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Squire and Partners

Twyman House, London NW1

Acoustic Report

By Sandy Brown Associates

For CIT Developments Ltd

10003

April 2011

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10342/ DR
18 April 2011

Twyman House

Acoustic report (Rev 03)

1 Introduction

Sandy Brown Associates LLP (SBA) has been appointed to provide acoustic advice relating to the proposed development at Twyman House, London, NW1. The mixed-use development comprises of residential units above commercial spaces.

This report presents the results of environmental noise surveys carried out at the site in April 2008 and November 2010.

The survey results have been used as the basis for:

- a PPG24 assessment, to evaluate the suitability of the site for residential development based on existing noise levels in the area;
- setting limits for noise emission from any building services plant associated with the proposed development; and
- a preliminary facade sound insulation assessment, to give an indication of the performance required to achieve appropriate internal noise levels.

2 The site and its surroundings

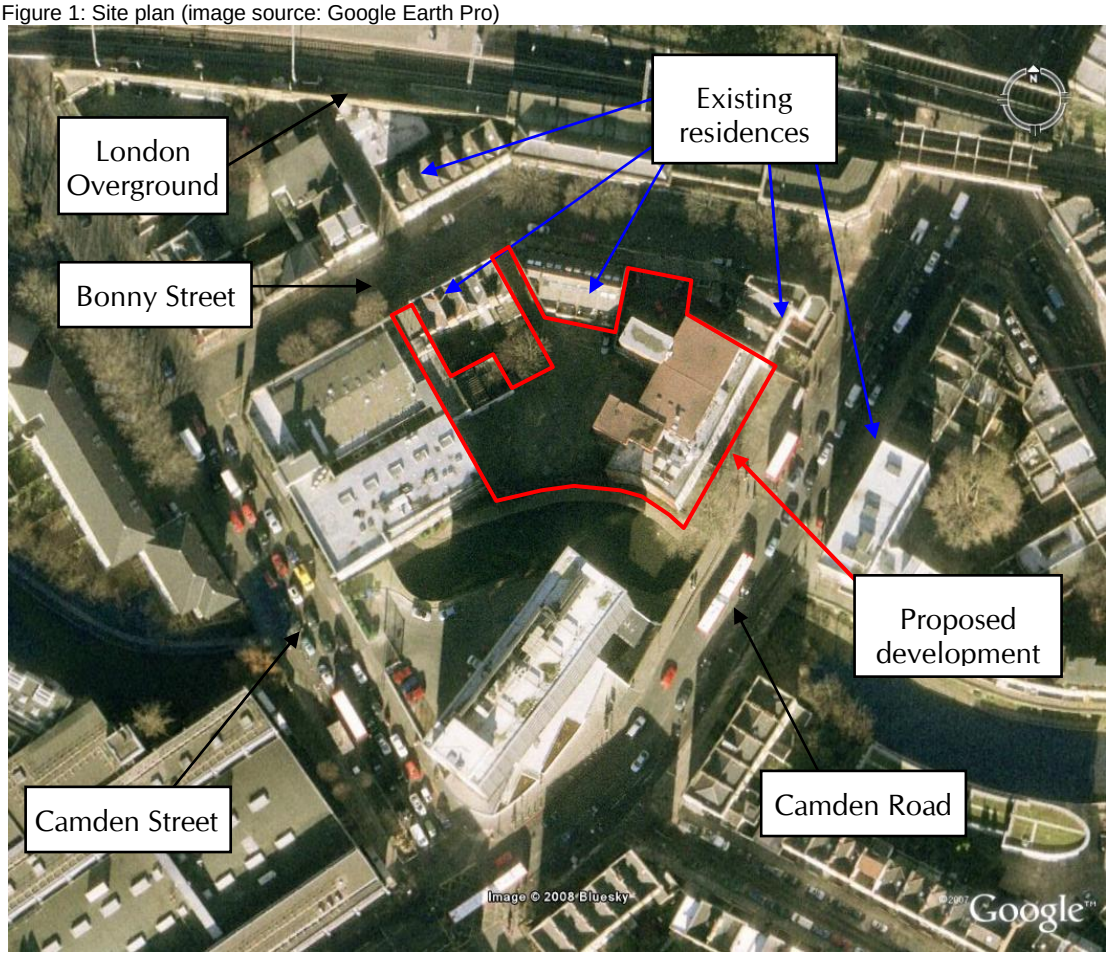
2.1 Site description

The site is located off of Camden Road (to the east) and bounded by Bonny Street (to the north) and Regent's Canal (to the south). Camden Street is to the west, although an existing building shields most of the lower levels from this road.

