes / hot food takeaways).

4. ACOUSTIC MITIGATION MEASURES: EXTERNAL NOISE

This Section provides a scheme of acoustic mitigation measures for the residential external building envelope, including acoustic specification for glazing and ventilators. The scheme is to protect the flats against external noise levels.

4.1 Criteria

Condition 4 requires that acoustic mitigation measures for the flats ensure noise levels comply with the standards of BS8233:2014 “*Guidance on Sound Insulation and Noise Reduction for Buildings*”.

The guidance of BS8233:2014 for noise into residential dwellings is reproduced below and is considered appropriate noise criteria for external noise intrusion into the flats. The criteria for living rooms and bedrooms are as per that stated in Havant Borough Council Condition 4.

Activity	Location	07:00 to 23:00 (day period)	23:00 to 07:00 (night period)
Resting	Living room	$\leq 35\text{dB } L_{\text{Aeq},16\text{hour}}$	-
Dining	Dining room/area	$\leq 40\text{dB } L_{\text{Aeq},16\text{hour}}$	-
Sleeping (daytime resting)	Bedroom	$\leq 35\text{dB } L_{\text{Aeq},16\text{hour}}$	$\leq 30\text{dB } L_{\text{Aeq},8\text{hour}}$

In applying the above noise criteria, then in accordance with normal acoustic design practice and definition as applicable to the residential flats of the development, it is taken that:

- The internal noise level criteria are applicable to all-encompassing external noise sources affecting the development, comprising noise contributions from traffic, pedestrians and general activity in the area including as associated with commercial / retail premises in the vicinity;
- The internal noise level criteria are to be achieved inside unoccupied but completed and normally furnished rooms of the flats;
- The day period criterion for living rooms is also applicable for dining areas and kitchens as open plan to living room areas (i.e. living/kitchen/diners etc.). The flats do not have separate dining rooms. Therefore the separate less onerous noise criterion of BS8233:2014 for dining rooms is not relevant for this development.

Note 4 to Table 4 in Section 7.7.2 *Internal ambient noise levels for dwellings* of BS8233:2014 advises that regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance and that a guideline value may be set in terms of SEL or $L_{\text{A}f\text{max}}$ depending on the character and number of events per night.

The development site is not noise affected by scheduled aircraft or passing trains, therefore and as per the guidance of BS8233:2014 it is not appropriate in this instance to apply a $L_{\text{A}f\text{max}}$ criterion for bedrooms during the night period. Similarly, Condition 4 does not state a $L_{\text{A}f\text{max}}$ criterion for bedrooms during the night period.

4.2 Noise Survey

In order to establish a scheme for building envelope acoustic mitigation measures it is necessary to determine day and also night period noise levels at the site.

4.2.1 Survey Details & Procedure

A noise survey has been carried out at the front and rear parts of the development site using logging type sound level meters over a 24 hour period midday 27 February 2019 through midday 28 February 2019; the weather included dry conditions during the day and also the night periods of the survey.

The noise measurement positions are indicated on the site location plan in Appendix A.

The measurement positions were 1m external to the façade of the building at first floor level recorded in terms of 5 minute samples of L_{Aeq} values continually over the full survey duration. Samples of octave band values were also obtained to provide frequency content information of noise levels to assist with acoustic calculations to establish the residential building envelope scheme for acoustic mitigation measures.

It is noted that noise levels for the assessment of residential development sites are generally measured at 1.2 to 1.5m above ground level; however for this development site it is considered appropriate to measure noise levels at an elevated position for reasons of security of the noise survey instrumentation and because the flats are only at first floor level (no flats at ground floor).

4.2.2 Instrumentation

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

4.2.3 Survey Results & Observations

Complete raw data results for 24 hour noise survey in terms of overall $L_{Aeq,T}$ values are provided in graphical format in Appendix C.

Overall L_{Aeq} noise levels to the development site follow a broadly diurnal profile as typical for this type of town centre location, with relatively steady (albeit fluctuating) levels throughout the day period, then reducing gradually into the evening and night (lowest during the middle of the night circa 2am to 4am) before then rising again in the morning.

Despite the site's proximity to various commercial / retail uses, day and night period noise to the development site is relatively low / moderate for a town centre location. This is principally because London Road past the front of the site has restricted vehicular access.

Subjectively, noise at the development site is principally due to traffic in the wider vicinity, plus with occasional buses on London Road, as well as pedestrians and general activity to the front and rear as normal for a town centre semi-pedestrianised retail "high street" type location.

There is some noise contribution to the rear part of the development site from various mechanical services plant and equipment items serving existing commercial / retail premises in the area. However, plant and equipment noise is not subjectively significant or dominant relative to the underlying predominant noise of traffic and general activity sources.

Summary results of the noise survey in terms of equivalent free-field overall $L_{Aeq,T}$ values for the separate day and night periods are shown in Table 1. *Note that in accordance with normal noise assessment procedures plus guidance of paragraph 3.1.10 of BS8233:2014, the 1m façade raw data results in Appendix C are taken to be 2dB higher than the equivalent free-field level values as required for use in the rigorous method building envelope calculation.*

Description		Period $L_{Aeq,T}$
Position A: Front part of the site overlooking London Road 24 Hour Period: 27 February 2019 - 28 February 2019	Day period 07:00-23:00	56dB (16 hour)
	Night period 23:00-07:00	48dB (8 hour)
Position B: Rear part of the site 24 Hour Period: 27 February 2019 - 28 February 2019	Day period 07:00-23:00	52dB (16 hour)
	Night period 23:00-07:00	47dB (8 hour)

Table 1: Equivalent free-field $L_{Aeq,T}$ noise levels for day and night periods at the development site

4.3 Scheme Of Acoustic Mitigation Measures

Although the development site is considered potentially noise affected (due to being within a town centre), noise levels at the site are not of such a high magnitude that requires bespoke or very high specification acoustic performance glazing and/or ventilators to the flats. Normal, albeit acoustic performance, glazing is required as part of the development's scheme of acoustic mitigation measures, to ensure compliance with the guidance requirements for noise into residential dwellings of BS8233:2014.

The scheme of acoustic mitigation measures relates to the sound insulation design and specification of elements of the overall new residential building envelope to protect against external noise.

