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ACOUSTIC CONSULTANTS

N.H.D.C.
16 APR 2018

Carrington House
37 Upper King Street, Royston

Change of use of ground floor office into a flat
Planning Noise Assessment

Report ref.
JW1344/17111/0

Issued to
C. J. Hammond Building Services
Grand Oaks Capital Limited

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1. SUMMARY

- Planning Permission has been obtained for a change of use from ground floor office to a two bedroom flat at Carrington House, Upper King Street, Royston. The Permission includes a noise-related Condition which requires an acoustic assessment in accordance with PPG24. North Hertfordshire District Council's requirements for internal noise levels are also included in the Condition.

- Noise measurements have been carried out by Spectrum Acoustic Consultants during a site survey between 20 and 24 April 2017. The measurement results have been used to calculate internal noise levels for the proposed scheme and identify the need for any additional acoustic mitigation.

- Upper King Street is relatively quiet for the majority of the time, with the main source of ambient noise being road traffic along Baldock Street and Melbourn Street to the north, and the A10 to the south. Noise levels were higher on Friday and Saturday night due to increased pedestrian activity in the town centre.

- Results of the noise measurements have been used to assess the site's separate daytime and night-time noise exposure levels in accordance with PPG 24 Annex 1, along with typical short-term maximum noise levels at night-time. For the survey period covered, all day and night time periods are within NEC B, apart from the Friday night period which enters NEC C by 1 dB.

- The analysis indicates that internal $L_{Aeq,T}$ noise levels comfortably meet those set out in the Planning Condition for all day and night time periods with the existing glazing. L_{AFmax} levels exceed the requirements Friday and Saturday nights, identifying the need for acoustic mitigation for the bedrooms.

- A specification for secondary sash glazing to the bedrooms has been provided, to ensure that L_{AFmax} levels, even during the worst-case Friday and Saturday night periods, meet the standards of the Condition.

2. INTRODUCTION

C J Hammond Building Services, on behalf of Grand Oaks Capital Limited, have obtained planning permission for a change of use of a ground floor office to a two bedroom flat, at Carrington House, Royston. The Planning Permission includes a noise-related Planning Condition, which requires a noise assessment to be carried out prior to occupation, to inform the acoustic design.

Spectrum Acoustic Consultants have been engaged to undertake the necessary measurements, analyses and assessment to discharge the Condition. The details of a noise measurement survey are set out in this report and, where necessary, mitigating measures required to meet North Hertfordshire District Council's indicated noise standards.

3. SITE DESCRIPTION

Carrington House is located at 37 Upper King Street, Royston SG8 9AZ. The existing ground floor office has windows looking directly on to Upper King Street, which is a town centre street containing a mix of residential and commercial properties. Access to the unit is via a gated archway set into the Upper King Street façade.

A site location plan and existing layout drawing is provided in Appendix A.

The permitted scheme is a two bedroom flat formed by creating new internal partitions, with a new room created for Bedroom 2 by partly extending the building into the gated archway. The intention is to maintain the existing windows which will become the Living Room and Bedroom 1 windows, and create a new window for Bedroom 2, if acoustically acceptable.

The proposed layout drawing is provided in Appendix B.

The proposed flat has only one external façade, which faces on to Upper King Street. The unit is tied into adjacent buildings on the other three sides. Upper King Street has low traffic considering it is a town centre location as it is not a through road. The main traffic flow is directed along Baldock Street and Melbourn Street to the north, and the A10 to the south.

4. STANDARDS AND PLANNING REQUIREMENTS

4.1 PLANNING CONDITION

Condition No. 3 of the Decision Notice for Application 08/01858/1, states:

> *The developer shall carry out a noise assessment following the guidelines of Planning Policy Guidance 24: Planning and Noise. Prior to occupation a scheme for sound insulation and noise control measures should be submitted for the Council's approval and implemented to the satisfaction of the Council to achieve the following internal noise targets:*
>
> *Bedrooms (23:00 - 7:00 hrs) 35 dB LAeq, and 45 dB LAmax (fast)*
>
> *Living Rooms (07:00 - 23:00 hrs) 40 dB LAeq*

4.2 DISCUSSIONS WITH THE LOCAL AUTHORITY

The Decision Notice is dated 2nd June 2010 and refers to PPG24, which is a guidance document that has since been withdrawn. Spectrum therefore contacted the Environmental Health department of North Hertfordshire District Council to confirm the requirements of the Condition. - C J Hammond Building Services also confirmed that the Permission remains valid (at the time of this report).

In correspondence with Patricia Howes, Environmental Health Officer, the approach followed in this report was agreed by email on 19th April 2017. It was agreed to carry out a PPG24 assessment, as stated in the Planning Condition, to ensure the stated internal noise levels are achieved.