Camden Road and Camden Street are busy main roads, with several bus routes. Bonny Street is a significantly quieter road, mainly used for access to the current site and nearby residential properties located north of the site.

Figure 1 shows the site location in relation to the surrounding area.

Figure 1: Site plan (image source: Google Earth Pro)



2.2 Adjacent premises

The south of the site is bound by Regent Canal. Across from this is Shirley House, occupied by the British Transport Police which is accessed regularly via Camden Street.

There are a number of existing residences surrounding the site. Those on the north boundary of the site are likely to be the most noise sensitive, since they are well sheltered from the main roads. Residential premises are also located on the upper levels of buildings across Camden Road to the east, but are not sheltered from the road.

2.3 Noise sources

During the April 2008 survey the noise climate in the area of the proposed development was dominated by road traffic noise from Camden Road and to a lesser extent, Camden Street. Noise from trains passing on the London Overground line (previously Silverlink railway) and noise from passing aircraft also intermittently impacts on the site.

The noise sources noted during the November 2010 survey were generally the same.

3 Survey method

3.1 Measurements performed

3.1.1 PPG24 noise level logging

To facilitate the PPG24 assessment, noise levels were logged from 10:50 hrs on Wednesday 02 April to 12:05 hrs on Friday 04 April 2008.

The microphone was placed outside of a Level 03 window on the east side of the existing building which stands to the east of the proposed site facing Camden Road. The measurement position was chosen so as to measure the highest noise levels incident on the site, while being a secure location to leave equipment unattended.

The measurement position is indicated as 'L1' in Figure 2 and a photograph is included in Appendix A.

3.1.2 Background noise level logging

For the purposes of determining background noise levels in the area of the existing residences to the rear of the site, continuous noise monitoring was carried out from 12:45 hrs on Friday 04 April to 10:35 hrs on Wednesday 09 April 2008.

The microphone was located out of a Level 02 window on the west side of the existing building which faces the 'courtyard' in the middle of the site. The measurement position was chosen so as to measure noise levels representative of those outside the nearest noise sensitive premises along Bonny Street.

The measurement position is indicated as 'L2' in Figure 2. A photograph of the area is included in Appendix A.

Measurements from position L1 are also used to establish the background noise levels of residences located across Camden Road.

3.1.3 Sample measurements

To assess the variation of noise levels around the site, sample measurements were made at three ground floor level positions on 4 April 2008.

Where appropriate, sample measurements were synchronised with the rooftop noise logging equipment.

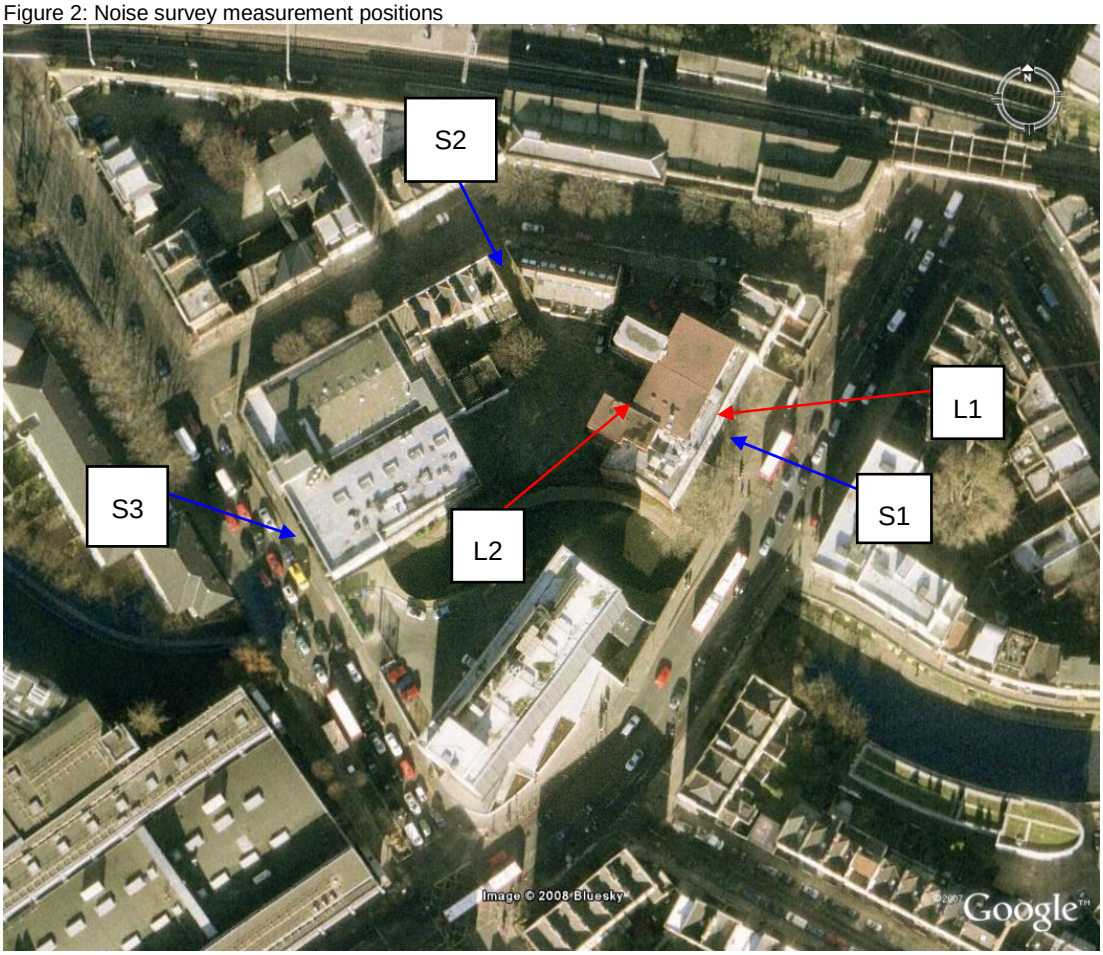
Further measurements were conducted at the same three locations on 25 November 2010 in order to validate the results obtained during the original survey.

