

Project: 108 London Street, Reading RG1 4SJ
Client: Aspire 108 London Street Limited

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Project:	108 London Street, Reading RG1 4SJ			
Client:	Aspire 108 London Street Limited			
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1.0 Introduction

It is proposed that 108 London Street, Reading RG1 4SJ, be converted from office to residential accommodation.

During the pre-application process, the Local Planning Authority has raised the following concern:

“Officers also consider that given the closeness of the After Dark club (part of the club abuts the side wall of the building) there will be direct vibration transmission to the building. A vibration assessment should also be submitted to ensure that occupiers of the flats would not be subject to disturbance from the effects of associated with loud/bassy music.”

The purpose of this vibration assessment is, through on-site vibration measurements, to assess the extent to which the proposed dwellings would be affected by groundborne vibration due to activity at the After Dark club.

The assessment reported herein is based on the guidance and principles set out in the following documents:

- British Standard BS 6472: Part 1:2008 Guide to the evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting

2.0 Site Description

The site and adjoining land uses is illustrated in Figure 1 below.

Figure 1: Site location



The site lies in an area which is characterised by mix of residential, commercial and retail premises. The eastern elevation of the scheme overlooks London Street, a moderately trafficked one-way route having a junction with London Road/Crown Street to the south and the A329 to the north.

The After Dark Club flanks the scheme to the south, with residential premises being evident to the north.

3.0 The Nature, Measurement and Effect of Vibration

When two objects come into contact through movement (such as a pile and the ground), the mechanical energy from the movement causes vibrations in the vicinity of the two objects. Vibrations in the air causes sound, but some vibrations can be felt through the ground or through structures, especially when a large amount of energy is exerted, such as the passage of heavy goods vehicles over an uneven surface.

Groundborne vibration, especially within structures, has a number of affects both to people and to the structures themselves.

The effects of groundborne vibration on buildings are dependent upon a whole range of factors, not least the magnitude and duration of the vibration, the structure of the soil, the properties and quality of the building materials, the design of the structure, as well as the general condition and age of the structure. In extreme cases, vibration can cause severe structural damage, but most vibration damage manifests itself in minor cosmetic damage such as cracks in rendering and roof tiles slipping, which in turn can cause other problems such as damp.

Groundborne vibration on buildings can be assessed using a number of quantities including the Peak Particle Velocity (PPV); the maximum instantaneous velocity of a particle at a point during a given time interval expressed in mm/s, or as maximum acceleration in m/s^2 .

3.1 Guidance and Criteria for Groundborne Vibration

Building vibrations as they affect people can be classified usefully according to a combination of descriptions. The time history of the vibration input to the subject can be:

- **Continuous:** vibration continues uninterrupted for a defined period (usually throughout daytime and/or night-time). This type of vibration can be assessed on the basis of weighted rms acceleration values. Examples of continuous vibration include machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery);
- **Intermittent:** vibration can be defined as interrupted periods of continuous (e.g. a drill) or repeated periods of impulsive vibration (e.g. a pile driver), or continuous vibration that varies significantly in magnitude. It may originate from impulse sources (e.g. pile drivers and forging presses) or repetitive sources (e.g. pavement breakers), or sources which operate intermittently, but which would produce continuous vibration if operated continuously (for example, intermittent machinery, railway trains and traffic passing by). This type of vibration can be assessed on the basis of vibration dose values. Examples of intermittent vibration may include Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines and impact pile driving;
- **Impulsive:** vibration is a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds. Impulsive vibration can be assessed on the basis of acceleration values. Impulsive vibration is most likely to startle subjects, particularly if irregularly or rarely occurring. Examples of impulsive vibration include occasional dropping of heavy equipment, occasional loading and unloading.

The adverse effects of vibration on people almost invariably occur inside buildings or other structures. Satisfactory values for sources of vibration are therefore usually set for locations indoors. From a planning viewpoint (or for convenience of measurement), it is sometimes necessary to translate indoor vibration values to values in the ground (for example, when a building has not yet been constructed or when access to an indoor location is not readily available).

Indoor vibration values caused by an external source can be measured externally (in the ground) and translated to indoor values or measured internally, and then compared to criteria such as those reviewed below. It should be noted that although the criteria are non-mandatory, they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures.

When predicted or measured vibration values exceed the preferred values, then mitigation measures to meet the preferred values should be considered. The degree of vibration impact quantifies the extent of mitigation required and the mix of vibration control measures to be adopted as a mitigation strategy.

3.2 British Standard BS 6472: Part 1:2008

BS 6472 Part 1 Guide to the evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting is the main guidance document utilised for this vibration assessment. It provides guidance for measuring and evaluating human exposure to vibration where the source of vibration does not arise from blasting activities.

