CENTRE POINT

PLANNING NOISE AND VIBRATION REPORT

11301-R01

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Version	Date	Comments	Author	Reviewer
A	6 February 12		Alba Losada-Amor	Bob Albon
B	10 February 12		Alba Losada-Amor	Bob Albon
C	18 May 12		Alba Losada-Amor	Bob Albon
D	28 May 12	Incorporating comments	Alba Losada-Amor	Bob Albon
E	22 March 13	Revise to incorporate Application 1A and 1B	Alba Losada-Amor	Jason Swan
F	27 March 13	Version E incorporating comments	Alba Losada-Amor	Jason Swan

1 Summary

1.0 Sandy Brown Associates LLP (SBA) has been appointed to carry out an environmental noise and vibration survey at Centre Point, London, in support of a planning application for the development of the site as described in chapter 5 of the Environmental Statement. The noise survey data has been used to determine appropriate plant noise limits in line with the requirements of LBC, assess the suitability of the site and perform a facade sound insulation assessment. The vibration survey data has been used to assess the impact of tactile vibration and ground-borne noise on the development.

1.1 The noise survey was performed between 19 January 2012 and 25 January 2012.

1.2 The lowest background noise levels measured during the survey at the nearest noise sensitive premise were $L_{A90,15min}$ 54 dB during the daytime and evening, and $L_{A90,15min}$ 53 dB at night.

1.3 Based on the requirements of LBC and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from any nearby noise sensitive premises identified does not exceed L_{Aeq} 49 dB during the daytime and L_{Aeq} 48 dB during the night.

1.4 The free field average ambient noise levels measured during the survey were $L_{Aeq,12h}$ 68 dB during the daytime, $L_{Aeq,4h}$ 58 dB during the evening and $L_{Aeq,8h}$ 66 dB at night for the measurement position adjacent to Centre Point Tower.

1.5 The National Planning Policy Framework (NPPF) requires that planning policy mitigates and minimises adverse impacts on health and quality of life arising from noise from a new development.

1.6 LBC requires residential developments to be assessed against noise criteria derived from PPG24 to assess the suitability of the site. While NPPF has replaced PPG24, a technical assessment in accordance with the principles of PPG24 is considered an appropriate method of satisfying the NPPF requirement. A PPG24 assessment has been carried out for Centre Point Tower based on the ambient noise levels measured during the survey. Comparison with the requirements of LBC indicates that attenuation measures will be required to provide suitable internal noise levels.

1.7 The PPG24 assessment indicates that Centre Point Tower and the proposed affordable housing block falls into Noise Exposure Category (NEC) C. PPG24 gives the following guidance for sites which fall into NEC 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.'*

1.8 It is not uncommon for developments within London to fall within Noise Exposure Categories C or D. Suitable internal noise levels can be achieved provided suitable attenuation measures incorporated into the façade and ventilation design.

1.9 As the residential premises in Centre Point House are existing it is not considered that an assessment of site suitability is applicable. However, a facade sound insulation assessment has been carried out for both Centre Point House and Tower in order to achieve the internal noise levels determined for the project from BS 82333.

1.10 A facade sound insulation assessment has been carried out based on the expected noise levels around the completed development to determine the required acoustic performance of the residential facades. The expected noise levels have been derived from a computer model and account for road traffic noise on the basis of the results of the noise survey and future traffic flows.

1.11 Internal noise levels have been derived from BS 8233 and adopted for use in the proposed residential premises in Centre Point Tower and the proposed affordable housing block.

1.12 For Centre Point Tower, the internal criteria can be achieved using glazing with minimum sound insulation performances between $R_w + C_{tr}$ 36 and 44 dB for levels 3 to 14, $R_w + C_{tr}$ 30 and 40 dB for levels 15 to 22, $R_w + C_{tr}$ 28 and 38 dB for levels 23 to 28, $R_w + C_{tr}$ 28 and 37 dB for levels 29 to 32, $R_w + C_{tr}$ 34 and 38 dB for levels 33 to 34. Mechanical ventilation is to be provided to eliminate noise ingress via ventilation openings in the façade and the reliance on openable windows for ventilation.

1.13 For the proposed affordable housing block, the internal criteria required by BS 8233 can be achieved using glazing with minimum sound insulation performances of $R_w + C_{tr}$ 44 and 39 dB for the two applications proposed. Mechanical ventilation is to be provided to eliminate noise ingress via ventilation openings in the façade and the reliance on openable windows for ventilation.

1.14 The replacement facade to Centre Point House needs to resist the passage of noise. The internal noise levels required by BS 8233 for Centre Point House can be achieved using glazing with minimum sound insulation performances between $R_w + C_{tr}$ 29 and 44 dB. As the replacement facade for Centre Point House will not be mechanically ventilated the facade needs to incorporate acoustic ventilators. The required performance for the acoustic ventilators to each room varies between $D_{n,e,w} + C_{tr}$ 39 and 48 dB.

1.15 A vibration survey was performed on 01 February 2012. The assessed tactile vibration levels based on the site measurements, expressed as vibration dose values, are significantly lower than the threshold of the 'Low probability of adverse comment' category from BS6472 during the daytime and night period.

1.16 The highest noise level predicted from a passing underground train is L_{ASmax} 31 dB on the lowest level of residential premises on level 3 of the Centre Point Tower. This complies with published guidelines and the requirements of LBC.

Contents

2 Introduction

2.1 Sandy Brown Associates LLP (SBA) has been commissioned to undertake planning assessment for the proposed Centre Point development.

2.2 Centre Point Tower will be refurbished and changed from office use to residential. Centre Point Link will be refurbished and will undergo a change of use from office to retail with the retail offer linked to the retail use on the lower floors of Centre Point House (basement, ground and mezzanine levels). The residential units within Centre Point House are to be refurbished as is the retail use on the lower floors. The existing office use with Centre Point House will no longer remain.

2.3 The Public House located to the south of Centre Point House will be demolished and a new affordable housing block is to be constructed. There are two applications proposed for the new Affordable Housing Scheme. Application 1A will comprise a mix of 13 apartment units. Application 1B will comprise 16 apartment units. Retail space is proposed to be provided at ground floor level for both options.

2.4 An environmental noise survey has been performed to establish the existing ambient and background noise levels in the vicinity of nearby noise sensitive premises. Measurements of ground-borne vibration from underground trains have also been performed.

2.5 The background noise levels measured during the survey will be used as the basis for setting limits for noise emission from proposed building services plant. These limits will be set in accordance with the requirements of LBC. The ambient noise levels measured will be used to perform an assessment in line with LBC Development Policy DP28, to evaluate the suitability of the site of Centre Point Tower for residential development.

2.6 The facade sound insulation will be assessed in order to determine the necessary performance required to achieve appropriate internal noise levels for residences set in accordance with BS 8233:1999 '*Sound insulation and noise reduction for buildings – Code of Practice'*, World Health Organisation and LBC guidelines.

2.7 A vibration survey has been performed with the objective of assessing the degree to which the Proposed Development will be affected by tactile vibration (with reference to BS 6472:2008 '*Evaluation of Human Exposure to Vibration in Buildings – Part 1: Vibration from sources other than blasting'*) and structure-borne re-radiated noise from the London Underground Central and Northern Line train movements.

2.8 This report presents the noise and vibration survey methods, the results of the surveys, a discussion of acceptable limits for noise emission from building services plant and façade sound insulation requirements for the residential areas of Centre Point Tower, Centre Point House and the proposed affordable housing block. An assessment of tactile vibration and ground-borne noise levels is also provided. Noise from future train movements associated with Crossrail are also considered.