The results of the sample measurements are used in the PPG24 and facade sound insulation assessments.

3.2 Measurement positions

The measurement positions used during the survey are indicated in Figure 2.

Figure 2: Noise survey measurement positions



L1 – L2	Noise logging positions
S1 – S3	Ground level sample measurement positions

3.3 Equipment and procedure

A Svantek 949 sound level meter was used to perform the continuous noise logging measurements at position L1 and L2. The April 2008 sample measurements were performed using a Brüel & Kjær 2260 sound level meter. The November 2010 sample measurements were conducted with a Svantek 957 sound level meter.

The meters and their microphones were calibrated at the beginning and end of measurements. No significant calibration deviation occurred.

All sample measurements were made at least 1.5 m from the ground and from any other large acoustically reflective surface.

3.4 Noise indices

3.4.1 Logged data

The equipment was set to record a continuous series of broadband sound pressure levels averaged over five minute periods. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period. Measured using the fast time weighting in accordance with the requirements of BS 8233 : 1999.
- $L_{AF90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background noise level.

The L_{AF90} is considered most representative of the background noise level for the purposes of complying with the Local Authority's requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{AF90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures*.

3.4.2 Sample measurements

Measurements were made in octave bands at all sample measurement positions. Again, a range of noise indices were measured but the L_{Aeq}, L_{AFmax} and L_{AF90} indices are of most interest here. All sample measurements were made over five minute periods.

3.5 Weather conditions

During the initial survey the weather was generally dry during the period over which the survey was carried out, with occasional light showers, and one day of snow fall. Average wind speeds were low. Temperatures ranged from approximately 3°C to 17°C. When the sample measurements were conducted on 25 November 2010, the weather was dry and fine.

Overall, the conditions were considered suitable for obtaining representative noise level measurements.

4 Measurement results

4.1 PPG24 noise level logging

The results of the PPG24 noise level logging at position L1 are shown graphically in Figure B1 in Appendix B and are summarised here.

The overall L_{Aeq} noise levels over the daytime and night-time periods, calculated from the logging results at position L1, are shown in Table 1.

Table 1: Overall daytime and night-time noise levels measured at position L1

Date	Daytime (07:00 – 23:00 hrs) $L_{Aeq,16hr}$	Night-time (23:00 – 07:00 hrs) $L_{Aeq,8hr}$
Wednesday 2 April 2008	71*	69
Thursday 3 April 2008	71	69
Friday 4 April 2008	71*	–
Average	71	69

* Note that these results were not calculated over a full 16 hour daytime period due to the times at which logging started and ended. The daytime level for Wednesday was calculated over the period 10:40 – 23:00 hrs. The daytime level for Friday was calculated over the period 07:00 – 12:05 hrs.