The development's residential building envelope is formed by masonry construction external walls; traditional double thickness solid brickwork walls to the front part conversion flats and with conventional insulated cavity brick / blockwork walls for the rear new roof extension flats. The development has a traditional tile over insulated pitched truss roof structure plus associated ceilings below to the front part conversion flats, and with a conventional insulated flat roof structure plus associated ceilings below for the rear new roof extension flats.

These external wall and roof structure elements of the residential building envelope will by default provide a relatively high level of sound insulation and for this development site will be more than adequate in terms of sound insulation to mitigate external noise, regardless of build-up specifications for the external wall and roof structure elements, insulation and roomside plasterboard wall linings / ceilings. Therefore as for most residential development sites, the dominant route for external noise to enter rooms of the flats will be via glazing and passive type ventilators.

By following the rigorous calculation procedures outlined in Section G.2 of Annex G (informative) of BS8233:2014 a specification for the sound insulation performance of glazing and ventilators has been established and is provided in Sections 4.3.1 and 4.3.2 respectively.

Copy of example composite sound insulation acoustic calculations of the residential building envelope for day period and night period noise intrusion into a sample "worse-case" living room and also bedroom of the development are provided in Appendix D. The sample "worse-case" rooms are of Flat 3 to the front part of the development site directly overlooking London Road.

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 of sound insulation measures, noise into the flats will comply with the guidance requirements for noise into residential dwellings of BS8233:2014, and thus comply with the requirement of Condition 4.

4.3.1 Glazing

Values in Table 2 show a specification schedule of glazing sound insulation performance for different parts of the development; glazing includes windows, any roof lights and also glazed exterior doors (such as the doors from bedrooms of the rear extension flats to the central sun terrace areas).

Description	Octave Band Centre Frequency (Hz)						Comments
	125	250	500	1k	2k	4k	
Glazing To Living Spaces & Bedrooms	17	17	25	35	35	35	Acoustic performance double glazing such as 4/airgap/4 configuration $\geq$ Rw 30dB
Glazing To Other Areas & Room Types	No acoustic performance need be specified						Any form of glazing acceptable for noise insulation reasons

Table 2: Minimum specification glazing sound insulation performance Sound Reduction Index R dB

The sound insulation performance figures for glazing to living spaces and bedrooms correspond to moderate acoustic performance double glazing, typically using such as 4mm/airgap/4mm configuration, with airgap in the range 16 to 20mm. Note that glazing to living spaces includes windows to the kitchen and dining areas (as open plan) as well as the specific living room parts of the living spaces. For noise insulation reasons, any glazing can be used for other rooms / areas.

It is advised that openable casements to living spaces and bedrooms have effective acoustic seals all round. Effective seals are normally rubber or neoprene beaded type that compress all around on closure of the windows. Plastic type or brush type weather seals are not classed as effective acoustic seals.

4.3.2 Ventilators

It is generally necessary to incorporate a ventilation system into the design of new and/or change of use residential dwellings such that they are provided with mandatory ventilation as the requirements of Building Regulations Approved Document F without reliance on open windows.

This is ordinarily achieved through use of one of the four ventilation system methods as defined in Building Regulations Approved Document F (System 1 to 4); which ventilation strategy is adopted generally being decided for non-acoustic reasons.

Note it is the author's experience that different Local Authorities interpret the requirements of Building Regulations Approved Document F (Ventilation) differently for residential sites that are potentially noise affected. In some instances acoustic performance passive type ventilators are permitted, whereas in other instances mechanical ventilation is a pre-requisite.

Noise levels to the development site at 260-262 London Road are not of such (high) magnitude as would require the specification of mechanical ventilation for acoustic mitigation reasons. Therefore, the developer proposal to use passive type ventilators is advised as acceptable with regard to sound insulation for the proposed flats.

Mandatory ventilation for the flats as required by Building Regulations Approved Document F is to be conventional "System 1" type ventilation, facilitated using passive type "trickle" ventilators within the window head framework.

Values in Table 3 show a specification schedule of passive type ventilator sound insulation performance for different parts of the development.

Description	Octave Band Centre Frequency (Hz)						Comments
	125	250	500	1k	2k	4k	
Ventilators To Living Spaces & Bedrooms	30	30	30	30	30	30	Standard/normal type passive trickle or "slot" ventilator with sound insulation performance $\geq D_{n,e,w}$ 30dB (open position)
Ventilators To Other Areas & Room Types	No special acoustic performance requirement						Any ventilators acceptable for sound insulation reasons

Table 3: Minimum specification ventilator sound insulation performance, Normalised Level Difference $D_{n,e}$ dB

The ventilator sound insulation performance requirement $\geq D_{n,e,w}$ 30dB (open position) for living spaces and bedrooms corresponds to standard / normal acoustic slot type or through wall type trickle ventilators as routinely installed either within glazing frames (window head framework) or through the external wall of a building. It is not necessary to specify specialist very high acoustic performance ventilators for this development.

5. ACOUSTIC MITIGATION MEASURES: INTERNAL NOISE

This Section provides a scheme of acoustic mitigation (sound insulation) measures for the separating floor structure between the ground floor commercial use to the flats at first floor above. The mitigation is principally to protect the flats against normal day to day trading activity internal noise occurring within ground floor commercial use.

As described in Section 3 of this report, the scheme of acoustic mitigation measures is cautiously / robustly and as “worse-case” based on the ground commercial use being Class A3/A5 (restaurants and cafes / hot food takeaways) as per the Council’s approved commercial change of use reference APP/18/00059.

The sound insulation of separating structures (walls and / or floors) of new build and/or change of use residential dwellings (including flats) is generally required to comply with the minimum performance standards of Building Regulations Approved Document E, and is generally covered / enforced by the Local Authority Building Control Department or Approved Inspector.

Compliance is normally demonstrated by registration of a development site with Robust Details or by undertaking pre-completion sound insulation tests of the separating walls and/or floors at, or very near to, completion of the development.

However, and as required by Condition 4, it is not uncommon for the planning approval associated with a development scenario of commercial use directly adjoining residential properties to include that a scheme of acoustic mitigation (sound insulation) for between the commercial use and residential be submitted to, and approved by, the Local Planning Authority.

5.1 Assessment Method & Criterion

The guidance values of BS8233:2014 for noise into residential dwellings as detailed in Section 4.1 of this report are applicable for external noise sources, and therefore do not provide an appropriate mechanism or criteria to assess internal noise such as from trading activity within the ground floor commercial use via the separating floor structure into the flats at first floor above.