Table 1 below summarises the levels of vibration dose values (VDV) and the corresponding probability of adverse comments.

Table 1: Vibration dose values which might result in various probabilities of adverse comment within residential buildings (source: BS 6472-1:2008, Table 1)

Place and time	Low probability of adverse comment $\text{m}\cdot\text{s}^{-1.75}$ 1)	Adverse comment possible $\text{m}\cdot\text{s}^{-1.75}$	Adverse comment probable $\text{m}\cdot\text{s}^{-1.75}$ 2)
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Perception thresholds for continuous whole-body vibration vary widely among individuals. Approximately half the people in a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2 . The weighting used is W_b . A quarter of the people would perceive a vibration of 0.01 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.02 m/s^2 peak or more. Perception thresholds are slightly higher for vibration duration of less than about 1 s.

4.0 Vibration Surveys

A vibration survey was carried out over the 14th to 19th March 2018 at the location illustrated by Figure 2 and described below. The survey period encompassed a Friday and Saturday night and thus included two nights of activity within the After Dark Club.

- **MPV1:** Prince Regent House, southeast corner of ground floor level slab

Measurements were carried out using the following instrumentation meeting the requirements of BS EN ISO 8041:2005

Manufacturer	Type	Serial Number	Calibration Due Date
SVANTEK	SVAN 958, 4 Channel Vibration Analyser	14627	2018-04-28
	SA207 Mounting box and Dytran tri-axial accelerometer 3233A	328	2018-04-29

The monitoring location was selected to be as close as possible to the boundary with the After Dark Club, with a view to quantifying worst case vibration exposure.

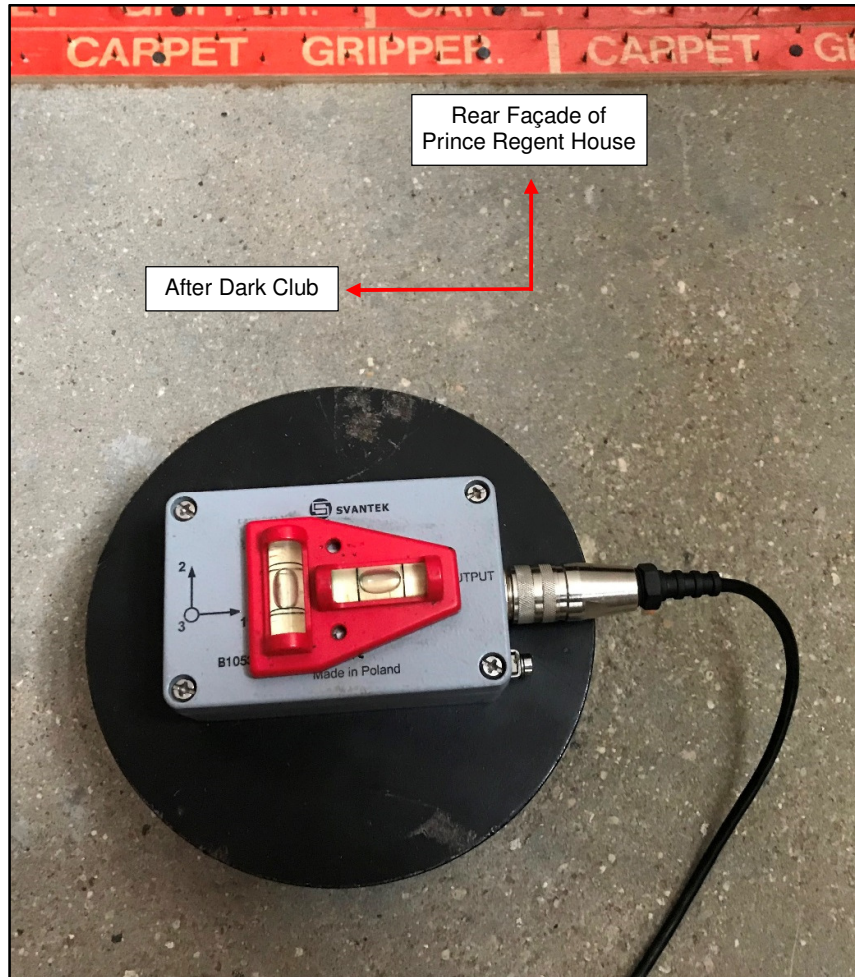
The accelerometer pack was rigidly affixed to a steel inertia block that was in direct contact with the ground floor level slab, Figure 3 illustrates, all floor coverings having been removed prior to start of measurements. The measurement mounting surface was selected to be as flat and level as possible. Cables were affixed back to structure following the general principles of BS ISO 5348:1998.