4.3 PPG24 PLANNING POLICY GUIDANCE 24: PLANNING AND NOISE

Planning Policy Guidance 24: Planning and Noise, DCLG, 1994 (replaced by the NPPF as of March 2012), provides a mechanism for judging whether noise should be a major factor when granting or refusing planning permission for a residential development. The method uses the concept of Noise Exposure Categories (NEC's) to rate the importance of noise in the planning process.

There are four NEC's into which a residential development site may be classified and these are included in Annex 1 of PPG 24. A summary of the guidance given for each category is given in the following tables.

NEC	Description
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 1: Planning guidance for each Noise Exposure Category

Noise Levels Corresponding To The Noise Exposure Categories For New Dwellings $L_{Aeq,T}$ dB					
Noise Source		Noise Exposure Category			
		A	B	C	D
Road traffic:	0700-2300	<55	55-63	63-72	>72
	2300-0700	<45	45-57	57-66	>66
Rail traffic:	0700-2300	<55	55-66	66-74	>74
	2300-0700	<45	45-59	59-66	>66
Air traffic:	0700-2300	<57	57-66	66-72	>72
	2300-0700	<48	48-57	57-66	>66
Mixed sources:	0700-2300	<55	55-63	63-72	>72
	2300-0700	<45	45-57	57-66	>66

Table 2: Noise level ranges for each Noise Exposure Category (free field noise levels)

If noise levels regularly exceed L_{ASmax} 82 dB regularly in any 1 hour period at night, the site is automatically classified as NEC C, unless it is otherwise in NEC D.

4.4 BS8233:2014 GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS

PPG24 refers to other guidance for determining suitable acoustic conditions for residential sites, including BS 8233:1999 *Sound insulation and noise reduction for buildings. Code of practice.*

This Standard has been updated to *BS 8233:2014 Guidance on sound insulation and noise reduction for buildings* and the 1999 version superseded. The current BS8233 is still considered to provide the appropriate methods for assessing the noise impact of new developments.

BS8233 advises that the main requirements are to provide reasonable resting/sleeping conditions in bedrooms, and good listening conditions in other rooms. A calculation method is described for determining internal noise levels. This calculation procedure is followed as part of this assessment, to ensure the Council's noise criteria given in the Condition are met.

5. NOISE MEASUREMENT SURVEY

5.1 MEASUREMENT PROCEDURE

Noise measurements were carried out during a site survey between Thursday 20th and Monday 24th April 2017. This represents typical mid-week conditions and also the weekend environment. The weather during the survey was overcast but dry, with little wind due to the sheltered location of the site.

The survey was carried out using an unattended noise logger attached to the railings on the Upper King Street façade. The measurements consisted of contiguous 5 minute periods to present the noise profile throughout the monitoring period and giving a good representation of night-time maximum noise events.

Noise measurement parameters consisted of equivalent continuous (L_{Aeq}) noise levels and maximum (L_{AFmax}) noise levels as well as statistical noise levels (termed L_n, where n is the percentage of time the level is exceeded during the measurement period). Both broadband and octave band measurements were stored for later analysis.

PPG24 says that where possible, measurements should be made well away from any buildings, in free-field conditions, at 1.2 to 1.5m above ground. The subject building is located in a densely populated section of Upper King Street and there are no suitable representative measurement positions in free-field conditions. The microphone was mounted on the railings at the entrance to the property, approximately 1.5m above the ground, and 1m from the façade. In accordance with PPG24, the results of the noise measurements in this report are corrected by -3 dBA to obtain the façade level.

The measurement position is shown in Appendix B.

5.2 MEASUREMENT EQUIPMENT

The following equipment was used for the survey:

- Bruel & Kjaer Type 2250 Sound Level Meter s/n 3009933
- Bruel & Kjaer Type 4189 Microphone s/n 3043744
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 2115516

Before and after the survey, the sound level meter was field-calibrated in accordance with the manufacturer's guidelines, and no significant drift was observed. The meters, microphones, and field calibrators are laboratory calibrated biennially in accordance with UKAS procedures or to traceable National Standards.

5.3 RESULTS

The results of the noise measurement survey are shown graphically in Appendix C. In addition, the results have been summarised into relevant daytime (07:00-23:00 hours) and night-time (23:00-07:00 hours) periods, coinciding with the reference periods used in the Planning Condition.

The numerical L_{AFmax} levels for each 8 hour night-time period have then been sorted by value from highest to lowest. From this, it is possible to read off the 10th highest L_{AFmax} level for each night. This value is then taken as the representative L_{AFmax} for design purposes at the respective monitoring locations. This is in full accordance with the guidance in the WHO "*Guidelines for community noise*" document, which states that, for a good nights' sleep, the L_{AFmax} level should not exceed 45 dB more than 10 to 15 times.