For the scenario of noise into residential dwellings from an adjoining space via separating floors and/or separating walls etc, then BS8233:2014 makes reference to Building Regulations as being the relevant Regulatory Framework, and specifically Building Regulations Approved Document E.

Full title of the current edition of the regulations is “*The Building Regulations 2010 Approved Document E Resistance to the passage of sound (2003 edition incorporating 2004, 2010, 2013 and 2015 amendments)*”.

Requirement E1 of Building Regulations Approved Document E provides guidance and minimum standards for sound insulation, including for airborne sound insulation in terms of $D_{nT,w} + C_{tr}$ dB to be achieved for separating floor structures to residential flats. $D_{nT,w} + C_{tr}$ is a single number quantity that characterises airborne sound insulation between rooms/spaces and is the Weighted Standardised Level Difference (dB) plus with a correction term applied to provide a weighting against low frequency performance.

The minimum sound insulation standards of Building Regulations Approved Document E for separating floors of purpose built (i.e. new build) flats and material change of use (i.e. conversion) flats are shown in Table 4 on the following page (reproduced from table 0.1a of the regulations). For airborne sound insulation the higher the value the better the performance, for impact sound insulation the lower the value the better the performance.

Description		Target Sound Insulation	
		Conversion Flats (flats formed by material change of use)	New Build Flats (purpose build flats)
Separating Floors	$D_{nT,w} + C_{tr}$ (airborne)	≥ 43 dB	≥ 45 dB
	$L'_{nT,w}$ (impact)	≤ 64 dB	≤ 62 dB

Table 4: Sound insulation performance standards for separating floors of flats

Note that under the requirements and procedures of Building Regulations Approved Document E, there is no impact sound insulation performance standard applicable for a separating floor structure between non-domestic use (including commercial premises) and residential flats above.

Building Regulations Approved Document E advises the sound insulation performance standards as reproduced in Table 1 are appropriate for floors that separate spaces used for normal domestic purposes, so are the standards to be achieved for separating floors between vertically adjoining residential flats.

Regarding sound insulation of the separating floor of this development between the ground floor commercial use and first floor flats above, then Section 0: Performance paragraph 0.8 of Building Regulations Approved Document E covers this and states:

“0.8 The performance standards set out in Tables 0.1a and 0.1b are appropriate for walls, floors and stairs that separate spaces used for normal domestic purposes. A higher standard of sound insulation may be required between spaces used for domestic purposes and communal or non-domestic purposes. In these situations the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice may be needed to establish if a higher standard of sound insulation is required, and if so, to determine the appropriate level.”

Paragraph 0.8 states the appropriate level of sound insulation will depend on the noise generated in the non-domestic space, for this development the space is ground floor commercial premises, with approved for use Class A1/A2 (retail / office type use as previous), and use Class A3/A5 (restaurants and cafes / hot food takeaways).

In situations where the non-domestic (commercial) space is a public house or bar etc. where very high internal trading activity noise levels are routinely generated including with loud amplified music, TV sports and large / concentrated groupings of customers talking with raised voices, then it is appropriate to set a substantially higher standard of sound insulation especially as peak times (with higher generated noise) for these uses generally occurs late at night and into the early morning hours.

Trading activity within Class A1/A2 and Class A3/A5 uses, do not generate especially high internal noise levels, and do not include loud amplified music etc.

The author has carried out several trading activity noise level surveys (for other similar development projects) within existing trading similar size use Class A3/A5 premises. The surveys have included lunchtime, afternoon and evening/night periods of a Friday, selected as being the times of typically busiest trading activity.

Trading activity internal noise levels within use Class A3/A5 premises are typically in the region up to (as worse-case during peak trading) $L_{Aeq,T}$ 65dB to 74dB. The higher values of this range tend to occur within the cooking areas and include contributions from kitchen extract fan ventilation systems, the lower values of this range occur more within the customer areas plus non kitchen back of house areas.

To protect the residential amenity of the flats above, and in accordance with Paragraph 0.8 of Building Regulations Approved Document E, it is considered appropriate to assess the separating floor structure between the ground floor commercial use and flats above against an uplifted (higher) airborne sound insulation performance than the minimum requirements of Building Regulations Approved Document E.

The uplifted airborne sound insulation performance to be target at least 5dB higher (better) than the minimum requirement of Building Regulations Approved Document E for purpose-built (new build) flats as shown in Table 4, such that the separating floor structure has a target airborne sound insulation $D_{nT,w} + C_{tr} \geq 50\text{dB}$.

The following discussion comments explain what this level of sound insulation would mean subjectively:

Based on trading activity internal noise levels within the ground floor commercial space as use Class A3/A5 in the region up to $L_{Aeq,T}$ 65dB to 74dB, and with an uplifted sound insulation performance for the separating floor of $D_{nT,w} + C_{tr} \geq 50\text{dB}$, then pro-rata any noise transfer from the use to within the flats above would broadly be expected to be in the region not exceeding $L_{Aeq,T}$ 15dB to 24dB.

At these levels, trading activity noise from within the ground floor commercial space, and including as use Class A3/A5, is not expected to be generally audible or noticeable within the flats above and thus not of detrimental impact on the residential amenity of the flats.

5.2 Scheme Of Acoustic Mitigation Measures

The ground to first separating floor throughout is to be formed by existing retained conventional timber joist structures, renovated and repaired as necessary.

It is recommended the most practicable and reliable (i.e. with high sound insulation) upgrade method to achieve the target uplifted airborne sound insulation performance is to fit acoustic grade mineral wool insulation between the joists, and then with an additional independent or suspended high mass insulated acoustic ceiling to within the ground floor commercial space below (with the existing ground floor ceilings retained or replaced).