4.2 Maximum night-time noise levels

During the night (23:00 – 07:00 hrs), L_{AFmax} levels recorded at position L1 (overlooking Camden Road) were typically up to 84 dB.

There were isolated events which resulted in L_{AFmax} levels as high as 98 dB, which likely corresponded to passing emergency vehicles. As levels this high occurred only infrequently, they are not considered representative.

4.3 Background noise level logging

The results of the background noise level logging are shown graphically in Figure B2 in Appendix B and are summarised here.

The lowest background noise levels that were measured at position L1 and L2 over the duration of the survey are presented in Table 2.

Table 2: Lowest background noise levels measured at position L1 and L2

Time period	Lowest measured background noise levels ($L_{AF90,5\ min}$ dB)	
	Position L1 (Camden Road)	Position L2 (Courtyard)
Daytime (07:00 – 23:00 hrs)	60	49
Night-time (23:00 – 07:00 hrs)	50	45

4.4 Sample measurements

The average (L_{Aeq}), maximum (L_{AFmax}) and background (L_{AF90}) sound pressure levels measured at the three positions around the site are presented in Table 3.

Table 3: Sample measurement results – 4 April 2008

Measurement position	Start time	A-weighted broadband sound pressure levels (dB)			Significant noise sources / notes
		$L_{Aeq,5\ min}$	$L_{AFmax,5\ min}$	$L_{AF90,5\ min}$	
S1	11:39	71	85	62	Engine noise from busses stopping at nearby bus stop. Conversations from pedestrians.
S1	11:50	71	80	66	Same as above
S1	11:56	71	85	64	Same as above
S2	12:55	60	74	53	Infrequent traffic and sawing noises from nearby workshop.
S2	13:15	60	69	56	Same as above
S3	13:05	70	82	59	Noise from one way traffic, also road is a main bus route.
S3	13:25	70	83	60	Same as above

Table 4: Sample measurement results - 25 November 2010

Measurement position	Start time	A-weighted broadband sound pressure levels (dB)			Significant noise sources / notes
		$L_{Aeq,5\ min}$	$L_{AFmax,5\ min}$	$L_{AF90,5\ min}$	
S1	11:31	72	84	65	Road traffic on Camden Road. Engine noise from busses stopping at nearby bus stop. Conversations from pedestrians.
S1	11:54	69	79	60	Same as above
S1	12:15	71	72	60	Generally same as above. Freight train movement on Overground line also audible
S1	12:26	69	72	60	Same as 11:31 measurement
S2	11:39	59	74	55	Road traffic along Camden Street and Camden Road dominates. Infrequent traffic along Bonny Street. Intermittent noise from a woodchipper (approx. 100 m away) audible.
S2	12:35	64	80	55	Road traffic along Camden Street and Camden Road dominates. Infrequent traffic along Bonny Street including a noisy UPS van and a bin lorry.
S2	12:40	65	81	54	Same as above
S2	12:45	61	72	55	Road traffic along Camden Street and Camden Road dominates. Infrequent traffic along Bonny Street.
S3	11:46	71	81	62	Road traffic along Camden Street dominates. Woodchipper also audible at times.
S3	12:07	72	84	62	Road traffic along Camden Street dominates.

4.5 Comparison of survey data from April 2008 and November 2010

Noise measurements conducted during the November 2010 survey were carried out at the same locations and at approximately the same time as the measurements conducted in April 2008 in order to identify any significant changes in the noise climate at the site.

Comparing the measured L_{Aeq} levels at each position indicates that the difference in noise levels between the two surveys is generally within 2 dB.

The noise measurements conducted at S2 demonstrate a slightly larger variation. The 12:35 and 12:40 measurements conducted during the November 2010 survey were 4-5 dB higher than measurements conducted at a similar time during the April 2008 survey, but this is likely to be due to individual noisy vehicle passes along Bonny Street that did not occur during the initial survey. When such noisy events did not occur, noise levels at this location were in line with what was measured previously.

Based on the above one may assume that the noise climate at the site has not changed significantly since the first survey and hence it can be assumed that the initial survey data is still valid.

5 PPG24 assessment

5.1 Criteria

Planning Policy Guidance Note 24: Planning and Noise (PPG24) gives guidance to local authorities on how to exercise their planning powers so as to minimise the adverse impact of noise. PPG24 defines noise exposure categories (NECs) for dwellings, designed to assist local authorities in their consideration of applications for residential developments near existing transport related noise sources.