3 Site description

3.1 The site and its surroundings

3.1.1 The site location is shown bounded in orange in relation to its surroundings in Figure 1. The site is composed of a tower of 34 floors (shown in grey), a building of 10 floors (shown in blue) with a bridge section between these two, and a pub to the south of the 10 storey building (shown in yellow).

3.1.2 There are a number of busy roads around the site. New Oxford Street to the north, Charing Cross Road to the west, St. Giles High Street to the south and Earnshaw Street to the east.

3.1.3 The London Underground Central Line runs underneath the site from west to east and vice versa, and the London Underground Northern Line runs to the west of the site from north to south and vice versa. Northern Line running tunnels are located at a deeper level position than Central Line running tunnels. Figure 1 also shows the approximate location of the Underground Central Line (in red) and Northern Line (in black) in relation to the site.

3.1.4 New train running tunnels associated with the Crossrail development are to be located to the south of the site.

3.1.5 The logging and sample measurement locations used during the environmental noise survey are indicated in Figure 1. The locations of the unattended measurements are indicated as positions L1 and L2 in red. The locations of the attended measurements are indicated as positions 1 to 8 in black.

3.1.6 As a result of Crossrail construction work site (hatched in Figure 1), there is currently no traffic between Charing Cross Road to St Giles Circus. This traffic is diverted towards Andrew Borde St and continues through St. Giles High St under the bridge section.

3.1.7 The measurements locations used during the vibration survey are indicated in Figure 1 as positions A and B.

3.2 Adjacent premises

3.2.1 The nearest noise sensitive premises to Centre Point Tower and the proposed affordable housing block are the residences to the east of the site (Matilda apartments) in the St Giles Central development and to the south of the site (St Giles High Street and Denmark Place). These are indicated in green in Figure 1.

3.2.2 Centre Point House is also considered as sensitive premises located to the east of Centre Point Tower and to the north of the proposed affordable housing block.

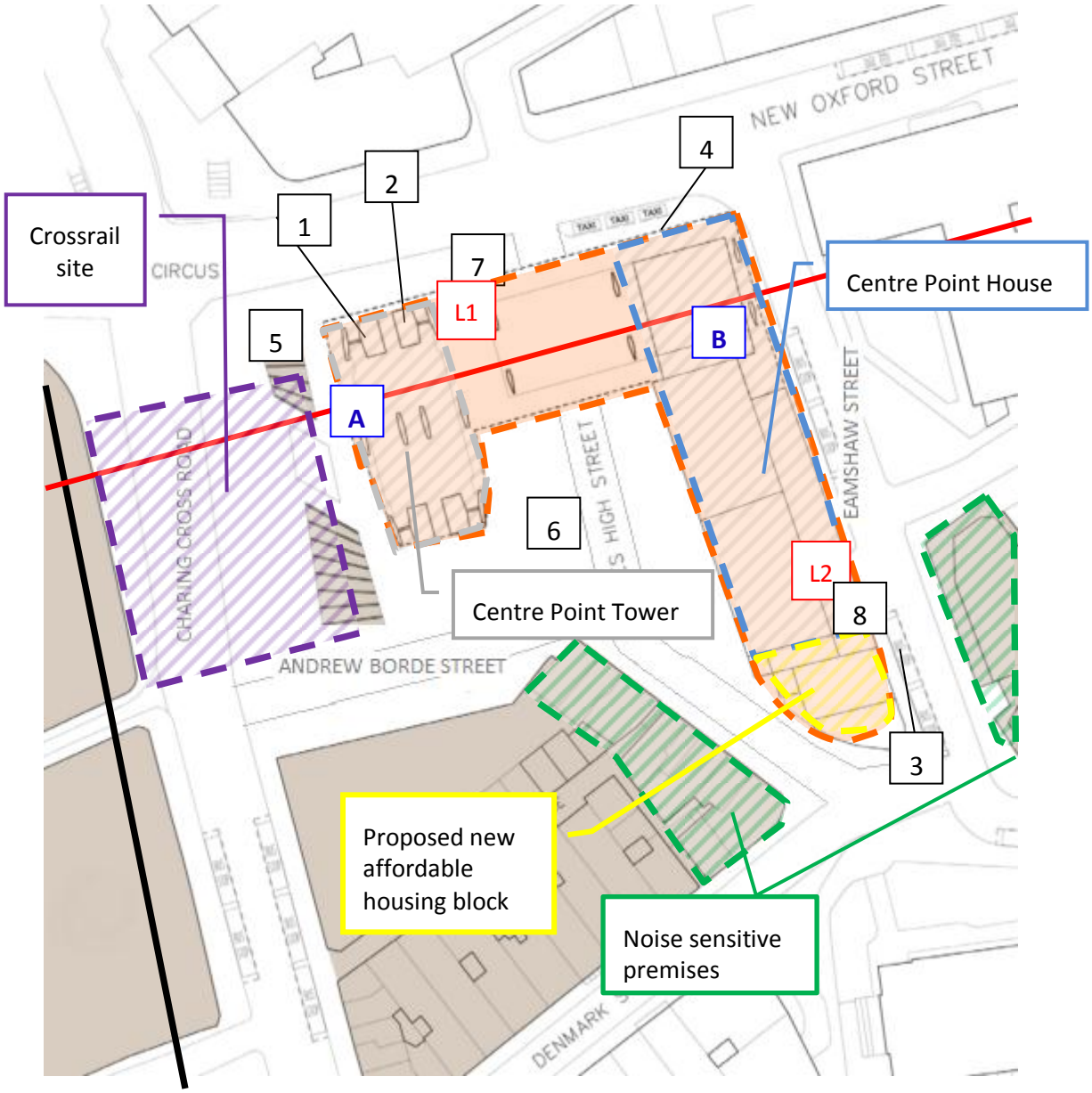


Figure 1 Plan showing the site location

4 Proposals

4.1 The Proposed Development includes the conversion of the third floor of Centre Point Tower and above from commercial to residential premises and redevelopment of the lower floors to provide residential amenity and entrance spaces.

4.2 The lower floors of Centre Point House and Centre Point Link are proposed to be refurbished for commercial use, primarily mixed retail use (A1/A3/A4). New cladding is to be provided to the lower floors of Centre Point House. New windows are to be provided to the existing residential portion of Centre Point House, in addition to limited refurbishment works including the provision of new lifts and decoration of common areas.

4.3 It is also proposed to demolish the Public House located to the south of Centre Point House and build a new affordable housing block. There are two applications proposed for the new Affordable Housing Scheme. Application 1A will comprise a mix of 13 apartment units. Application 1B will comprise 16 apartment units. Retail space is proposed to be provided at ground floor level for both options.

5 Noise and vibration survey method

5.0.1 Measurements have been performed of the existing noise and vibration levels experienced at the site in order to assess its suitability for development and inform the design to ensure that appropriate acoustic conditions are provided. The survey methods are provided below.

5.1 Noise survey

5.1.1 *Unattended measurements*

5.1.1.1 A six day continuous noise unattended survey was undertaken at the site to establish the existing noise climate and allow determination of the existing background noise levels in the vicinity of nearby noise sensitive premises.

5.1.1.2 The unattended measurements were performed over 15 minute periods using two different sound level meters between 19 January 2012 and 25 January 2012.

5.1.1.3 The unattended noise measurement positions used during the survey are indicated in Figure 1, denoted by the letters L1 and L2 in red.