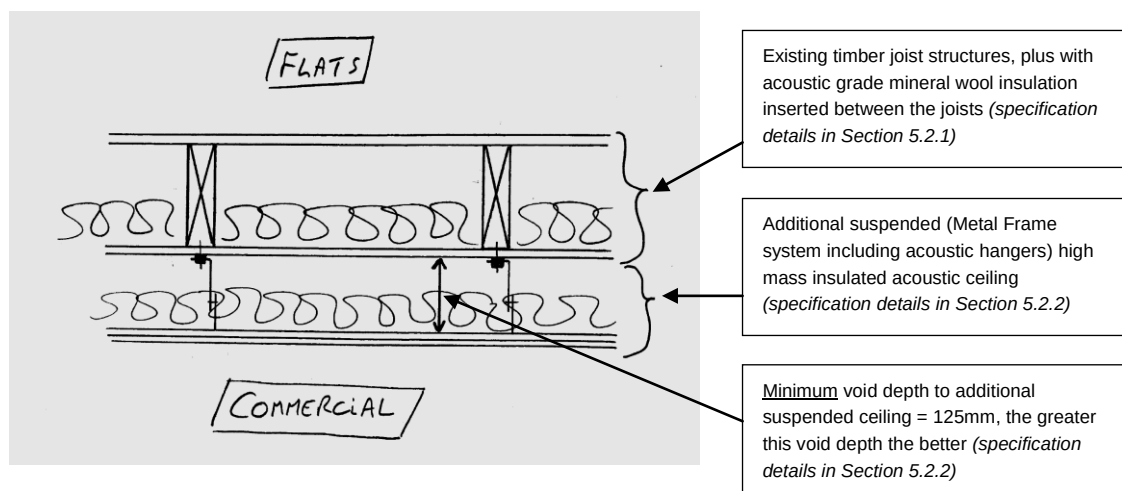
This method of sound insulation upgrade to existing timber joist type structure floors is nominally defined as Floor Treatment 1: *Independent Ceiling With Absorbent Material* from Section 4 of Building Regulations Approved Document E.

The additional high mass insulated acoustic ceiling can be erected in two ways:

- i) Using independent timber joists as per the Floor Treatment 1 diagram 4-3 from Section 4 of the Building Regulations Approved Document E;
- ii) Using a Metal Frame (MF) type suspension system incorporating acoustic hangers. This method is much more commonly used than the independent timber joists method.

It is expected that for this development the Metal Frame (MF) type suspension system as item ii) would be used as being more practicable and better suited to the existing building structure.

A concept sketch drawing for the overall separating floor including recommended additional high mass insulated acoustic ceiling sound insulation upgrade is provided below. Specification details are provided in Sections 5.2.1 and 5.2.2. Discussion of the sound insulation performance for this specification of overall upgraded separating floor structure is provided in 5.2.3.



5.2.1 Existing Timber Joist Structures

Floor Boarding On Top Of Joists:

This can be existing floor boarding retained or any new floor boarding. *The specification for the floor boarding is relatively unimportant for sound insulation in this instance (where there is an additional ceiling below) and whatever is needed for architectural/structural and build considerations will be adequate for sound insulation.*

Insulation Between Joists:

Acoustic grade mineral wool insulation fitted between the joists minimum 100mm thick Rockwool RWA45 semi rigid slab type (or equivalent).

Plasterboard Direct To Underside Of Joists:

This can be the existing plasterboard ceilings retained, or if these are to be removed (*often a builder or developer preference*) then install 1 x layer minimum 15mm plasterboard (any type) direct to underside of the joists. This plasterboard to the underside of the joists is in effect a “sacrificial” ceiling as it will not be viewed from below when the development is completed. The plasterboard does not need to be taped or jointed or plaster skimmed for sound insulation reasons. It is acceptable to use FireLine (or equivalent) type plasterboard etc. if required for fire safety or other reasons.

5.2.2 Additional High Mass Insulated Acoustic Ceiling

Metal Frame Suspension System:

Typically formed by a Gypframe Casoline MF system by British Gypsum, incorporating proprietary acoustic hangers type GAH (or equivalent). The additional ceiling should be suspended as low as practicably possible below the existing ground floor ceiling to create as large a cavity void as possible and minimum 125mm below the existing ceiling (i.e. the distance from the top surface of the new additional ceiling to underside of the existing ceiling $\geq 125\text{mm}$). The depth of void to the suspended ceiling is important, the deeper the void the higher the sound insulation.

Insulation Within Suspended Ceiling Void:

Acoustic grade mineral wool insulation fitted within the ceiling void minimum 100mm thick Rockwool RWA45 semi rigid slab type (or equivalent).

Suspended Ceiling Plasterboard:

2 x layers (i.e. double layer) minimum 15mm British Gypsum SoundBloc type (or equivalent) plasterboard, with staggered joints, then taped and jointed as normal. The plasterboard does not need to be plaster skimmed for sound insulation reasons.

5.2.3 Sound Insulation Performance Of Specified Overall Upgraded Separating Floor Structure

The specified overall timber joist type separating floor structure including with upgrade nominally as Floor Treatment 1: *Independent Ceiling With Absorbent Material*, and using a Metal Frame suspended ceiling (with acoustic hangers), acoustic grade insulation and 15mm SoundBloc type plasterboard, reliably provides sound insulation performance well in excess of the minimum requirements of Building Regulations Approved Document E, and for airborne sound insulation reliably $D_{nT,w} + C_{tr} \geq 50\text{dB}$.

From considerable sound insulation testing experience (to date, Philip Acoustics has undertaken circa >10,000 individual sound tests at more than 2,000 development sites), this type of upgraded overall timber joist type separating floor structure reliably has high airborne sound insulation with tested performance $D_{nT,w} + C_{tr} \geq 50\text{dB}$, and with typical performance $D_{nT,w} + C_{tr} \geq 55\text{dB}$.

The author has carried out sound insulation testing for several similar mixed use conversion flats developments, including one recently with the same specification upgraded overall timber joist type separating floor structure between a ground floor commercial use Class A3 and with flats at first floor above. The separating floor had a tested airborne sound insulation performance $D_{nT,w} + C_{tr}$ 57 to 58dB.

It is therefore expected that for this development the separating floor structure between the ground floor commercial use and flats above, will have sound insulation performance circa $D_{nT,w} + C_{tr} \geq 55\text{dB}$.

This level of sound insulation comfortably exceeds (is better than) the minimum requirements of Building Regulations Approved Document E (to which BS8233:2014 makes reference), and also comfortably exceeds (is better than) the uplifted target criterion $D_{nT,w} + C_{tr} \geq 50\text{dB}$ as detailed in Section 5.1.

Based on expected trading activity internal noise levels within the commercial space as use Class A3/A5 in the region up to $L_{Aeq,T}$ 65dB to 74dB, and with expected sound insulation performance for the separating floor of $D_{nT,w} + C_{tr} \geq 55\text{dB}$, then pro-rata any noise transfer from the use to within the flats above would broadly be expected to be in the region not exceeding $L_{Aeq,T}$ 10dB to 19dB.