A site is categorised into one of four NECs (A, B, C or D) based on overall daytime (07:00 – 23:00 hrs) and night-time (23:00 – 07:00 hrs) noise levels. Recommended noise level limits for each NEC given in PPG24 are reproduced in Table 5. These particular limits apply where road traffic is the dominant noise source, as is the case at Twyman House.

Table 5: PPG24 noise exposure category limits for road traffic

Noise levels corresponding to the noise exposure categories for new dwellings $L_{Aeq,T}$ (dB)				
	Noise Exposure Category (NEC) for road traffic			
	A	B	C	D
07:00 – 23:00	< 55	55 – 63	63 – 72	> 72
23:00 – 07:00 *	< 45	45 – 57	57 – 66	> 66

* Where individual noise events regularly exceed 82 dB L_{Amax} (slow time weighting) several times in any hour, the site should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$ (except where the $L_{Aeq,8h}$ already puts the site in NEC D).

Where there is a clear need for new residential development in a noisy area, the local planning authority may increase the limits for each NEC by up to 3 dB above those shown in Table 5.

5.2 Adjustment of noise levels to account for measurement position

PPG24 requires that noise levels be assessed on an open site at a height of approximately 1.5 metres above ground level. However, for reasons of practicality, the noise logging equipment was located at Level 03, outside of a window (position L1).

The results of synchronised sample measurements performed at position S1 (1.5 metres above ground level) were about 1 dB higher than the corresponding level measured at logging position L1. Therefore, in determining the site's noise exposure category, 1 dB has been added to the overall levels measured at position L2, in order to estimate the corresponding levels at a height of 1.5 metres above ground level.

It is noted that the small difference in noise levels between ground and Level 03 is due to Camden Road being sided by equally tall buldings. Noise from major sources are reflected between the buildings causing a 'canyon effect,' resulting in a louder environment than if the road was only developed on one side.

5.3 PPG24 noise exposure category

The free-field noise levels at the most exposed elevation are around $L_{Aeq,16hr}$ 72 dB (daytime) and $L_{Aeq,8hr}$ 70 dB (night-time). The dominant noise source is road traffic. This places the site in NEC C during the daytime and NEC D during the night-time.

PPG24 requires that a site be treated as being in at least NEC C if individual night-time noise events regularly exceed L_{ASmax} 82 dB several times in any hour. As the site is already classified in NEC D based on overall noise levels, maximum noise levels do not affect the PPG24 classification. However, night-time maximum noise levels are significant at the site and will be considered when determining facade sound insulation requirements.

5.4 Discussion

For sites which fall into NEC D, PPG24 recommends that planning permission should normally be refused. However, it is not uncommon for a site in central London facing on to a main road to be in this category.

The PPG24 classification is a site-wide assessment, and it is required to base the assessment on noise levels at the noisiest site boundary. The PPG24 classification therefore does not take into account the fact that noise levels will be lower towards the rear of the site, due to increased distance and screening from the main roads.

It is important to note that the rationale behind PPG24 is to ensure that noise levels within new dwellings will be acceptable. External noise levels at the site are such that it will be possible, with appropriate facade sound insulation and ventilation strategy, to achieve internal noise levels in line with published guidance. The required level of facade sound insulation performance is discussed below.

6 Environmental noise limits for building services plant

6.1 Summary

The proposed development will incorporate some new items of mechanical services plant, the majority of which is to be located within the building at lower ground level served by grilles in the floor on the Camden Road elevation.

Environmental noise limits are set in order to protect the amenity of nearby noise sensitive premises from the proposed plant installation. As discussed in Section 2.2, the nearest noise sensitive receptors have been identified as the existing residences to the north of the site on Bonny Street and the upper level of the buildings on the east side of Camden Road.

6.2 Criteria

The London Borough of Camden's Local Development Policy DP28 contains the following guidance regarding noise emission from mechanical services plant. The criteria is based on the guidance in *BS4142:1997 – Method for rating noise affecting mixed residential and industrial areas*.

Table 6 - Plant noise criteria from DP28

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive facade	Day, evening and night	00:00 – 24:00	5 dB (A) < L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a noise sensitive facade	Day, evening and night	00:00 – 24:00	10 dB (A) < L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a noise sensitive facade	Day, evening and night	00:00 – 24:00	10 dB (A) < L_{A90}
Noise at 1 metre external to sensitive facade where L_{A90} > 60 dB	Day, evening and night	00:00 – 24:00	55 dB L_{Aeq}

6.3 Noise criteria

The appropriate criteria for maximum noise levels from plant have been determined in accordance with the criteria given in section 6.2.