5.1.1.4 The microphone located at L1 was positioned on the roof of the bridge section, adjacent to Centre Point Tower, approximately 12 m above ground floor and 1.8 m above the roof level. The microphone located at L2 was positioned on the roof at level 2 of Centre Point House at approximately 12 m above ground floor and 1.8 m above roof level. Location L2 is considered representative of the noise level experienced at the adjacent residential premises. Photographs showing the unattended measurement location are provided in Appendix C.

5.1.2 *Attended measurements*

5.1.2.1 Attended sample measurements were performed at a number of different locations around the site. These are indicated in Figure 1 as positions 1 to 8. The attended measurements were carried out on 19 January 2012 and 25 January 2012, over 5 minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

5.1.2.2 The locations of the attended measurements are described below:

1 Microphone on a pole out from a window at 1 m from Centre Point Tower facade and approximately 57 m from ground level;

2 Microphone on a pole out from a window at 1 m from Centre Point Tower facade and approximately 9 m from ground level;

3 Microphone mounted on a tripod approximately 1.5 m above ground level and 1 m from Centre Point House facade;

4, 5, 6 Microphone mounted on a tripod under the bridge section approximately 1.5 m above ground level and at least 3 m from any other reflective surface;

7 Microphone mounted on a tripod approximately 1.5 m above Centre Point Link roof level, 12 m above ground level and 1 m from Centre Point Tower facade;

8 Microphone mounted on a tripod approximately 1.5 m above Centre Point House roof level, 12 m above ground level and more than 3 m from any other reflective surface.

5.2 Vibration survey method

5.2.1 Vibration measurements were performed at two different locations within Centre Point Tower and House basements in order to determine the vibration levels from the passage of underground trains beneath and adjacent to the site. The different vibration measurement locations are indicated in Figure 1 as positions A and B.

5.2.2 For the vibration measurements, two accelerometers were set up, one to measure vibration dose values (VDV) and one for 1/3 octave band slow weighted RMS acceleration. The VDV measurements were taken to establish levels of tactile vibration while the 1/3 octave band slow weighted maximum RMS acceleration measurements were used for purposes of ground-borne re-radiated noise prediction.

5.2.3 These measurements were performed on 01 February 2012.

5.2.4 Position A was located on the floor of the sub-basement of the Centre Point Tower. The measurements at position B was performed on the floor of a store room within a car park located in the sub-basement of the Centre Point House. Figure 2 shows a photo of the vibration measurement location A.

5.2.5 The vibration measurements performed at location A are considered to be most representative of the vibration levels incident on the structure of the building common to Centre Point Tower with the potential to affect the residential premises above.

5.2.6 It was also possible to measure re-radiated noise levels directly at position A. However, this was not possible at position B because the noise climate was dominated by plant noise.

Figure 2 Vibration measurement equipment at position A

5.3 Equipment and procedure

5.3.1 Larson Davis 820 and Svantek 957 sound level meters were used to undertake the unattended noise measurements. The attended noise measurements were carried out using a Brüel and Kjær 2260 sound level meter.

5.3.2 The VDV and 1/3 octave band RMS acceleration measurements were carried out using an Svantek Type 948 vibration level meter and a Brüel & Kjær 2260 sound level meter, respectively.

5.3.3 Calibration details of the equipment used during the noise and vibration surveys are provided in Appendix E of this report.

5.3.4 Calibration of the sound and vibration level meters used for the measurements is traceable to national standards. The sound and vibration level meters and the respective measurement chains were calibrated at the beginning and end of the measurements using their respective sound level and vibration calibrators. No significant calibration deviation occurred.

5.4 Vibration measurement mountings

5.4.1 The accelerometers were fixed to the floor using beeswax, away from the boundaries of the room.

5.4.2 The VDV measurements were conducted in three axes as follows:

- X axis - Horizontal vibration approximately parallel to the Northern Line railway tracks (North to South);
- Y axis - Horizontal vibration approximately parallel to the Central Line railway tracks (West to East);
- Z axis - Vertical vibration.

5.4.3 The RMS acceleration measurements were performed in the vertical axis only.

5.5 Noise and vibration indices

5.5.1 *Noise indices*

5.5.1.1 The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{Amax,T}$ The A-weighted maximum sound pressure level that occurred during a given period. Measured using the fast and slow time weightings in accordance with the requirements of BS 8233 and PPG24.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background noise level.

5.5.1.2 The L_{A90} is considered most representative of the background noise level for the purposes of complying with LBC requirements.

5.5.1.3 Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

5.5.1.4 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.

5.5.2 *Vibration indices*

5.5.2.1 For each measurement period a number of parameters were recorded. The most relevant of these are described below:

- The vibration dose value (VDV) in each of three axes with the appropriate frequency weightings (as defined in BS 6472-1:2008);
- The maximum RMS acceleration levels in each of three axes in one-third-octave bands, measured using the slow exponential time weighting.

5.6 Weather Conditions

5.6.1 During the attended measurements carried out on 19 January 2012 and 25 January 2012, the weather was generally clear and dry and no rain occurred. Wind speeds varied between 4 m/s and 6 m/s.

5.6.2 During the unattended noise measurements between 19 January 2012 and 25 January 2012, weather reports for the area indicated that temperatures varied between 1 °C at night and 13 °C during the day, and the wind speed was generally less than 6 m/s. Rain showers occurred on two of the days whilst the others stayed dry.

5.6.3 These weather conditions are considered suitable to obtain a sample of representative measurements.

6 Measurement results

6.0.1 The results of the noise and vibration measurements undertaken at the existing site are presented below.

6.1 Observations

6.1.1 The dominant noise source observed at Centre Point during the survey consisted of busy traffic including a high proportion of buses.

6.1.2 Less significant noise sources included pedestrians and construction works.

6.2 Noise measurements results (existing condition)

6.2.1 *Unattended measurement results*

6.2.1.1 The results of the unattended noise measurements performed at Centre Point are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix D of this report.

6.2.1.2 The daytime, evening and night time ambient noise levels measured during the unattended survey are presented in Table 1 at logger position L1, 1 m from the façade of Centre Point Tower.

Table 1 Ambient noise levels measured during the survey at logger position L1

Date	Daytime (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 19/01/2012	-	70	69
Friday 20/01/2012	73	72	71
Saturday 21/01/2012	71	70	70
Sunday 22/01/2012	69	69	67
Monday 23/01/2012	71	71	68
Tuesday 24/01/2012	73	71	68

6.2.1.3 The minimum background noise levels measured during the unattended survey are given in Table 2 at logger position L1.

Table 2 Minimum background noise levels measured during the survey at logger position L1

Date	Daytime (07:00 – 19:00) $L_{A90,15min}$ (dB)	Evening (19:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Thursday 19/01/2012	66 *	64	61
Friday 20/01/2012	65	64	60
Saturday 21/01/2012	62	64	59
Sunday 22/01/2012	59	61	60
Monday 23/01/2012	65	63	60
Tuesday 24/01/2012	65	64	61
Wednesday 25/01/2012	66 *	-	-

* Measurement not made over full period due to logger start and end time.

6.2.1.4 The lowest background noise level measured during the survey was $L_{A90,15min}$ 59 dB during the daytime, $L_{A90,15min}$ 61 dB during the evening and $L_{A90,15min}$ 59 dB at night at logger position L1.

6.2.1.5 The daytime, evening and night time average noise levels measured during the unattended survey are presented in Table 3 at logger position L2, adjacent to Centre Point House overlooking Earnshaw Street.