Figure 2: Vibration monitoring location



The vibration analyser was programmed to measure the frequency weighted acceleration in each of the three orthogonal axes (weighting W_d and W_b for horizontal and vertical motion) over continuous, consecutive 60-minute periods.

Figure 3: Vibration transducer mounting arrangement



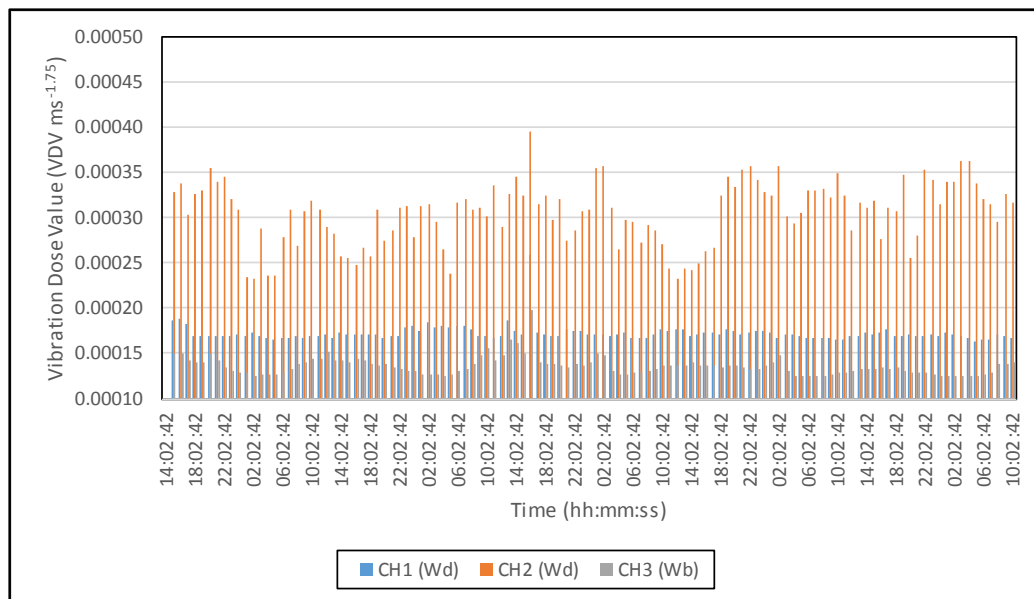
5.0 Vibration Monitoring Results

The vibration data obtained from continuous measurements are summarized in Table 1 and Figure 3 below. The full data set is reproduced in full in Appendix A.

Table 1: Summary of continuous Monitoring Measurement Data

Period	X Axis	Y Axis	Z Axis	VDV _{b/d,day}	X Axis	Y Axis	Z Axis	VDV _{b/d,night}
	VDV _{d,day}	VDV _{d,day}	VDV _{b,day}		VDV _{d,day}	VDV _{d,day}	VDV _{b,day}	
1	0.0003	0.0006	0.0002	0.0006	0.0003	0.0005	0.0002	0.0005
2	0.0003	0.0006	0.0003	0.0006	0.0003	0.0005	0.0002	0.0005
3	0.0004	0.0006	0.0003	0.0006	0.0003	0.0005	0.0002	0.0005
4	0.0003	0.0006	0.0003	0.0006	0.0003	0.0005	0.0002	0.0005
5	0.0003	0.0006	0.0003	0.0006	0.0003	0.0006	0.0002	0.0006
6	0.0002	0.0004	0.0002	0.0004				

Figure 4: Vibration dose value time series



6.0 Discussion

Examination Table 1 shows a worst night vibration dose value of $0.0006 \text{ ms}^{-1.75}$. This figure falls orders of magnitude below the lowest value of the range of exposures corresponding to a “low probability of adverse comment” according to BS 6472:2008, i.e., $0.1 \text{ ms}^{-1.75}$. Significantly, there was no material change in night vibration values across the entire survey duration, which demonstrates that vibration transmission from the After Dark Club is making a negligible contribution to the extant night time vibration climate.

As regards the daytime, the worst vibration dose value was $0.0006 \text{ ms}^{-1.75}$. The onset of “low probability of adverse comment” occurs at $0.2 \text{ ms}^{-1.75}$ according to Table 1 of BS 6472-1 and hence exposure from all extant sources is minimal.

On the basis of the data reviewed herein, it is concluded that vibration exposure is of a magnitude such that no material loss of amenity should occur within the proposed residential demise. It is therefore considered that sufficient information is presented herein to address concerns raised by the LPA at the pre-application stage.