The measured daytime $L_{Aeq,16hr}$ and night time $L_{Aeq,8hr}$, as well as the representative measured night-time L_{AFmax} levels for each day of the survey are summarised in Table 3 below.

Date	Daytime $L_{Aeq,16hr}$ dB (07:00-23:00)	Night Time $L_{Aeq,8hr}$ dB (07:00-23:00)	Design L_{AFmax} dB
Thursday 20th April 2017	54*	47	71
Friday 21st April 2017	57	58	81
Saturday 22nd April 2017	56	55	76
Sunday 23rd April 2017	55	48	70
Arithmetic average (rounded up) in accordance with PPG24	56	52	-

Table 3: Summary of survey results (corrected for façade level)
* Survey started at 11am therefore value reported is $L_{Aeq,12hr}$

Night time noise levels on Friday and Saturday night are entirely controlled by the early night time period between 11pm and 3am. This coincides with social venues in the town centre. Activity in the area was most prominent on Friday night. Maximum noise events were mainly due to pedestrians and taxis on Upper King Street. L_{ASmax} 82 dB was exceeded on the Friday night up to a maximum of 2 times in 1 hour (12-1am).

6. ASSESSMENT AND MITIGATION

6.1 PPG24 NOISE EXPOSURE CATEGORY

When following the guidance in PPG24 by taking the arithmetic average and rounding up to the nearest dB, the site is within Noise Exposure Category B during both the day and night time periods. If considering the noisiest days of the week individually as a worst-case, the Friday night time period is the only instance where the noise level entered NEC C, by just 1 dB.

The Noise Exposure Categories in PPG24 are not assessments of the acceptability of noise in themselves. They provide outline guidance as to the suitability of land for residential use based on daytime and night-time noise, but then refer to more specific guidance, such as BS8233, for determining the noise levels which will ensure that amenity is protected. In particular, the guidance for NEC C is not an outright recommendation for refusal. Rather, it is a situation where permission should not normally be granted but is conditional, depending upon other factors. The example is given where there is no availability of alternative quieter sites. Another example is given in paragraph 9, PPG24 of a need for residential development in an already noisy area. There may be many other reasons why the residential use of the land is desirable. In such cases PPG24 advises that planning conditions can properly protect residential amenity.

At paragraph 8, PPG24 considers both NEC B and C together stating, 'Categories B and C deal with situations where noise mitigation measures may make development acceptable'. In paragraph 9, PPG24 allows the variation of the boundary between NEC B & C within a 6 dB range. As a result, the delineation between NEC B & C is somewhat arbitrary and it is not a situation where residential development 'flips' from generally acceptable to unacceptable. Therefore, the noise control measures required in Category C are merely a matter of degree rather than of principle.

PPG 24 further recognises that even in NEC B noise mitigation is necessary. In Annex B, where the boundaries of each of the Noise Exposure Categories are discussed, PPG24 indicates that it is only well within Category A that residential development can occur without noise mitigation measures.

Therefore, in order to provide an acceptable level of acoustic amenity for occupants of the proposed residences, it is necessary to provide methods of noise mitigation. The objective noise levels which would provide a suitable noise environment are those set out in the Planning Condition, which North Herts District Council have indicated as being acceptable for this development. The likely measures required are discussed later within this report.

6.2 INTERNAL NOISE LEVELS

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* describes a 'more rigorous calculation method' for determining internal noise levels, using octave band data (i.e. more rigorous than for single-number estimates). This is calculated from external noise levels, given the size and sound insulation properties of the building façade elements including glazing and ventilation, as well as acoustic properties of the receiving room, such as the volume and reverberation time. Usually, it is the glazing and, depending upon the particular strategy, the ventilation apertures that admit most noise into residences. It is then a matter of providing façade elements with appropriate acoustic performance to achieve sufficient noise reduction to meet the internal noise target.

The analysis uses:

- External noise levels for daytime $L_{Aeq,16hr}$ and night time $L_{Aeq,8hr}$ and design L_{AFmax} from Table 3 above.
- Room sizes and layouts from the proposed layout drawing in Appendix B.
- External wall and window sizes shown on the proposed layout drawing.
- Typical internal reverberation times for bedrooms and living rooms in occupied dwellings as measured by Spectrum on previous occasions.

The general construction of the building envelope used in the analysis is as follows:

- External wall as per existing construction (brick with insulated cavity to blockwork lining).
- Thermal double glazed window units having a specification as described below.
- No ventilation openings. There is an existing whole unit mechanical ventilation system with ducted intake/extract.