In accordance with Local Authority requirements, criteria for plant noise from the development are presented in Table 7 for the noise sensitive receptors on Bonny Street and Camden Road. These are based upon the lowest measured background noise levels at logging positions “L2” and “L1" respectively.

Table 7: Cumulative plant noise limit at 1m from facade of nearest residence

Time period	Maximum sound pressure level Bonny Street receptors $L_{Aeq,5\ min}$ dB	Maximum sound pressure level Camden Road receptors $L_{Aeq,5\ min}$ dB
Daytime (07:00 – 23:00 hrs)	44	55
Night-time (23:00 – 07:00 hrs)	40	45

If the plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit 5 dB below those set out in Table 7.

In addition to the requirements of the Local Authority set out in Table 7, the plant will also need to be designed to achieve L_{Aeq} 50 dB at 1 m from the floor grilles on Camden Road to ensure that plant noise ingress into the residential units of Twyman House itself is not excessive. Achieving this criteria will also ensure that the Local Authority requirements at the nearby noise sensitive premises are met.

Once details of the proposed plant are available, noise levels will need to be assessed to ensure that the environmental noise limits will not be exceeded.

7 Internal noise criteria

7.1 Criteria for residential units

Guidance on acceptable internal noise levels for residences is given in BS8233:1999 *Sound insulation and noise reduction for buildings – Code of practice*, and the World Health Organisations *Guidelines for community noise*. The relevant guidance given by these documents is shown in Table 8.

Table 8: Internal noise criteria given by BS8233 and WHO

Internal space	Design range, L_{Aeq} (dB)		
	BS8233 "Reasonable"[1]	BS8233 "Good"[1]	WHO
Living rooms	40	30	35[2]
Bedrooms[3]	35	30	30[2]

[1]The design range given in BS8233 refers to criterion for "reasonable resting/sleeping conditions" in both living rooms and bedrooms. No time periods are specified.

[2]WHO recommends L_{Aeq} 35 dB in relation to speech intelligibility and 30 dB L_{Aeq} in relation to sleep disturbance, broadly presumed to be for living rooms and bedrooms, respectively. WHO provides a 16 hour time base when referring to speech intelligibility and an 8 hour time base when referring to sleep disturbance.

[3]BS8233 indicates that individual noise events should not normally exceed L_{AFmax} 45 dB during night time, which is also suggested in the guidance given by the WHO.

The assessment that follows is based on achieving the 'reasonable' standards for internal noise criteria specified within the BS8233 document.

7.2 Criteria for commercial units

Internal noise level criteria for retail units depend mainly on its use. Guidance from BS8233 would be to meet an internal noise level of L_{Aeq} 50 dB for retail stores, with lower noise levels desirable for office units. However, it is understood that the new commercial units are unlikely to be offices, and as such the facade will be designed to achieve L_{Aeq} 50 dB internally.

It is further noted that levels of internal noise in retail units could be significant, in which case the required facade sound insulation can also be driven by the requirement to control noise breakout in order to meet environmental noise break-out criteria. Concurrently, noise levels affecting new residential units above should also be considered.

8 Preliminary facade sound insulation assessment

8.1 Introduction

This section presents an initial assessment of the required sound insulation on residential and commercial facades of the proposed development to achieve acceptable internal noise levels. The assessment has been based on the currently available information, and should be reviewed and revised as the design progresses.

8.2 External noise levels

Road noise levels on Camden Road as established from sample measurements and logging measurements are L_{Aeq} 73 dB in the day and L_{Aeq} 70 dB at night.

Noise levels affecting the courtyard are lower due to screening from the surrounding buildings and were measured to be L_{Aeq} 58 dB in the daytime and L_{Aeq} 56 dB in the night-time. Typically during the night time, L_{AFmax} noise levels up to around 75 dB were measured.

8.3 Preliminary facade sound insulation requirements – residential

8.3.1 Facade sound insulation requirements

Based on the external noise levels measured around the site, preliminary guidance on the sound insulation required for the residential units is given in Table 9 and is indicated in Figure 3 overleaf.

The facade sound insulation requirements for the retail units is discussed below in Section 8.4.

Table 9: Preliminary facade sound insulation requirements

Facades	Colour (see Fig. 3)	Required minimum facade sound insulation ($R_w + C_{tr}$ dB) Residential
East (Camden Rd)		38
North East		35
South		33
North (Courtyard)		30

Maximum noise levels during the night-time hours have been considered and are approximately L_{AFmax} 84 dB. The recommended noise limit of L_{AFmax} 45 dB should be achievable with the above specifications. Occasional events may result in higher noise levels, but would not be considered representative of typical conditions.