At this level it is not expected that trading activity noise from within the ground floor commercial space, and including as use Class A3/A5, would be audible or noticeable within the flats above, and therefore the separating floor sound insulation (scheme of acoustic mitigation) complies with the requirement of Condition 4 to protect the amenity of residents within the flats above.

A P P E N D I X A

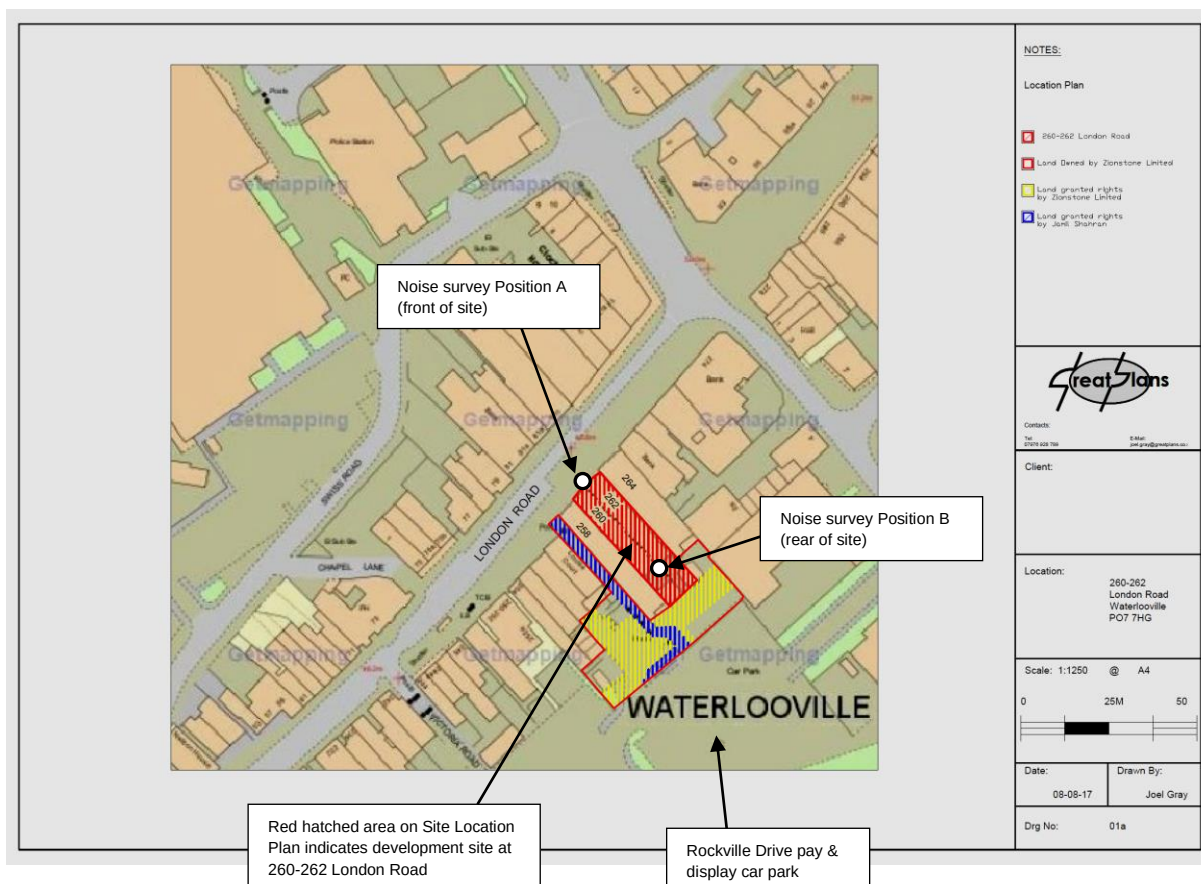
Site Location Plan & Proposed Layout Drawings For The Flats Development

Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix A (page 1 of 3)

Date: March 2019

SITE LOCATION PLAN



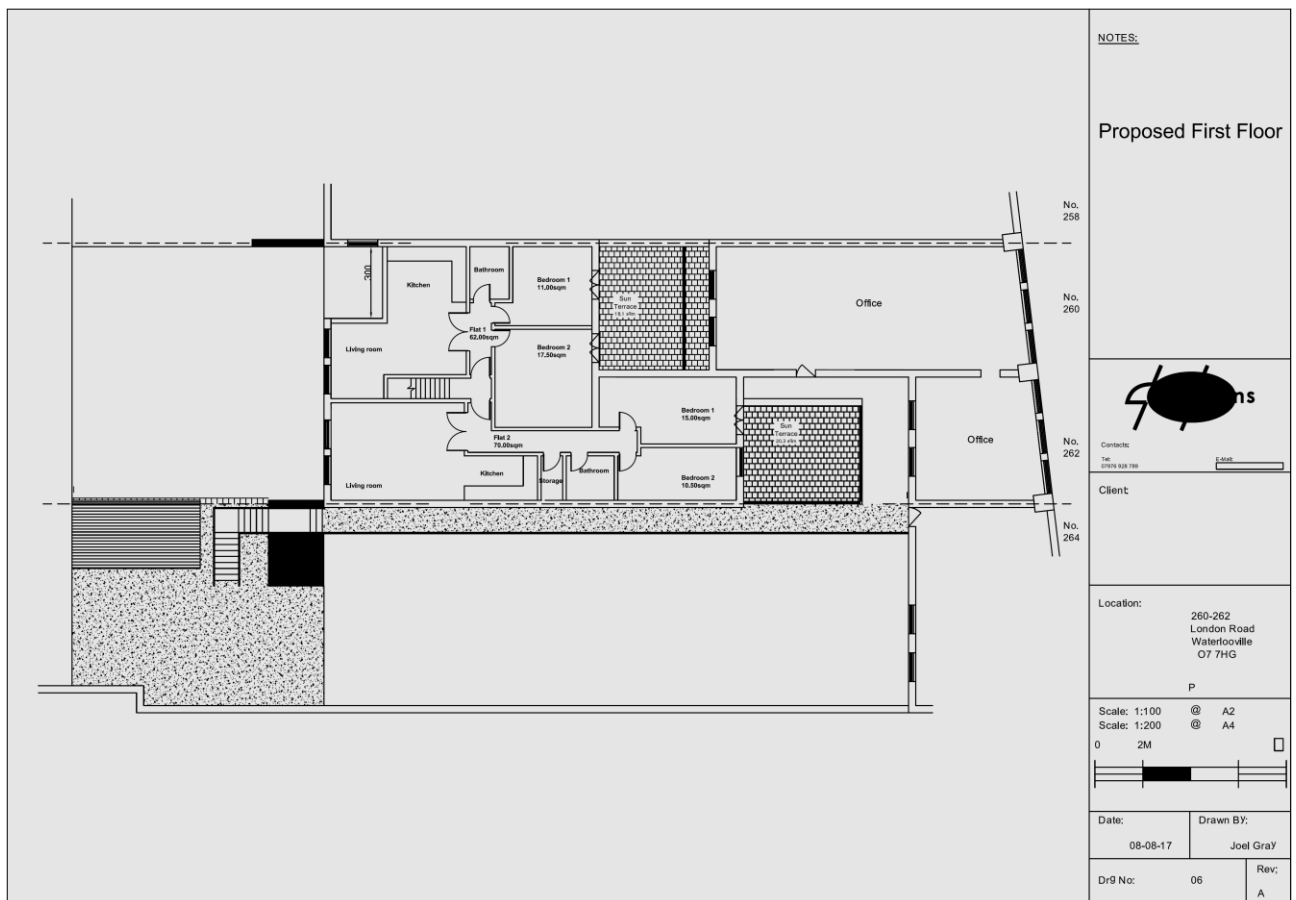
Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix A (page 2 of 3)