The exact makeup and sound insulation performance of the existing windows is unknown. Upon visual inspection, they are thermal double glazed units, well-installed with working open/closing mechanisms and seals. One glazed panel in the proposed Living Room window has been damaged and temporarily boarded. It is proposed to replace the glazing panel only and maintain the existing windows. Any additional mitigation, if required, is preferred to be in the form of an internal secondary sash, so that the existing windows can be kept as they match the appearance of the building.

To present a conservative worst-case assessment, it is assumed that the glazing makeup is basic double glazing e.g. 4mm/12mm/4mm with a low acoustic performance of $R_w(C_{tr})$ 31(-6) dB. The actual windows installed are likely to have a higher acoustic performance than this.

Appendix D shows the intrusive noise calculations carried out following the method described above. The calculations show that with the basic windows assumed as stated above, the internal levels are calculated to be:

- $L_{Aeq,16hr}$ 23 dB in the Living Room during the day (07:00-23:00)
- $L_{Aeq,8hr}$ 26 dB in Bedroom 1 during the night (23:00-07:00)

The above levels are well below the Planning Requirements of $L_{Aeq,16hr}$ 40 dB and $L_{Aeq,8hr}$ 35 dB. However, L_{AFmax} levels are predicted to exceed 45 dB when considering the worst-case Friday night typical L_{AFmax}. Accordingly, it is recommended that a secondary sash is installed in the bedrooms to protect the future occupants from night time disturbance from maximum noise events.

Sound insulation performance data supplied by Pilkington Glass states that a basic secondary sash system comprising 6mm glass installed on a 100mm cavity achieves $R_w(C_{tr})$ 46(-9) dB, when installed over a 4mm single glazed window. The manufacturer's octave band data for this system has been used in the calculation in Appendix D which gives an internal level of L_{AFmax} 44 dB.

The above secondary sash performance applies to a single glazed (4mm) underlying window construction. The existing windows at Carrington House are double glazed (4mm/12mm/4mm or better) and therefore the overall performance with a 6mm secondary sash would be higher than the figure used in the calculation, which is therefore conservative.

The following mitigation is therefore recommended:

- Install secondary sash glazing in both bedrooms. The composite acoustic performance of the glazing (existing window and secondary sash together), should be at least $R_w(C_{tr})$ 46(-9) dB. Manufacturer's data from Pilkington Glass suggests this can be achieved with a 6mm sash installed with a 100mm cavity to the existing window. (Glazing suppliers often quote acoustic performances of secondary glazing systems based on a single 4mm underlying window. Where that is the case, the performance needs to be $R_w(C_{tr})$ 46(-9) dB or better).

7. CONCLUSION

C J Hammond Building Services, on behalf of Grand Oaks Capital Limited, have obtained planning permission for a change of use of a ground floor office to a two bedroom flat, at Carrington House, Royston. The Permission includes a noise-related Condition to carry out a noise assessment prior to occupation, to inform the acoustic design and ensure that internal noise levels meet North Hertfordshire District Council's standards.

An acoustic survey has been carried out to establish external noise levels at the site. The site is located on Upper King Street which, although is a town centre location, has a low traffic flow and relatively low ambient noise levels for the majority of the time. The main source of ambient noise is road traffic along the major through roads Baldock Street and Melbourn Street to the north, and the A10 to the south. Being a town centre location, noise levels are elevated on Friday and Saturday nights due to increased pedestrian activity in the area.

Results of the noise survey have been used to calculate internal noise levels based on the proposed layout and conservative assumptions for the existing glazing, showing that both day and night time $L_{Aeq,T}$ levels are comfortably within the Council's criteria. Internal L_{AFmax} levels during the night are acceptable for the majority of the time, but are exceeded on Friday and Saturday nights. Accordingly, a specification for secondary sash glazing to the bedrooms has been provided, to ensure L_{AFmax} levels during the night meet the Council's stadards.

In summary, suitable internal noise levels are achievable for the proposed dwelling. A mitigation scheme has been provided to demonstrate that North Hertfordshire District Council's planning noise criteria can be met.