Table 3 Ambient noise levels measured during the survey at logger position L2

Date	Daytime (07:00 – 19:00) $L_{Aeq,12h}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Thursday 19/01/2012	-	65	64
Friday 20/01/2012	65	64	63
Saturday 21/01/2012	62	62	62
Sunday 22/01/2012	62	61	62
Monday 23/01/2012	64	61	60
Tuesday 24/01/2012	65	62	61

6.2.1.6 The minimum background noise levels measured during the unattended survey are given in Table 4 at logger position L2.

Table 4 Minimum background noise levels measured during the survey at logger position L2

	Daytime (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
Date	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)
Thursday 19/01/2012	60 *	58	54
Friday 20/01/2012	59	57	54
Saturday 21/01/2012	56	56	54
Sunday 22/01/2012	54	54	54
Monday 23/01/2012	57	54	54
Tuesday 24/01/2012	59	55	53
Wednesday 25/01/2012	58 *	-	-

* Measurement not made over full period due to logger start and end time.

6.2.1.7 The lowest background noise levels measured during the survey were $L_{A90,15\ min}$ 54 dB during the daytime, $L_{A90,15min}$ 54 dB during the evening and $L_{A90,15min}$ 53 dB at night at logger position L2.

6.2.2 *Attended measurement results*

6.2.2.1 Attended measurements were performed at a number of different locations around the site on 19 January 2012 and 25 January 2012. The sound pressure levels recorded during these measurements are summarised in Table 5 in terms of the most notable parameters. The dominant noise sources noted during the measurements are also described in the following table. All the attended measurements were performed over 5 minute periods.

Table 5 Sound pressure levels from attended measurements

Position	Date	Start time	Sound pressure levels (dB)				Noise sources
			L_{Aeq}	L_{AFmax}	L_{ASmax}	L_{A90}	
1	19 Jan 12	14:40	67	74	71	65	Busy traffic
2	19 Jan 12	14:57	74	85	81	69	Busy traffic
	19 Jan 12	16:00	74	96	91	64	Busy traffic
3	19 Jan 12	16:32	72	86	83	63	Busy traffic
	25 Jan 12	11:13	70	86	85	64	Busy traffic
	19 Jan 12	16:07	73	86	79	70	Busy traffic
4	19 Jan 12	16:38	74	86	82	70	Busy traffic
	25 Jan 12	11:20	75	88	84	71	Busy traffic
	19 Jan 12	16:13	73	84	79	69	Busy traffic
5	19 Jan 12	16:44	74	90	84	70	Busy traffic
	25 Jan 12	11:25	73	81	79	70	Busy traffic
	19 Jan 12	16:21	74	88	83	69	Busy traffic
6	19 Jan 12	16:50	74	88	85	69	Busy traffic
	25 Jan 12	11:32	77	92	88	73	Busy traffic
7	25 Jan 12	12:21	69	79	74	66	Busy traffic
8	25 Jan 12	12:40	62	74	69	59	Busy traffic

6.3 Vibration measurement results (existing condition)

6.3.1 *Tactile vibration measurements*

6.3.1.1 The maximum vibration dose values (VDV) measured in each axis, during any measurement, are listed in the table below. These values belong to the measurement position A and B, beneath Centre Point Tower and House, respectively. Full details of the measured VDV values at the two locations can be found in Appendix A.

Table 6 Maximum measured vibration dose values at location A and B

Position	Start time	Duration (min)	VDV ($m/s^{1.75}$)			Comments
			X	Y	Z	
A	11:11	00:17	0.0018	0.0014	0.0018	Loud train
A	11:13	00:13	0.0019	0.0009	0.0017	Quiet train
B	12:32	00:19	0.0005	0.0008	0.0017	Loud train

6.3.1.2 The highest vibration levels occur in the vertical Z axis so to give the 'worst case' scenario, assessments are based on these values.

6.3.1.3 The Central Line passes beneath Centre Point Tower and Centre Point House, and the Northern Line passes approximately 60 m to the east side of the Centre Point Tower. Based on the deeper level of the Northern Line running tunnels, perceived quiet trains during the measurements are considered to be from Northern Line, and louder trains from Central Line.

6.3.1.4 The RMS acceleration levels measured at locations A and B can be found in Appendix B.

6.3.2 *Ground-borne noise measurements*

6.3.2.1 The ground-borne noise levels from underground train passes were measured at position A. As a result of practical limitations during the measurements, the microphone was located approximately 0.5 m from two adjacent walls. These measurements are presented in the following table in terms of L_{ASmax}. Due to the presence of plant noise it was not possible to directly measure the level of ground-borne noise at position B.

Table 7 Ground-borne noise measured at location A

Vibration location A			
Start time	Duration (min)	L_{ASmax} (dB)	Comments
11:39	00:13	38	Trains pass
11:40	00:12	35	Quiet train pass
11:42	00:10	42	Train pass + crossrail noise
11:44	00:10	42	Quiet then loud train pass
11:45	00:16	32	Background noise (no trains)
11:46	00:21	35	Background noise (no trains)
11:47	00:19	42	Loud then quiet train pass
11:49	00:10	33	Quiet train pass
11:50	00:11	43	Train pass

6.3.2.2 Once corrected for the typical background noise levels measured, the highest maximum noise level measured associated with a train pass is L_{ASmax} 42 dB. With an allowance of 3 dB for the unfavourable measured location, the highest typical maximum level measured during a train event was L_{ASmax} 39 dB.

7 Assessment criteria

7.1 LBC requirements

7.1.1 *Camden Development Policy 28* states the following regarding noise and vibration for noise and vibration sensitive developments:

'The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:

a) Development likely to generate noise pollution; or

b) Development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.'

7.1.2 Where noise sensitive developments are proposed in environments with noise pollution, LBC will only grant planning permission if adequate attenuation measures are implemented. Attenuation measures required to achieve suitable internal noise levels for residential premises are set out in the following section to ensure LBC's requirements for noise sensitive developments are met.

7.1.3 LBC also states that a PPG24: *Planning and Noise* type assessment is to be carried out when noise generating and noise sensitive developments are proposed. PPG24 assesses the suitability of a site to build new residences. While PPG24 has been replaced by NPPF, the technical basis of PPG24 remains an appropriate method of assessing the suitability of the site for development.

7.1.4 On the basis that the residential premises in Centre Point House are existing it is considered that assessment of site suitability is only applicable to Centre Point Tower and the affordable housing block as they will contain new residences.

7.2 Site suitability

7.2.1 *LBC requirements*

7.2.1.1 Table 8 and Table 9 below set out the noise levels given in LBC Development Policy 28 for sites where planning permission will not be granted, and where attenuation measures will be required, respectively.

7.2.1.2 The levels are based on PPG24 guidance and expanded to include the evening period. Consequently comparison of the noise levels a site with the criteria requires a PPG24 assessment.

Table 8 LBC Development Policy 28 Noise levels above which permission will not be granted

Noise description and location of measurement	Period	Time	Sites adjoining roads
Noise at 1 metre external to a sensitive facade	Day	07:00 – 19:00	72 dB $L_{Aeq,12h}$
Noise at 1 metre external to a sensitive facade	Evening	19:00 – 23:00	72 dB $L_{Aeq,4h}$
Noise at 1 metre external to a sensitive facade	Night	23:00 – 07:00	66 dB $L_{Aeq,8h}$

Table 9 LBC Development Policy 28 Noise levels above which attenuation measures will be required

Noise description and location of measurement	Period	Time	Sites adjoining roads
Noise at 1 metre external to a sensitive facade	Day	07:00 – 19:00	62 dB $L_{Aeq,12h}$
Noise at 1 metre external to a sensitive facade	Evening	19:00 – 23:00	57 dB $L_{Aeq,4h}$
Noise at 1 metre external to a sensitive facade	Night	23:00 – 07:00	52 dB $L_{Aeq,8h}$
Individual noise events several times an hour	Night	23:00 – 07:00	>82 dB L_{AMAX} (S time weighting)

7.2.2 *PPG24*

7.2.2.1 PPG24 was superseded by National Planning Policy Framework in March 2012. However, LBC still refers to PPG24 in LBC Development Policy 28. DP28 requires compliance of the proposed development with PPG24.