Date: March 2019

LAYOUT DRAWINGS FOR THE FLATS DEVELOPMENT

Roof Extension Flats (application ref APP/18/00020): 2 x flats formed by new roof extension at first floor level to the rear part of the existing building



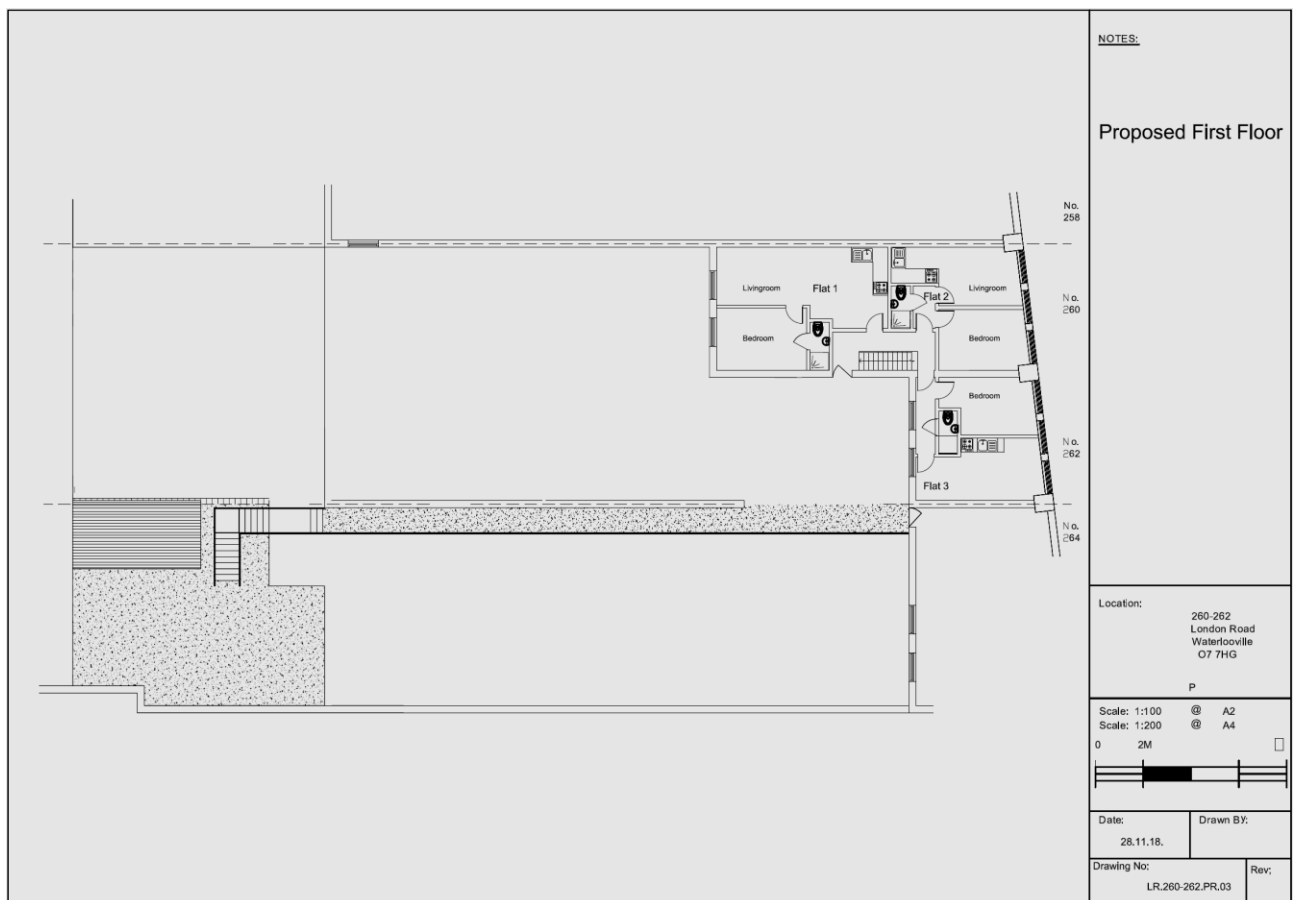
Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix A (page 3 of 3)

Date: March 2019

LAYOUT DRAWINGS FOR THE FLATS DEVELOPMENT

Change Of Use Flats (application ref APP/18/01245): 3 x flats formed by conversion of previous office use space at first floor level within the front part of the existing building



A P P E N D I X B

Noise Survey Instrumentation

Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix B (*page 1 of 1*)

Date: March 2019

NOISE SURVEY INSTRUMENTATION

24 Hour Noise Survey At Position A (*front elevation of the site*)

- Rion sound level meter type NL-31 Class 1 serial number 00773045, with Rion preamplifier type NH-21 serial number 25056 and Rion microphone type UC-53A serial number 313002, Rion microphone windshield type WS-10, Rion microphone extension cable type EC-04A and tripod/boom arrangement;
- Bruel & Kjaer calibrator type 4231 serial number 2326801 (UKAS certified).