Report Code: E/RT/EH

APPENDIX A

Site location plan and existing layout drawing

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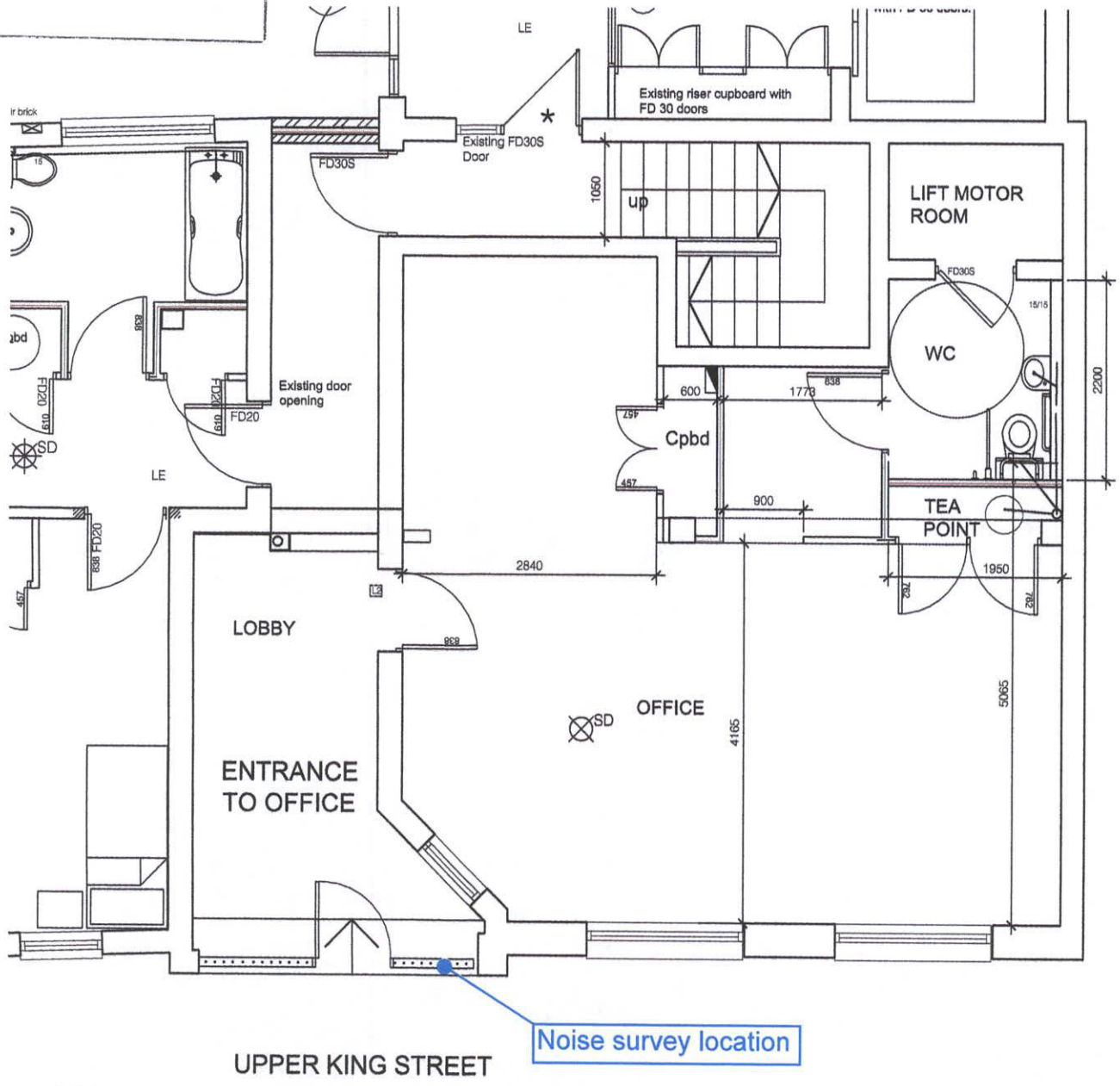
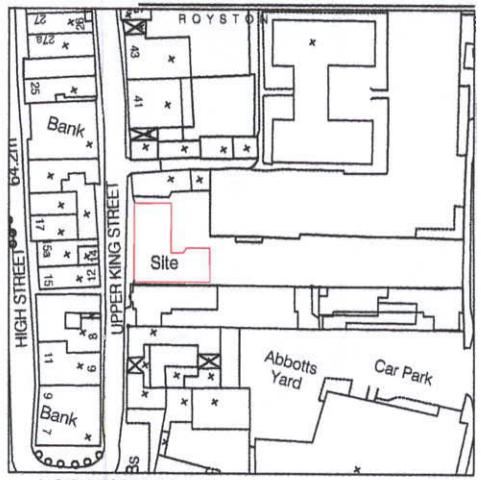
16 APR 2018



FLOOR PLAN
Scale 1:50



LOCATION PLAN
Scale 1:1250

This drawing is a print and must not be scaled from without making reference to the accompanying scale bar. Any queries regarding dimensions must be taken up with BBR Architects. All dimensions of existing buildings to be verified on site.