7.2.2.2 A technical assessment in accordance with the requirements of PPG24 remains an appropriate method for assessing the suitability of a site for development.

7.2.2.3 PPG24 guidance recommends Noise Exposure Categories for assessing the suitability of sites for new residential developments in relation to various types of noise sources, including road and rail traffic, and mixed sources. These are designed to help local planning authorities in their consideration of applications for residential developments near transport related noise sources.

7.2.2.4 The categorisation of levels is defined separately at night (23:00 to 07:00) and during the day time (07:00 to 23:00). Noise levels corresponding to the Noise Exposure Categories are shown in Table 10.

Table 10 PPG 24 Noise Exposure Category limits for road traffic noise sources

Noise levels corresponding to the noise exposure categories for new dwellings $L_{Aeq,T}$ (dB)				
	Noise Exposure Category (NEC) for mixed noise sources			
	A	B	C	D
Road traffic				
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 a free field level of 82 dB L_{ASmax} several times in any hour, the site should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$.

7.2.2.5 Category A represents the circumstances in which noise is unlikely to be a determining factor while Category D relates to the situation in which development should normally be refused. Categories B and C deal with situations where noise mitigation measures may make residential development acceptable.

7.2.2.6 Where there is a clear need for new residential development in a noisy area, the local planning authority may increase limits of the Noise Exposure Categories up to 3 dB above those shown

7.2.3 *National Planning Policy Framework*

7.2.3.1 NPPF was published in March 2012 and states the following in terms of environmental noise (numbering added):

'Planning policies and decisions should aim to:

1. *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
2. *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
3. *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
4. *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

7.3 External noise levels – noise egress

7.3.1 *Standard guidance*

7.3.1.1 Standard guidance for noise emission from proposed new items of building services plant is given in BS4142:1997 '*Method for rating industrial noise affecting mixed residential and industrial areas*'.

7.3.1.2 BS4142 provides a method for assessing noise from items such as building services plant against the existing background noise levels at the nearest noise sensitive receptors to assess the risk of complaints occurring.

7.3.1.3 BS4142 suggests that if the rating noise level is 10 dB or more higher than the existing background noise level, complaints are likely. If the rating level is 5 dB above the existing background noise level, it is considered of marginal significance. If the rating level is 10 dB or more below the existing background noise level, this is considered a positive indication that complaints are unlikely.

7.3.1.4 If the noise contains 'attention catching features' such as tones, bangs etc, these limits should be reduced by a further 5 dB.

7.3.2 *LBC requirements*

7.3.2.1 Environmental noise limits for plant are typically set at a distance of 1 m from the worst affected window of the nearest noise sensitive premises.

7.3.2.2 For noise from external building services plant, LBC Development Policy 28 states that planning permission will not be granted if the cumulative noise level from the operation of all plant exceeds a level 5 dB below the lowest background noise level at 1 m from the worst affected window of the nearest noise sensitive premises. If the plant contains attention catching characteristics (such as tonal elements, whines, whistles, bangs etc), the total noise level at the same location should not exceed 10 dB below the lowest background noise level measured.

7.4 Internal noise levels – noise ingress

7.4.1 *Standard guidance*

7.4.1.1 Guidance on acceptable internal noise levels in residential dwellings is given in BS8233:1999 *Sound insulation and noise reduction for buildings – Code of Practice*, and is also provided by the World Health Organisation. The guidance given by BS8233 and WHO is shown in Table 11.

Table 11 Internal noise criteria for sleeping/resting

Internal space	Design range, L_{Aeq} (dB)		
	BS8233 "Reasonable"[1]	BS8233 "Good"[1]	WHO
Living rooms	40	30	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 do not differentiate between different types of living spaces, but recommend L_{Aeq} 30 dB in relation to sleep disturbance and L_{Aeq} 35 dB in relation to speech intelligibility. 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 broadly in line with the guidance given by the WHO. However, Section 3.4 of the WHO guidelines suggests that good sleep will not generally be affected if internal levels of L_{AFmax} 45 dB are not exceeded more than 10-15 times per night.

7.4.2 *LBC requirements*

7.4.2.1 There are no specific LBC requirements for internal noise levels resulting from external noise ingress.

7.5 Tactile vibration criteria

7.5.1 *Standard guidance*

7.5.1.1 Tactile vibration is that which is perceived as mechanical motion. In assessing the potential human response to vibration, we have used the procedures laid down in BS6472-1:2008 '*Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting'*.

7.5.1.2 As the vibration is intermittent, it is assessed in terms of the equivalent "vibration dose value". This relates the level of vibration to the duration of vibration.

7.5.1.3 For information, the BS6472-1:2008 assessment table is reproduced below:

Table 12 BS6472-1:2008 tactile vibration assessment criteria

Vibration dose values ($m/s^{1.75}$) above which might result in various degrees of adverse comment within residential buildings.

Place	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16 hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential building 8 hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

*Note: For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a 16 hour day.

7.5.1.4 It is important to note that people exhibit wide variations of vibration tolerance. Specific values are dependent upon social and cultural factors, psychological attitudes and expected degree of intrusion.

7.5.2 *LBC requirements*

7.5.2.1 LBC Development Policy 28 states the following vibration levels on residential sites adjoining railways and roads at which planning permission will not be granted:

Table 13 LBC Development Policy 28 Vibration level criteria

Vibration description and location of measurement	Period	Time	Vibration levels
Vibration inside dwellings	Day and evening	07:00 – 23:00	0.2 to 0.4 VDV $ms^{-1.75}$
Vibration inside dwellings	Night	23:00 – 07:00	0.13 VDV $ms^{-1.75}$
Vibration inside offices	Day, evening and night	00:00 – 24:00	0.4 VDV $ms^{-1.75}$
Vibration inside workshops	Day, evening and night	00:00 – 24:00	0.8 VDV $ms^{-1.75}$

7.6 Ground-borne noise criteria

7.6.1 *Standard guidance*

7.6.1.1 There is currently no international or British Standard which provides guidance on assessing the impact of ground-borne noise from railways on the occupants of a building. The Association of Noise Consultants (ANC) published in 2001 a book called '*Measurement and assessment of ground-borne noise and vibration*', which is generally used as the basis of assessments such as this.

7.6.1.2 This document also provides discussion on the relevant research that has been carried out, and a summary of typically adopted criteria.

7.6.1.3 The most relevant items are set out below:

- The American Public Transit Association (APTA) guidelines recommend criteria of between 30 and 40 dB(A) depending on the density and type of residential properties. They do not define where within a building these apply, or the time response that should be used.
- The Federal Transit Administration (FTA), also American, recommends limits for maximum pass-by levels of 35 dB(A) for frequent events (more than 70 events per day) and 43 dB(A) for infrequent events.
- London Underground Limited has studied the relationship between ground-borne noise levels and complaint thresholds. This was used to define a complaint threshold of 40 dB L_{Amax}.

7.6.1.4 The ANC guidelines also note that local authority guidelines for ground-borne noise were published in London and the South East, and state a limit of 35 dB L_{Amax}.

7.6.1.5 It should be noted that most of this research relates to residential accommodation, and is aimed at providing good sleeping / resting conditions.