The above residential specifications apply to both living rooms and bedrooms. The sound insulation requirements must be achieved by all of the building elements in combination.

Figure 3: Site plan indicating facade sound insulation requirements

8.3.2 Implications for glazing specification

Typical glazing configurations suitable for achieving various overall facade sound insulation performances are given in Table 10. These example glazing configurations are given as guidance only. The actual sound insulation performance of a proposed glazing system should be verified with the glazing supplier.

Table 10: Typical glazing configurations

Required overall facade sound insulation $R_w + C_{tr}$ (dB)	Example glazing configuration
Up to 28	6 mm glass / 12 mm cavity / 6 mm glass
29 – 31	10 mm glass / 12 mm cavity / 4 mm glass
32 – 34	10 mm glass / 12 mm cavity / 6 mm glass
35 – 36	6.4 mm acoustic laminate / 12 mm cavity / 10 mm glass
37 – 38	9 mm acoustic laminate / 12 mm cavity / 10 mm glass

8.3.3 Ventilation strategy

The levels of facade sound insulation required to achieve appropriate internal noise levels dictate that a ventilation strategy must be designed capable of providing sufficient fresh air with windows closed.

It is understood that each dwelling will incorporate a whole house ventilation system, and the system will be designed to ensure that noise break-in via the atmosphere side connections will not result in an exceedance of the target internal noise criteria.

8.4 Retail units

8.4.1 Facade sound insulation requirements

The internal noise level criterion relating to environmental noise break-in is L_{Aeq} 50 dB (section 7.2). As discussed, consideration is also given to noise break-out from the retail spaces affecting residential receptors.

Owing to the variable nature of the possible operations encompassed by the use class of the retail units (A1 – A3), it is not possible to accurately predict the resulting internal noise levels that could occur.

As a consequence, a reasonable worst case facade sound insulation requirement for all possible operations has been established based on the following factors:

- Achieving an internal noise level below L_{Aeq} 50 dB;
- Setting a maximum internal noise limit that is reasonably indicative of the majority of operations encompassed by the various use classes;
- The worst case noise break-out path between development facade and the nearest residential premises (the residences directly above and across Camden Road).

In assessing these factors, the facade sound insulation requirement and associated maximum internal noise levels for the retail units are given in Table 11. Day and night time maximum noise levels are provided to facilitate the possibility of night time operations.

Table 11: Retail facade sound insulation requirements and maximum internal noise levels

Period	Maximum internal noise level ($L_{Aeq,T}$ dB)	Required minimum facade sound insulation ($R_w + C_{tr}$ dB)
Daytime (07:00 – 23:00)	85	26
Night-time (23:00 – 07:00)	75	26

It is noted that these maximum internal noise levels are relatively high. The sound insulation performance within the building should be carefully considered and designed so that disturbance to the adjacent residential units is prevented.

8.4.2 Mitigation measures

Meeting the required environmental criteria is based on ensuring internal noise levels within the retail units do not exceed the maximum levels presented. In practice, this is difficult to regulate but it is reasonable to expect that noise generated by the various operations associated with use classes A1 (shops), A2 (office) and A3 (restaurant/café), would not normally exceed the maximum internal noise levels presented.

It is recommended that the nature of potential operations is considered and probable noise levels evaluated prior to letting out the retail units. If it is likely that noise levels will be at or exceed the noise levels presented, then additional forms of sound attenuation must be implemented as part of the tenant's fit-out works.

9 Summary

Sandy Brown Associates LLP carried out a noise survey at the site of Twyman House in April 2008. Further measurements were conducted at the site to validate the initial survey data in November 2010.

The survey results have been used as the basis for a PPG24 assessment, a preliminary facade sound insulation assessment, and for a discussion regarding limits for noise emission from new building services plant. The key results are summarised below.

9.1 PPG24 assessment

Measured overall daytime and night-time noise levels place the site in noise exposure category D (NEC D). This is not uncommon for a site in central London which faces onto a main road.

9.2 Building services plant noise limits

The nearest noise sensitive premises have been identified and background noise levels measured in a representative position.

Noise limits for emissions from permanent items of plant have been set based on Local Authority guidance, as well as mitigating noise break-in to Twyman House itself.

As details of the proposed plant become available, noise levels should be assessed and, if necessary, appropriate noise mitigation measures specified.

9.3 Preliminary facade sound insulation assessment

Preliminary facade sound insulation requirements for residential units have been determined based on meeting the BS 8233 'reasonable' criteria for internal noise levels.