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REV	DATE	NOTE	BY

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CONTRACT
PROPOSED DEVELOPMENT
CARRINGTON HOUSE
UPPER KING HIGH STREET
ROYSTON

DRAWING TITLE
EXISTING PLAN

SCALE	1:50 @ A3	DRAWING NUMBER	REVISION
DATE	OCTOBER 2011	01	
DRAWN	IHL		CHECKED BY
JOB NUMBER	11634		

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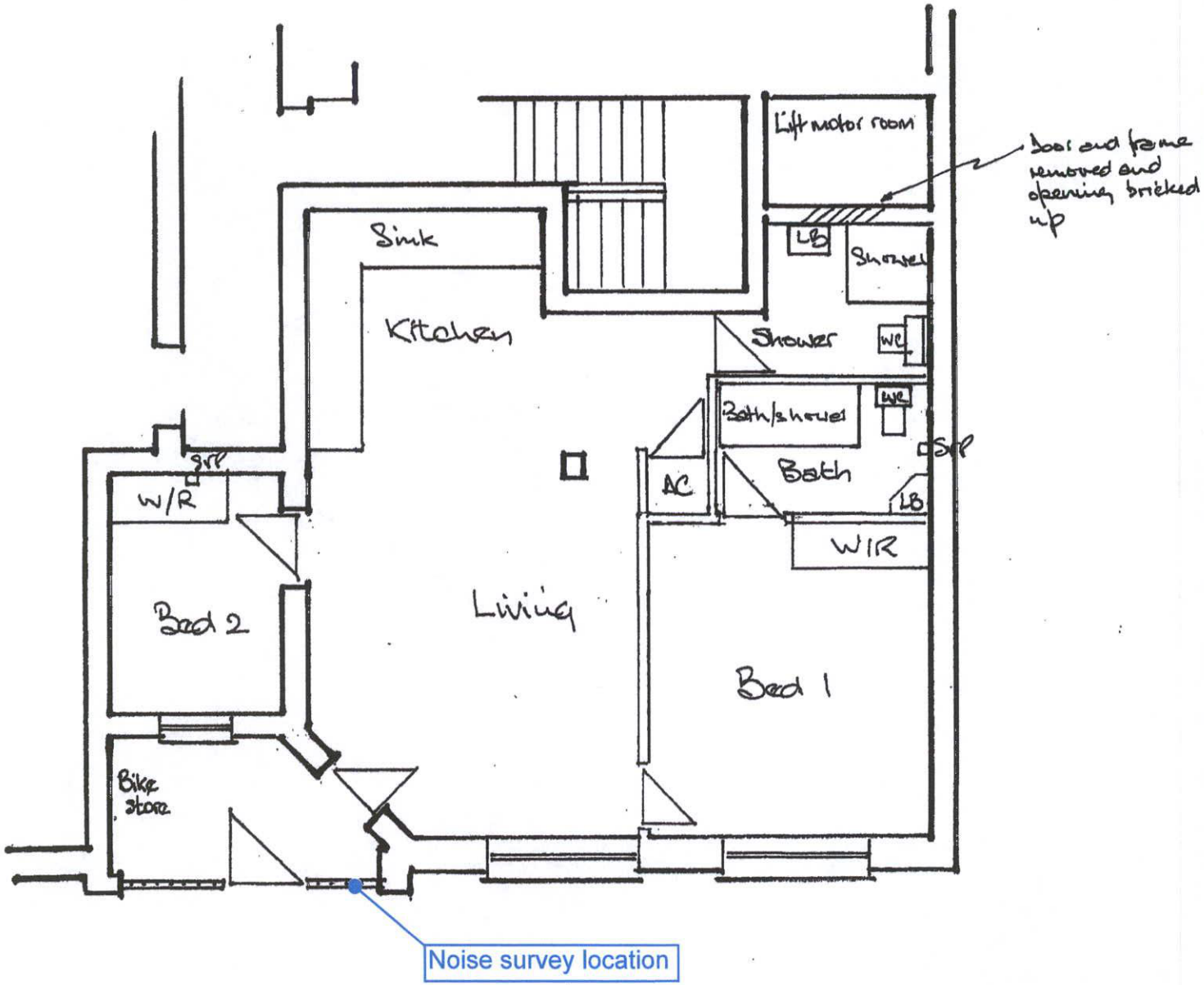
APPENDIX B

Proposed layout drawing



N.H.D.C.
16 APR 2018

Conversion of existing office at Carrington House, 37 Upper Kiln Street, Royston SG8 9AZ into 2 bed apartment