24 Hour Noise Survey At Position B (*rear of the site*):

- Rion sound level meter type NL-31 Class 1 serial number 01193690, with Rion preamplifier type NH-21 serial number 31316 and Rion microphone type UC-53A serial number 317534, Rion microphone windshield type WS-10, Rion microphone extension cable type EC-04A and tripod/boom arrangement;
- Bruel & Kjaer calibrator type 4231 serial number 2326801 (UKAS certified).

Noise Survey Samples Including Octave Band Levels:

- Bruel & Kjaer sound level meter type 2260 Class 1 serial number 2311656 plus PCB microphone type 377B02 serial number 143228 with Bruel & Kjaer standard 100mm windshield, plus tripod;
- Bruel & Kjaer calibrator type 4231 serial number 2326801 (UKAS certified).

Weather Conditions Data:

- Speedtech Instruments Skymaster model SM-28 serial number 19370.

A P P E N D I X C

Noise Survey Results

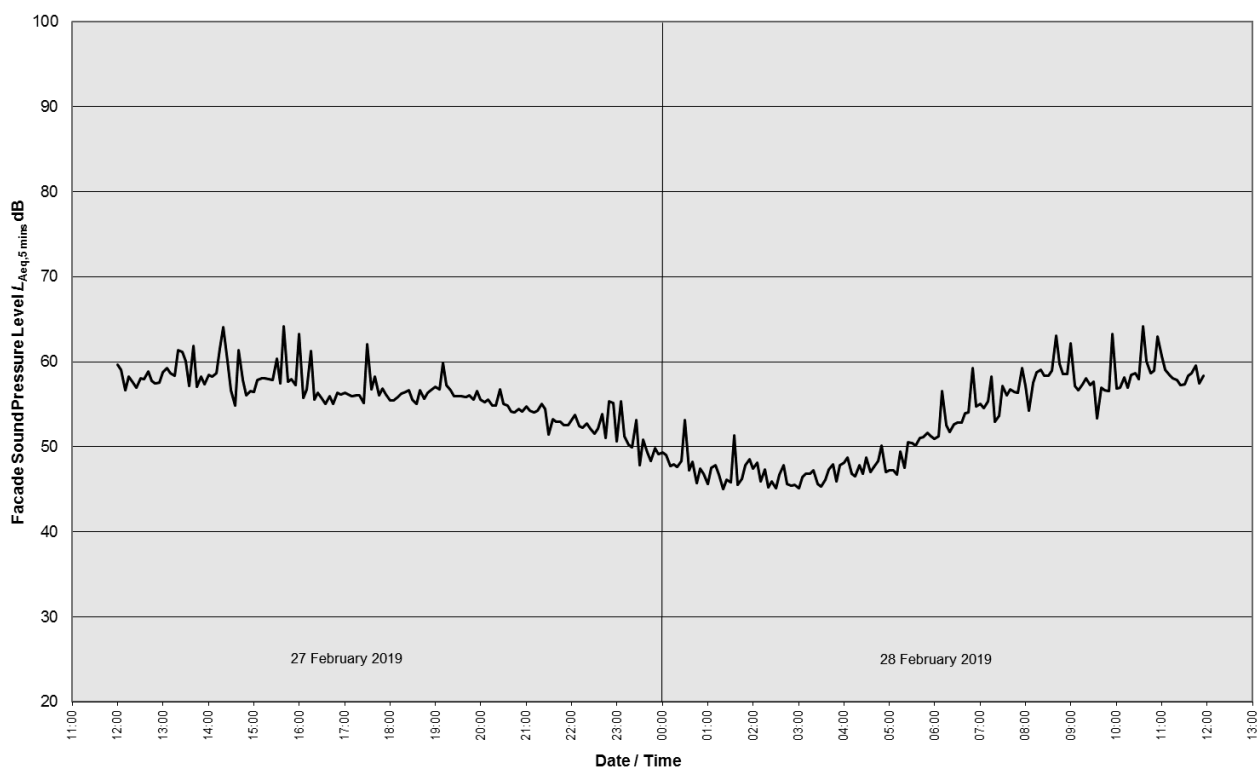
Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix C (page 1 of 2)

Date: March 2019

NOISE SURVEY RESULTS

24 Hour Noise Survey Position A (front elevation of the site overlooking London Road):



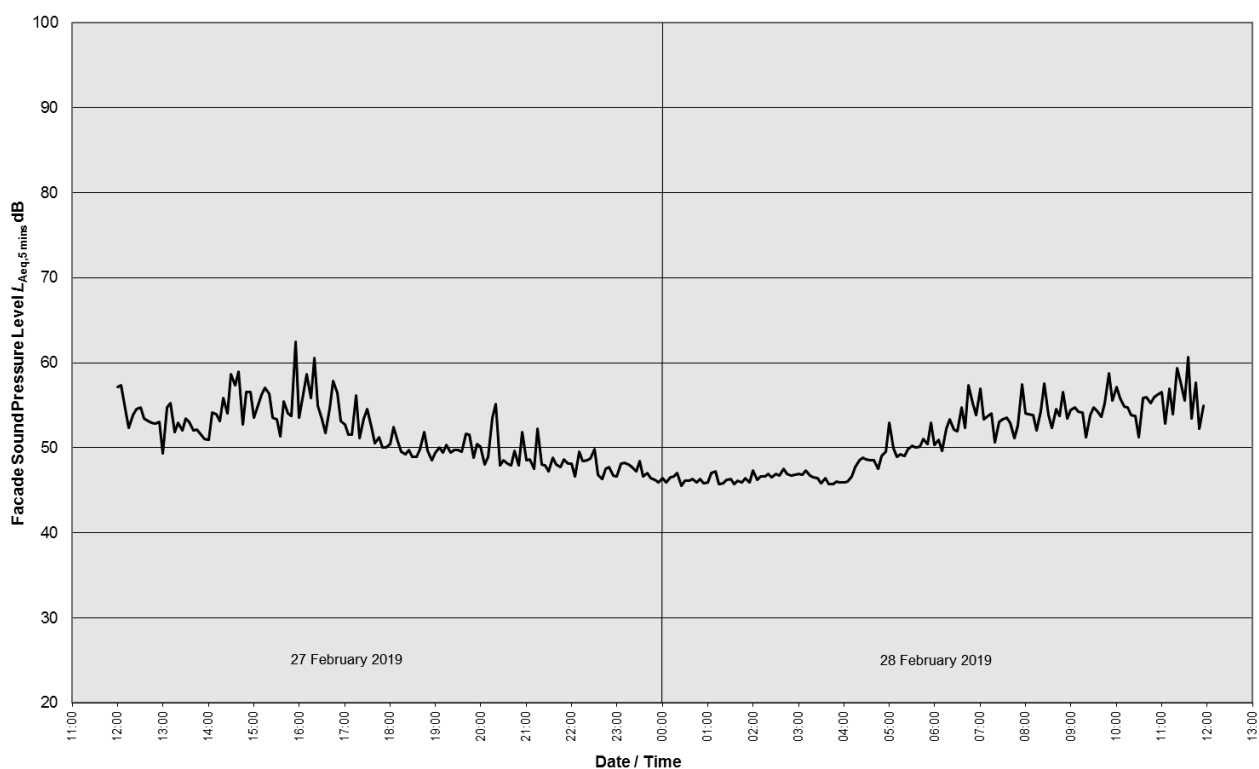
Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix C (page 2 of 2)