7.6.2 *LBC requirements*

7.6.2.1 LBC Development Policy 28 states *'Where dwellings may be affected by ground-borne regenerated noise internally from, for example, railways or underground trains within tunnels, noise levels within the rooms should not be greater than 35 dB(A)max.'*

8 PPG24 assessment

8.1 A PPG24 assessment has been carried out for Centre Point Tower and the proposed new affordable housing block to allow comparison with the requirements of DP28 to assess the suitability of the site for the provision of residential premises based on LBC criteria. The assessment is based on the existing noise levels measured around the site. An assessment of the sound insulation requirements of the facade is provided in Section 11.

8.2 As the residential dwellings in Centre Point House are existing and only subject to refurbishment works these are not considered in this assessment. However, an assessment of the sound insulation requirements of the facade to achieve suitable internal noise levels is provided in Section 11.

8.3 For the three cases the façade sound insulation assessments are based on the predicted noise levels on completion of the Proposed Development accounting for the future road arrangements.

8.1 Assessment

8.1.1 *Adjustment of noise levels to account for noise logging measurement position*

8.1.1.1 The recommended NEC limits given in PPG24 relate to noise levels measured on an open site approximately 1.5 m above ground level.

8.1.1.2 The unattended measurements performed at position L1 (1.8 m above roof level and 12 m above ground level) were taken at 1 m from the façade of Centre Point Tower. In order to estimate a free field level, they were reduced by 3 dB (in line with the guidance in PPG24) to obtain the equivalent free field levels.

8.1.1.3 As the measurements were performed at heights corresponding to the lowest levels at which residential premises may be provided, the measurements are not adjusted for height.

8.1.2 *PPG24 noise levels*

8.1.2.1 The adjusted free-field daytime and night-time noise levels are given in Table 14 and Table 15.

Table 14 Daytime and night-time free field noise levels at 12 m from ground floor at logger position L1

Date	Daytime (07:00 – 19:00) $L_{Aeq,12hr}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4hr}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8hr}$ (dB)
Thursday 19/01/2012	-	67	66
Friday 20/01/2012	70	69	68
Saturday 21/01/2012	68	67	67
Sunday 22/01/2012	66	66	64
Monday 23/01/2012	68	68	65
Tuesday 24/01/2012	70	68	65
Average	68	58	66

Table 15 Measured daytime and night time free field noise levels at 12 m from ground floor at logger position L2

Date	Daytime (07:00 – 19:00) $L_{Aeq,12hr}$ (dB)	Evening (19:00 – 23:00) $L_{Aeq,4hr}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8hr}$ (dB)
Thursday 19/01/2012	-	65	64
Friday 20/01/2012	65	64	63
Saturday 21/01/2012	62	62	62
Sunday 22/01/2012	62	61	62
Monday 23/01/2012	64	61	60
Tuesday 24/01/2012	65	62	61
Average	64	62	62

8.1.3 *Site noise exposure category*

8.1.3.1 Based on the noise levels presented in tables above, the L_{ASmax} levels measured at the site and the criteria set out in the previous section, the site lies within NEC C for the daytime period and NEC C for the night time period. The PPG24 noise levels are above those which LBC requires attenuation measures but below those above which LBC will not grant planning permission.

8.2 Discussion

8.2.1 This site falls into NEC C for the daytime period and NEC C for the night-time period.

8.2.2 For sites which fall into NEC C, PPG24 gives the following guidance:

'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.'

8.2.3 It should be noted that the rationale behind PPG24 is to ensure that noise levels inside new dwellings will be acceptable. It is not unusual for a development in busy urban locations to fall within NEC C or D.

8.2.4 It will be possible, with appropriate facade sound insulation and attenuation of ventilation openings, to achieve internal noise levels in line with the recommendations of BS8233: 1999 '*Sound insulation and noise reduction for buildings – Code of Practice'* and the World Health Organisation's guidelines for community noise.

8.2.5 The facade sound insulation requirements are discussed further in the following sections of this report.

9 NPPF assessment

9.1 The assessment provided in this report performed in relation to plant noise egress in accordance with the LBC requirements and BS 4142, together with the assessment of site suitability and determination of design measures to ensure that internal noise levels achieve the requirements of BS 8233 are considered to adequately show compliance with items 1 and 2 of NPPF detailed in Section 7.2.3.

9.2 Based on the Proposed Development being located in an area with significant numbers of existing residential premises in the vicinity, it is unlikely this scheme will create unreasonable restrictions on surrounding established businesses (Item 3) or disturb the tranquillity of nearby recreational areas (Item 4).

10 Plant noise limits - noise egress

10.1 Based on the criteria set out above and the measurement results, the cumulative noise level resulting from the operation of all new plant associated with the Proposed Development should not exceed a level 5 dB below the lowest background noise level at 1 from any noise sensitive development. These limits are set out in the table below.

Table 16 Plant noise limits at the nearest noise sensitive premises

Time of day	Maximum sound pressure level at noise sensitive premises (dB)
Daytime (07:00 - 23:00)	49
Night-time (23:00 - 07:00)	48

10.2 As previously stated, if the proposed 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 above.

10.3 Proposed building services plant noise levels will be assessed in detail as the design progresses. All plant items will be designed to achieve the plant noise limits set out above. This will be a major improvement over the current plant noise levels.

10.4 The required attenuation measures will depend on the type and location of the plant items, but typical measures include in-duct attenuation, acoustic enclosures or screens, or acoustic louvres.

11 Facade sound insulation assessment (noise ingress)

11.0.1 The PPG24 assessment and LBC requirements indicate that noise is a factor which should be taken into account for the new residential premises in Centre Point Tower and the proposed new affordable housing block, and attenuation measures should be employed to ensure that appropriate internal noise levels will be achieved. This section discusses internal noise level criteria and assesses the required facade sound insulation performance for the Tower and the proposed new affordable housing block. An assessment has also been performed to determine the performance requirements for the new windows to be provided to the dwellings within Centre Point House.

11.0.2 In principle, the required facade specification depends on two factors – the external noise levels at the site, and the internal noise criteria.

11.0.3 The external noise levels have been based on a computer model which has been used to predict the noise levels around the finished development. The computer modelling is discussed in section 11.1.

11.0.4 The following assessment is based on achieving the internal noise levels set out in Table 17 which have been adopted from the guidance for 'good' internal noise levels set out in BS8233.

Table 17 Internal noise criteria

Internal space	Criteria, L_{Aeq} (dB)
Living rooms	35
Bedrooms	30

11.1 Computer modelling

11.1.1 The environmental noise levels measured around the Proposed Development have been used to inform the creation of a 3 dimensional computer model in the noise modelling software package CadnaA. The software has been used to predict the noise levels around the Proposed Development.

11.1.2 The computer model accounts for noise from road traffic around the completed site.

11.1.3 The computer model also accounts for the future traffic flow data.

11.1.4 The predicted noise levels on the east and west facades of Centre Point Tower are shown in Figure 3 and Figure 4.

11.1.5 The predicted noise levels at the east and west facades of Centre Point House are shown in Figure 5 and Figure 6.

11.1.6 The predicted noise levels at the east, south and west facades of the proposed new affordable housing block are also shown in Figure 5 and Figure 6.