Scale 1:50 at A3

August 2016

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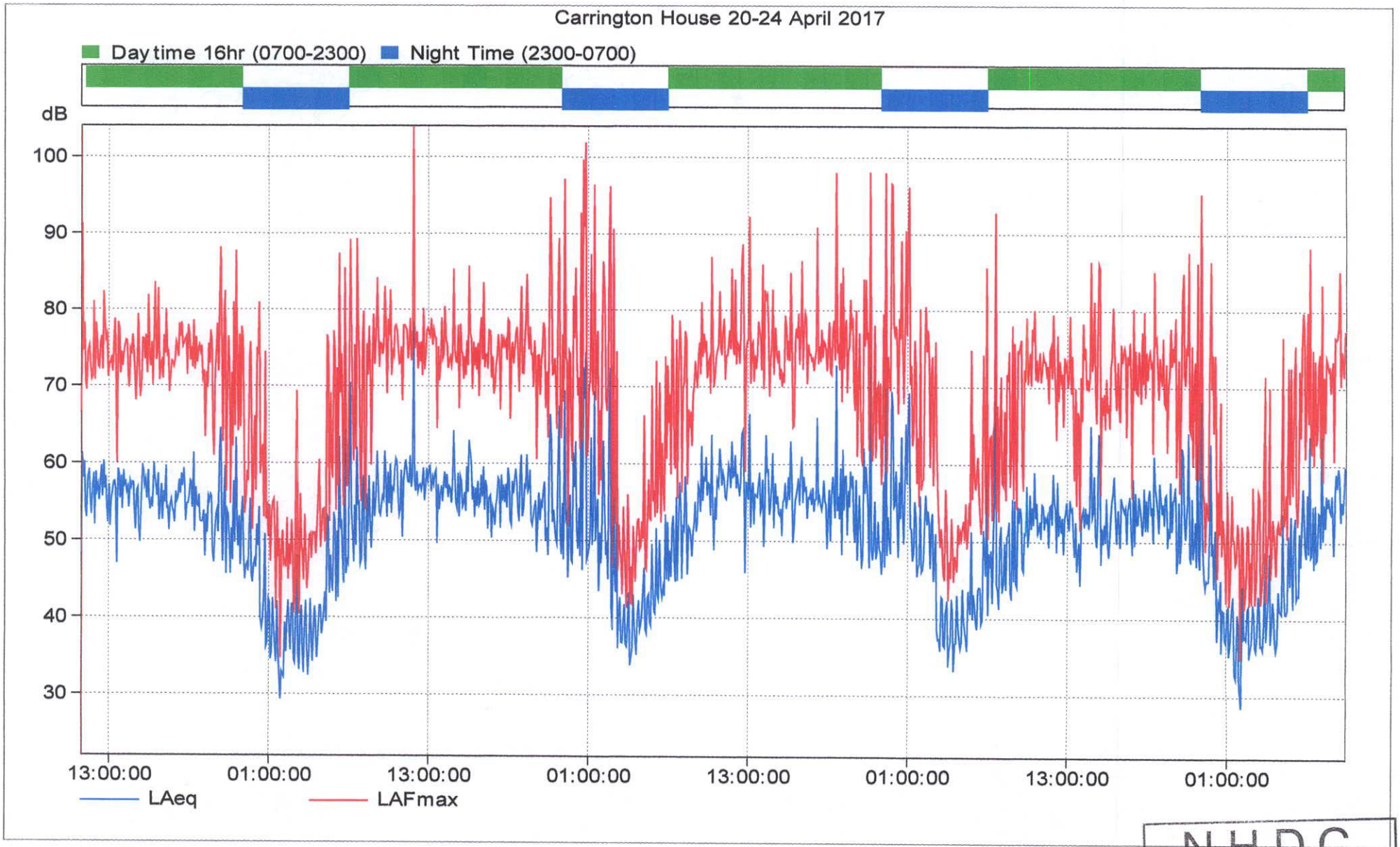
APPENDIX C

Noise survey results



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16 APR 2018

APPENDIX D

Intrusive noise calculation

Date: 29/04/2017 **Project No:** 17111 **Project:** Carrington House, Royston

Receiver room for this calculation: Living Room

Estimated Indoor Ambient Noise Levels - Living Room

Estimation of the indoor ambient noise level in a room based on the external noise levels and façade sound insulation taken from equations in Section 6.7.2.1 of BS8233:1999

$$L_{internal} = L_{external} - \Sigma R + 10 \log S + 10 \log T - 10 \log 0.163V + 3 + C$$

Where: -

- $L_{internal}$ - estimated indoor reverberant sound pressure level
- $L_{external}$ - measured external sound pressure level (LAeq, 16hr) - i.e. the design external LAeq
- C - correction factor to convert the measured external sound pressure level to 'free field' (6dB for measurements within millimetres of the façade, 3dB for mesurements 2m from the façade)
- ΣR - overall sound reduction of the facade
- T - reverberation time inside the room in question
- V - volume of the room in question