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Appendix A: Measurement Data

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No.	Date & time	CH1 (Wd) [m/s^2]	CH2 (Wd) [m/s^2]	CH3 (Wb) [m/s^2]
1	14/03/2018 14:02:42	0.00061	0.00066	0.00059
2	14/03/2018 15:02:42	0.00019	0.00033	0.00015
3	14/03/2018 16:02:42	0.00019	0.00034	0.00015
4	14/03/2018 17:02:42	0.00018	0.00030	0.00014
5	14/03/2018 18:02:42	0.00017	0.00033	0.00014
6	14/03/2018 19:02:42	0.00017	0.00033	0.00014
7	14/03/2018 20:02:42	0.00017	0.00035	0.00015
8	14/03/2018 21:02:42	0.00017	0.00034	0.00014
9	14/03/2018 22:02:42	0.00017	0.00034	0.00013
10	14/03/2018 23:02:42	0.00017	0.00032	0.00013
11	15/03/2018 00:02:42	0.00017	0.00031	0.00013
12	15/03/2018 01:02:42	0.00017	0.00023	0.00013
13	15/03/2018 02:02:42	0.00017	0.00023	0.00013
14	15/03/2018 03:02:42	0.00017	0.00029	0.00013
15	15/03/2018 04:02:42	0.00017	0.00024	0.00013
16	15/03/2018 05:02:42	0.00017	0.00024	0.00013
17	15/03/2018 06:02:42	0.00017	0.00028	0.00013
18	15/03/2018 07:02:42	0.00017	0.00031	0.00013
19	15/03/2018 08:02:42	0.00017	0.00027	0.00014
20	15/03/2018 09:02:42	0.00017	0.00031	0.00014
21	15/03/2018 10:02:42	0.00017	0.00032	0.00014
22	15/03/2018 11:02:42	0.00017	0.00031	0.00014
23	15/03/2018 12:02:42	0.00017	0.00029	0.00015
24	15/03/2018 13:02:42	0.00017	0.00028	0.00014
25	15/03/2018 14:02:42	0.00017	0.00026	0.00014
26	15/03/2018 15:02:42	0.00017	0.00026	0.00014
27	15/03/2018 16:02:42	0.00017	0.00025	0.00014
28	15/03/2018 17:02:42	0.00017	0.00027	0.00014
29	15/03/2018 18:02:42	0.00017	0.00026	0.00014
30	15/03/2018 19:02:42	0.00017	0.00031	0.00014
31	15/03/2018 20:02:42	0.00017	0.00028	0.00014
32	15/03/2018 21:02:42	0.00017	0.00029	0.00014
33	15/03/2018 22:02:42	0.00017	0.00031	0.00013
34	15/03/2018 23:02:42	0.00018	0.00031	0.00013
35	16/03/2018 00:02:42	0.00018	0.00028	0.00013
36	16/03/2018 01:02:42	0.00017	0.00031	0.00013
37	16/03/2018 02:02:42	0.00018	0.00032	0.00013
38	16/03/2018 03:02:42	0.00018	0.00029	0.00013
39	16/03/2018 04:02:42	0.00018	0.00027	0.00013
40	16/03/2018 05:02:42	0.00018	0.00024	0.00013
41	16/03/2018 06:02:42	0.00018	0.00032	0.00013
42	16/03/2018 07:02:42	0.00018	0.00032	0.00013