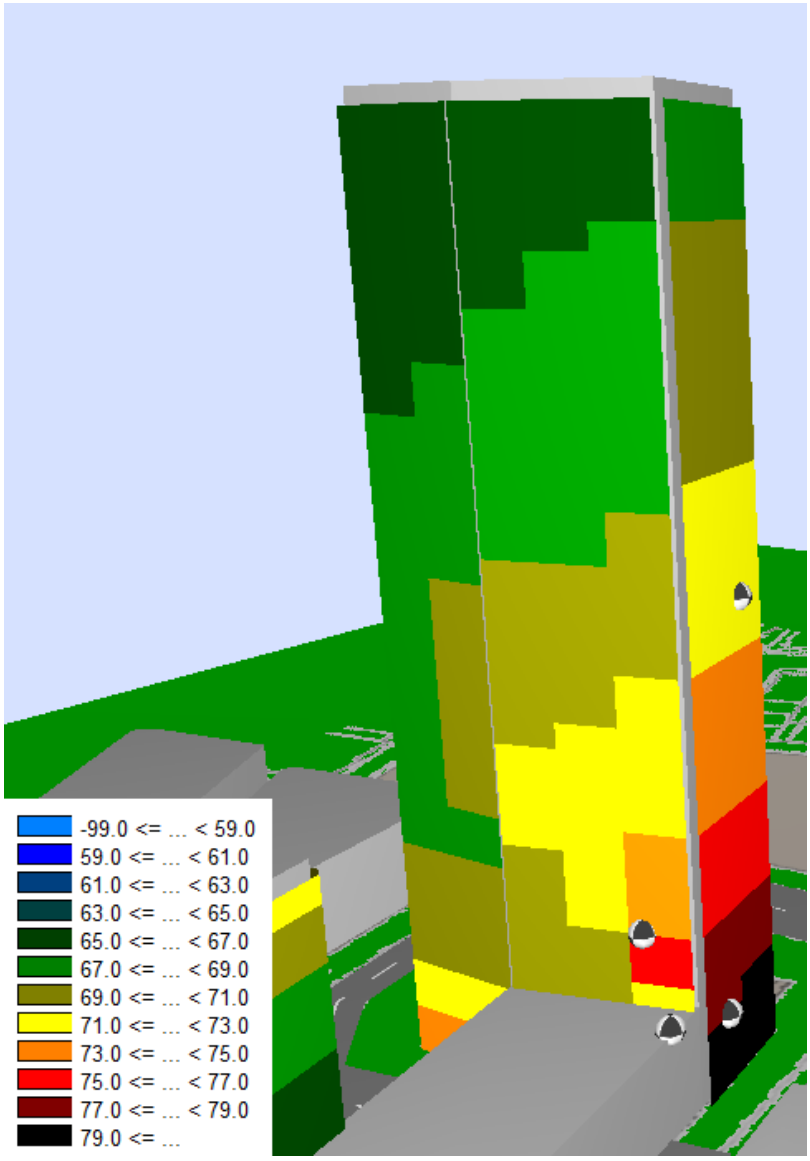


Figure 3 Predicted noise levels: East facade Centre Point Tower

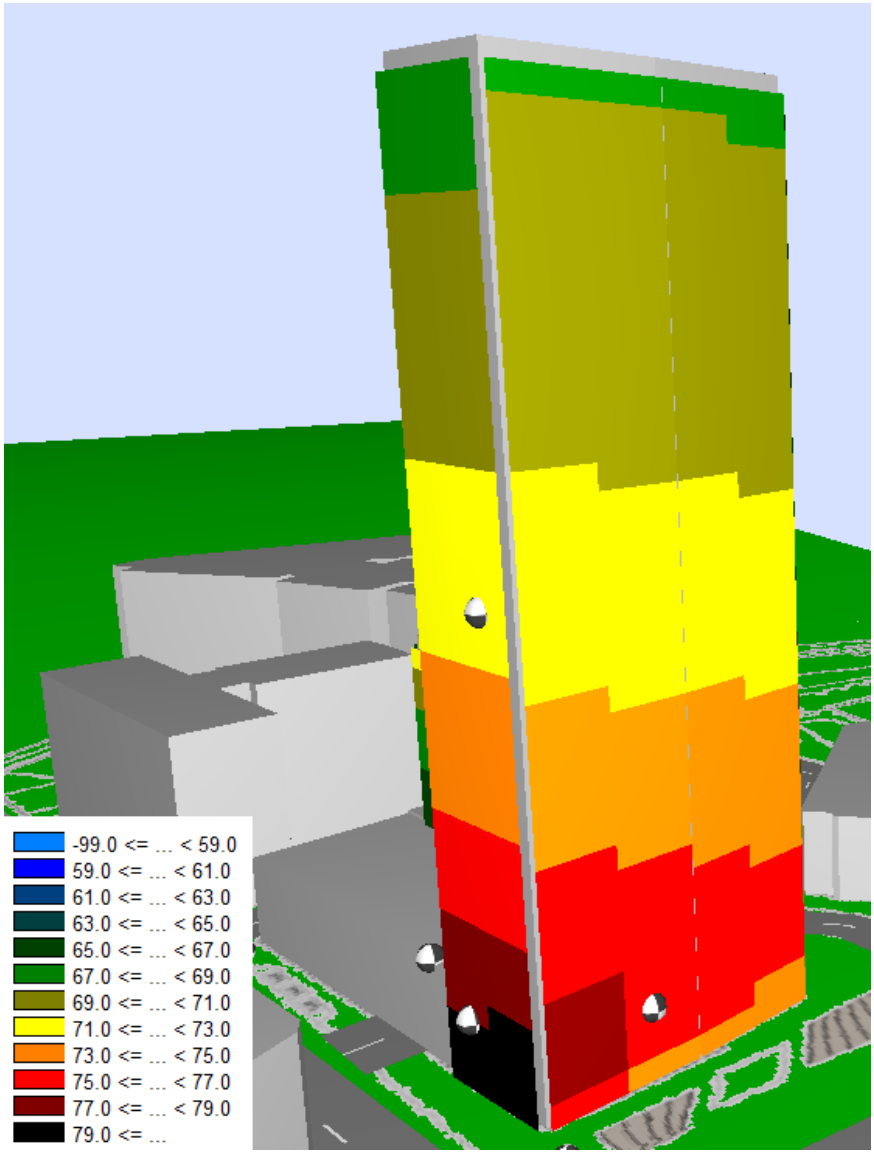


Figure 4 Predicted noise levels: West facade Centre Point Tower

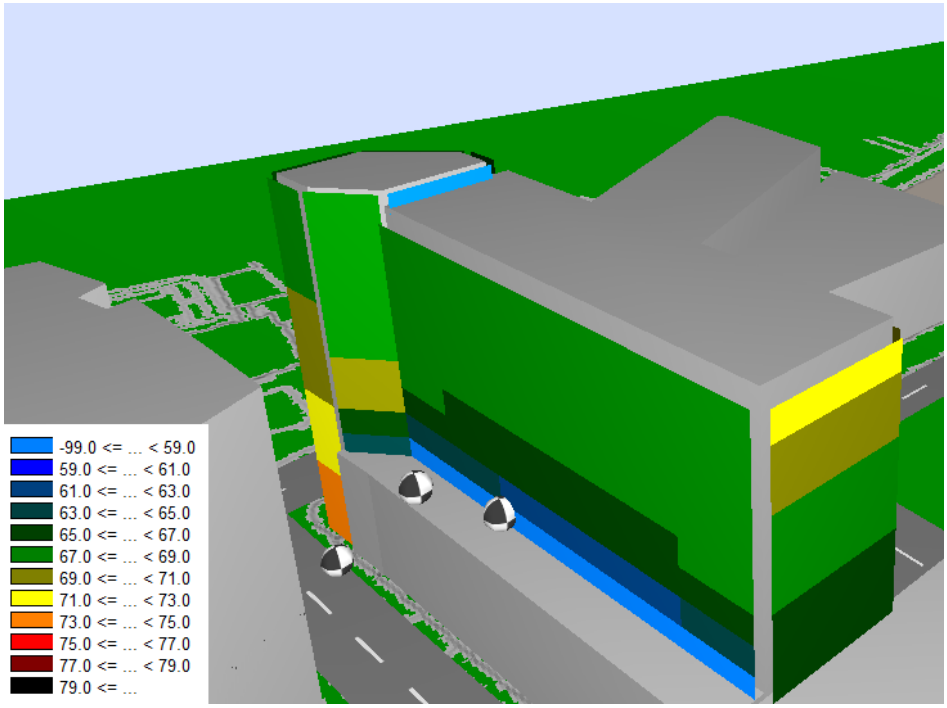


Figure 5 Predicted noise levels: East facade Centre Point House and the proposed new affordable housing block