		Octave Band Centre Frequency (Hz)							
External Noise Spectral Data	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
LAeq, 16hr	**56**	60	61	55	53	50	47	41	36
Façade Correction Factor, C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reduction of façade elements									
Basic double glazing (e.g. 4/12/4) Rw(Ctr) 31(-6)dB									
Area:		2.2	m^2						
R:		18	24	20	25	35	38	35	35
Brick and block external wall									
Area:		8.6	m^2						
R:		34	40	44	45	51	56	60	63
None									
Number of:		0							
D_{ne}		0	0	0	0	0	0	0	0
Room Data									
Living Room Reverberation Time		0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3
Total Façade Area		10.8	m^2						
Room Volume		66.2	m^3						
Overall sound reduction of the facade									
Combined sound reduction		24.5	30.5	26.8	31.7	41.5	44.6	41.9	41.9
		Octave Band Centre Frequency (Hz)							
Estimated Indoor Noise Level	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
	23	36	31	28	21	8	1	0	0

Date: 29/04/2017 **Project No:** 17111 **Project:** Carrington House, Royston

Receiver room for this calculation: Bedroom 1

Estimated Indoor Ambient Noise Levels - Bedroom

Estimation of the indoor ambient noise level in a room based on the external noise levels and façade sound insulation taken from equations in Section 6.7.2.1 of BS8233:1999

$$L_{internal} = L_{external} - \Sigma R + 10 \log S + 10 \log T - 10 \log 0.163V + 3 + C$$

Where: -

- $L_{internal}$ - estimated indoor reverberant sound pressure level
- $L_{external}$ - measured external sound pressure level (LAeq, 8hr) - i.e. the design external LAeq
- C - correction factor to convert the measured external sound pressure level to 'free field' (6dB for measurements within millimetres of the façade, 3dB for mesurements 2m from the façade)
- ΣR - overall sound reduction of the facade
- T - reverberation time inside the room in question
- V - volume of the room in question

		Octave Band Centre Frequency (Hz)							
External Noise Spectral Data	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
LAeq, 8hr	**52**	54	61	56	49	42	36	31	26
Façade Correction Factor, C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reduction of façade elements									
Basic double glazing (e.g. 4/12/4) Rw(Ctr) 31(-6)dB									
Area:		2.2	m^2						
R:		18	24	20	25	35	38	35	35
Brick and block external wall									
Area:		5.8	m^2						
R:		34	40	44	45	51	56	60	63
None									
Number of:		0							
D_{ne}		0	0	0	0	0	0	0	0
Room Data									
Bedroom Reverberation Time		0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3
Total Façade Area		8	m^2						
Room Volume		29	m^3						
Overall sound reduction of the facade									
Combined sound reduction		23.3	29.3	25.6	30.5	40.3	43.4	40.6	40.6
		Octave Band Centre Frequency (Hz)							
Estimated Indoor Noise Level	**dB(A)**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
	26	34	35	33	21	3	0	0	0

Date: 29/04/2017 **Project No:** 17111 **Project:** Carrington House, Royston

Receiver room for this calculation: Bedroom 1

Estimated Indoor Ambient Noise Levels - Bedroom LAFmax

Estimation of the indoor ambient noise level in a room based on the external noise levels and façade sound insulation taken from equations in Section 6.7.2.1 of BS8233:1999

$$L_{internal} = L_{external} - \Sigma R + 10 \log S + 10 \log T - 10 \log 0.163V + 3 + C$$

Where: -

- $L_{internal}$ - estimated indoor reverberant sound pressure level
- $L_{external}$ - measured external sound pressure level (LAFMax) - i.e. the design external LAFM
- C - correction factor to convert the measured external sound pressure level to 'free field' (6dB for measurements within millimetres of the façade, 3dB for mesurements 2m from the façade)
- ΣR - overall sound reduction of the facade
- T - reverberation time inside the room in question
- V - volume of the room in question

			Octave Band Centre Frequency (Hz)							
External Noise Spectral Data	**dB(A)**		**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
LAFMax	**81**		83	84	86	79	71	65	56	47
Façade Correction Factor, C			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reduction of façade elements										
Secondary Sash (6/100/4) Rw(ctr) 46(-9)										
		Area:	2.2	m^2						
		R:	23	26	34	44	56	53	52	52
Brick and block external wall										
		Area:	5.8	m^2						
		R:	34	40	44	45	51	56	60	63
None										
		Number of:	0							
		D_{ne}	0	0	0	0	0	0	0	0
Room Data										
Bedroom Reverberation Time			0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3
Total Façade Area			8	m^2						
Room Volume			29	m^3						
Overall sound reduction of the facade										
Combined sound reduction			27.8	31.2	38.6	44.7	51.9	54.9	56.1	56.8
			Octave Band Centre Frequency (Hz)							
Estimated Indoor Noise Level	**dB(A)**		**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
	44		58	56	50	37	20	11	0	0

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