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No.	Date & time	CH1 (Wd) [m/s^2]	CH2 (Wd) [m/s^2]	CH3 (Wb) [m/s^2]
43	16/03/2018 08:02:42	0.00018	0.00031	0.00014
44	16/03/2018 09:02:42	0.00017	0.00031	0.00015
45	16/03/2018 10:02:42	0.00017	0.00030	0.00016
46	16/03/2018 11:02:42	0.00017	0.00034	0.00014
47	16/03/2018 12:02:42	0.00017	0.00029	0.00015
48	16/03/2018 13:02:42	0.00019	0.00033	0.00017
49	16/03/2018 14:02:42	0.00018	0.00034	0.00016
50	16/03/2018 15:02:42	0.00017	0.00032	0.00015
51	16/03/2018 16:02:42	0.00026	0.00040	0.00020
52	16/03/2018 17:02:42	0.00017	0.00031	0.00014
53	16/03/2018 18:02:42	0.00017	0.00032	0.00014
54	16/03/2018 19:02:42	0.00017	0.00030	0.00014
55	16/03/2018 20:02:42	0.00017	0.00032	0.00014
56	16/03/2018 21:02:42	0.00018	0.00027	0.00013
57	16/03/2018 22:02:42	0.00018	0.00029	0.00014
58	16/03/2018 23:02:42	0.00017	0.00031	0.00014
59	17/03/2018 00:02:42	0.00017	0.00031	0.00014
60	17/03/2018 01:02:42	0.00017	0.00036	0.00015
61	17/03/2018 02:02:42	0.00017	0.00036	0.00015
62	17/03/2018 03:02:42	0.00017	0.00031	0.00013
63	17/03/2018 04:02:42	0.00017	0.00027	0.00013
64	17/03/2018 05:02:42	0.00017	0.00030	0.00013
65	17/03/2018 06:02:42	0.00017	0.00030	0.00013
66	17/03/2018 07:02:42	0.00017	0.00027	0.00013
67	17/03/2018 08:02:42	0.00017	0.00029	0.00013
68	17/03/2018 09:02:42	0.00017	0.00029	0.00013
69	17/03/2018 10:02:42	0.00018	0.00027	0.00014
70	17/03/2018 11:02:42	0.00017	0.00024	0.00014
71	17/03/2018 12:02:42	0.00018	0.00023	0.00014
72	17/03/2018 13:02:42	0.00018	0.00024	0.00014
73	17/03/2018 14:02:42	0.00017	0.00024	0.00014
74	17/03/2018 15:02:42	0.00017	0.00025	0.00014
75	17/03/2018 16:02:42	0.00017	0.00026	0.00014
76	17/03/2018 17:02:42	0.00017	0.00027	0.00014
77	17/03/2018 18:02:42	0.00017	0.00032	0.00014
78	17/03/2018 19:02:42	0.00018	0.00034	0.00014
79	17/03/2018 20:02:42	0.00017	0.00033	0.00014
80	17/03/2018 21:02:42	0.00017	0.00035	0.00013
81	17/03/2018 22:02:42	0.00017	0.00036	0.00013
82	17/03/2018 23:02:42	0.00017	0.00034	0.00013
83	18/03/2018 00:02:42	0.00017	0.00033	0.00014
84	18/03/2018 01:02:42	0.00017	0.00033	0.00014

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85	18/03/2018 02:02:42	0.00017	0.00036	0.00015
86	18/03/2018 03:02:42	0.00017	0.00030	0.00013
87	18/03/2018 04:02:42	0.00017	0.00029	0.00013
88	18/03/2018 05:02:42	0.00017	0.00031	0.00013
89	18/03/2018 06:02:42	0.00017	0.00033	0.00012
90	18/03/2018 07:02:42	0.00017	0.00033	0.00012
91	18/03/2018 08:02:42	0.00017	0.00033	0.00013
92	18/03/2018 09:02:42	0.00017	0.00032	0.00013
93	18/03/2018 10:02:42	0.00016	0.00035	0.00013
94	18/03/2018 11:02:42	0.00016	0.00032	0.00013
95	18/03/2018 12:02:42	0.00017	0.00029	0.00013
96	18/03/2018 13:02:42	0.00017	0.00032	0.00013
97	18/03/2018 14:02:42	0.00017	0.00031	0.00013
98	18/03/2018 15:02:42	0.00017	0.00032	0.00013
99	18/03/2018 16:02:42	0.00017	0.00028	0.00013
100	18/03/2018 17:02:42	0.00018	0.00031	0.00013
101	18/03/2018 18:02:42	0.00017	0.00031	0.00013
102	18/03/2018 19:02:42	0.00017	0.00035	0.00013
103	18/03/2018 20:02:42	0.00017	0.00025	0.00013
104	18/03/2018 21:02:42	0.00017	0.00028	0.00013
105	18/03/2018 22:02:42	0.00017	0.00035	0.00013
106	18/03/2018 23:02:42	0.00017	0.00034	0.00013
107	19/03/2018 00:02:42	0.00017	0.00032	0.00013
108	19/03/2018 01:02:42	0.00017	0.00034	0.00012
109	19/03/2018 02:02:42	0.00017	0.00034	0.00012
110	19/03/2018 03:02:42	0.00017	0.00036	0.00012
111	19/03/2018 04:02:42	0.00017	0.00036	0.00012
112	19/03/2018 05:02:42	0.00016	0.00034	0.00013
113	19/03/2018 06:02:42	0.00017	0.00032	0.00013
114	19/03/2018 07:02:42	0.00017	0.00032	0.00013
115	19/03/2018 08:02:42	0.00017	0.00030	0.00014
116	19/03/2018 09:02:42	0.00017	0.00033	0.00014
117	19/03/2018 10:02:42	0.00017	0.00032	0.00014