Date: March 2019

NOISE SURVEY RESULTS

24 Hour Noise Survey Position B (rear of the site):



APPENDIX D

Example Building Envelope Sound Insulation Calculations (*BS8233:2014 Rigorous Method*)

Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix D (page 1 of 3)

Date: March 2019

BS8233:2014 ANNEX G RIGOROUS METHOD BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM: Flat 3 (first floor front elevation), Living Area (combined living/kitchen/diner)

NOISE CONDITION: Day Period (07:00 to 23:00) Equivalent Free-Field $L_{Aeq,16hr}$ 56dB

NOISE CRITERION: Internal Noise Limit In Room = $L_{Aeq,16hr} \leq 35dB$

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	56	56	54	53	52	47	45
Building Envelope Details For Sample Room:							
Element	Area (m²) or Vent No	Element Specification / Description					
Walls	7.1	Masonry structure external walls					
Window s	4.0	Double glazing 4-airgap-4 configuration, sound insulation performance ≥ Rw 30dB					
Doors	0	No external doors to room					
Roof & associated ceiling	12.4	Conventional tiles on rafters with insulation & single layer plasterboard ceilings					
Ventilators	2	Passive type ventilators, sound insulation performance ≥ Dn,e 30dB (open position)					
Element Sound Reduction Index:							
Element	Area (m²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	7.1	40	44	45	51	55	55
Window s	4.0	17	17	25	35	35	35
Doors	0						
Roof & associated ceiling	12.4	24	34	40	45	49	53
Ventilators (Dn,e)	2	30	30	30	30	30	30
Overall Sound Reduction All Elements Combined		-22.0	-23.5	-28.4	-30.3	-30.4	-30.4
Sample Room Volume (m³):		30					
Sample Room Building Envelope Surface Area (m²):		23.5					
Sample Room Characteristics:							
		Reverberation Time (seconds) at Octave Band Centre Frequency					
Sample Room Type:	Living Area	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	33.0	40.0	36.4	30.0	26.3	21.3	19.3

Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix D (page 2 of 3)

Date: March 2019

BS8233:2014 ANNEX G RIGOROUS METHOD BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM: Flat 3 (first floor front elevation), Bedroom

NOISE CONDITION: Day Period (07:00 to 23:00) Equivalent Free-Field $L_{Aeq,16hr}$ 56dB

NOISE CRITERION: Internal Noise Limit In Room = $L_{Aeq,16hr} \leq 35dB$

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	56	56	54	53	52	47	45
Building Envelope Details For Sample Room:							
Element	Area (m ²) or Vent No	Element Specification / Description					
Walls	2.8	Masonry structure external walls					
Window s	2.8	Double glazing 4-airgap-4 configuration, sound insulation performance ≥ Rw 30dB					
Doors	0	No external doors to room					
Roof & associated ceiling	9.0	Conventional tiles on rafters with insulation & single layer plasterboard ceilings					
Ventilators	2	Passive type ventilators, sound insulation performance ≥ Dn,e 30dB (open position)					
Element Sound Reduction Index:							
Element	Area (m ²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	2.8	40	44	45	51	55	55
Window s	2.8	17	17	25	35	35	35
Doors	0						
Roof & associated ceiling	9.0	24	34	40	45	49	53
Ventilators (Dn,e)	2	30	30	30	30	30	30
Overall Sound Reduction All Elements Combined		-21.2	-22.6	-26.9	-28.4	-28.4	-28.4
Sample Room Volume (m³):		21					
Sample Room Building Envelope Surface Area (m²):		14.6					
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	0.25	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	32.0	39.0	34.7	28.5	26.0	21.0	19.0

Site: 260-262 London Road, Waterlooville, Hampshire PO7 7HG

Report: 19008-002 Appendix D (page 3 of 3)

Date: March 2019

BS8233:2014 ANNEX G RIGOROUS METHOD BUILDING ENVELOPE SOUND INSULATION CALCULATION

SAMPLE ROOM: Flat 3 (first floor front elevation), Bedroom

NOISE CONDITION: Night Period (23:00 to 07:00) Equivalent Free-Field $L_{Aeq,8hr}$ 48dB

NOISE CRITERION: Internal Noise Limit In Room = $L_{Aeq,8hr} \leq 30dB$

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	48	50	48	45	44	40	37
Building Envelope Details For Sample Room:							
Element	Area (m ²) or Vent No	Element Specification / Description					
Walls	2.8	Masonry structure external walls					
Window s	2.8	Double glazing 4-airgap-4 configuration, sound insulation performance ≥ Rw 30dB					
Doors	0	No external doors to room					
Roof & associated ceiling	9.0	Conventional tiles on rafters with insulation & single layer plasterboard ceilings					
Ventilators	2	Passive type ventilators, sound insulation performance ≥ Dn,e 30dB (open position)					
Element Sound Reduction Index:							
Element	Area (m ²) or Vent No	dB at Octave Band Centre Frequency					
		125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz
Walls	2.8	40	44	45	51	55	55
Window s	2.8	17	17	25	35	35	35
Doors	0						
Roof & associated ceiling	9.0	24	34	40	45	49	53
Ventilators (Dn,e)	2	30	30	30	30	30	30
Overall Sound Reduction All Elements Combined		-21.2	-22.6	-26.9	-28.4	-28.4	-28.4
Sample Room Volume (m ³):		21					
Sample Room Building Envelope Surface Area (m ²):		14.6					
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	0.25	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	24.9	33.0	28.7	20.5	18.0	14.0	11.0