Façade requirements for the commercial units have also been assessed and discussed.

It is not yet known whether any planning condition will be applied requiring the development to be designed to meet specific internal noise level targets.

Appendix A

Survey photographs

Figure A1 Measurement position L1 for PPG24 noise level logging
(looking east from Level 03 window of existing building)

Figure A2 Measurement position L2 for background noise level logging
(looking west towards centre of site)

Appendix B

Graphs of noise level logging survey results

Figure B1 Results of noise level logging survey at position L1

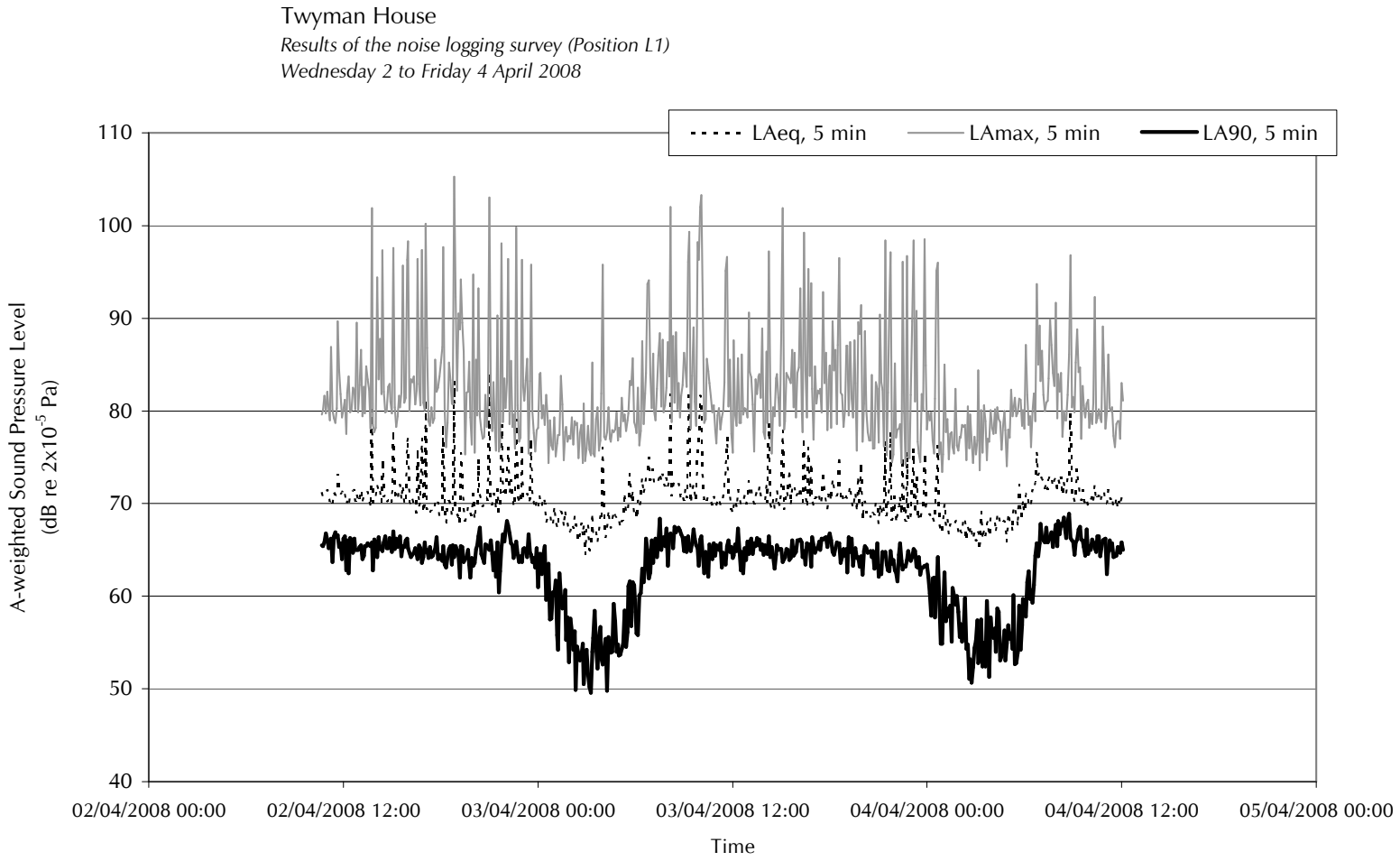


Figure B2 Results of noise level logging survey at position L2