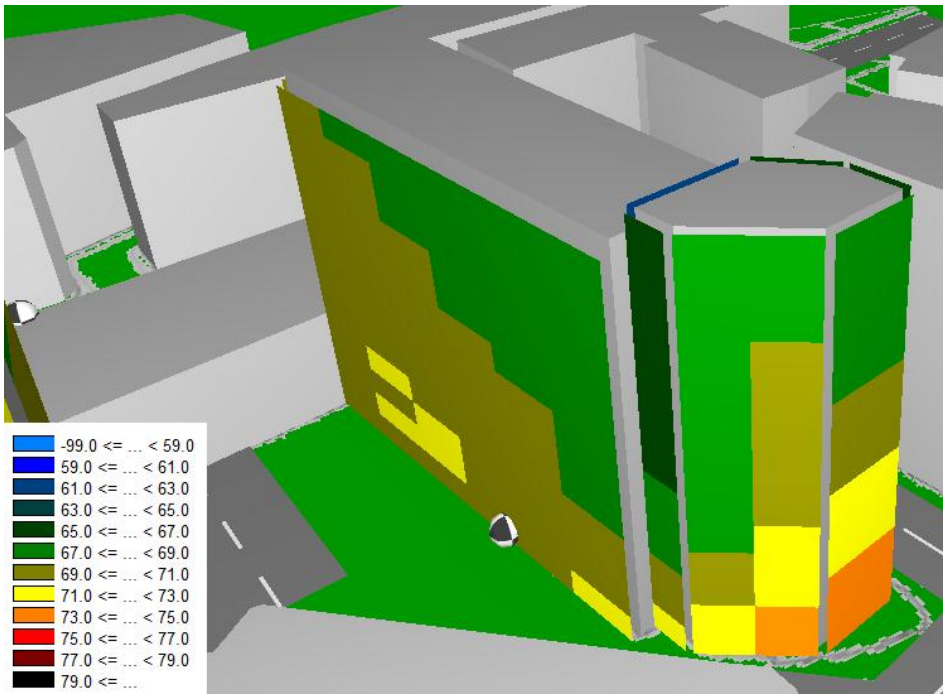


Figure 6 Predicted noise levels: West facade Centre Point House and west and south façade of the new affordable housing block

11.2 Centre Point Tower facade sound insulation

11.2.1 The existing precast concrete sections of the facade are to be retained. The remainder of the facade is to be glazed. All dwellings are to be provided with mechanical ventilation.

11.2.2 The facade requirements have been based on the existing traffic noise levels and predicted noise levels accounting for future traffic flow.

11.2.3 To achieve the internal noise criteria for bedrooms and other living areas, minimum glazing sound insulation requirements have been determined, based on the external noise levels determined from the computer modelling. The number of 15 minute periods at night during which the L_{AFmax} is expected to be greater than 45 dB in bedrooms has been also considered. The minimum sound insulation performances suggested ensure that internal noise levels of L_{AFmax} 45 dB are not exceeded in more than thirteen 15 minute periods per night based on the worstcase measured noise levels.

11.2.4 The minimum sound insulation performances for the east and west facades on levels 3 to 14 are given in Table 18, levels 15 to 22 are given in Table 19, levels from 23 to 28 are given in Table 20, levels from 29 to 32 are given in Table 21, and level 33 and 34 are given in Table 22.

Table 18 Facade sound insulation performance requirements from level 3 to 14

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)
East	Bedroom	44
East	Living Room	36
West	Bedroom	44
West	Living Room	39

Table 19 Facade sound insulation performance requirements from level 15 to 22

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)
East	Bedroom	40
East	Living Room	30
West	Bedroom	40
West	Living Room	33

Table 20 Facade sound insulation performance requirements from level 23 to 28

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)
East	Bedroom	38
East	Living Room	28
West	Bedroom	38
West	Living Room	36

Table 21 Façade sound insulation performance requirements from level 29 to 32

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)
East	Bedroom	37
East	Living Room	28
West	Bedroom	37
West	Living Room	34

Table 22 Facade sound insulation performance requirements for floor level 33 and 34

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)
East	Study and Terrace	34
West	Study and Terrace	38

11.3 Centre Point House facade sound insulation

11.3.1 The facade requirements have been based on the existing traffic noise levels and predicted noise level accounting for future traffic flow.

11.3.2 To achieve the internal noise levels adopted for the project for bedrooms and other living areas, minimum glazing sound insulation requirements have been determined for Centre Point House, based on the external noise levels at each facade stated in Figure 5 and Figure 6.

11.3.3 Ventilation to Centre Point House will be provided by acoustic trickle ventilators. Rapid ventilation will be provided by openable windows, which is consistent with the existing arrangement. The trickle ventilators will need to achieve the performances given in Table 23 to ensure that internal noise levels are achieved in the dwellings with the windows closed. The provision of new windows and trickle vents is expected to reduce levels experienced within the dwellings over the existing arrangement.

11.3.4 The ventilator performance applies to all ventilators serving a room. If more than one vent is present the performance must be reduced correspondingly.

11.3.5 The minimum sound insulation performances for Centre Point House for east and west facades are given in Table 23.

Table 23 Facade sound insulation performance requirements for Centre Point House

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)	Minimum ventilator sound insulation performance $D_{new} + C_{tr}$
East	Bedroom	33	43
East	Living Room	29	39
West	Bedroom	44	48
West	Living Room	37	42

11.4 Proposed new affordable housing block facade sound insulation

11.4.1 All dwellings are to be provided with mechanical ventilation.

11.4.2 The facade requirements have been based on the existing traffic noise levels and predicted noise levels accounting for future traffic flow.

11.4.3 To achieve the internal noise criteria for bedrooms and other living areas, minimum glazing sound insulation requirements have been determined, based on the external noise levels determined from the computer modelling. The number of 15 minute periods at night during which the L_{AFmax} is expected to be greater than 45 dB in bedrooms has also been considered. The minimum sound insulation performances suggested ensure that internal noise levels of L_{AFmax} 45 dB are not exceeded in more than fourteen 15 minute periods per night based on the worst-case measured noise levels.

11.4.4 The minimum sound insulation performances for the two applications proposed for the new affordable housing block building for all facades are given in Table 24.

Table 24 Facade sound insulation performance requirements for the proposed new affordable housing block

Facade	Room	Overall sound insulation performance $R_w + C_{tr}$ (dB)
All	Bedroom	44
All	Living Room	39

11.5 Guidance on facade construction and glazing

11.4.1 Table 25 sets out some examples of glazing configurations that could be employed to achieve the required sound insulation performance for the various elevations.

Table 25 Example glazing configurations

Sound insulation ($R_w + C_{tr}$) dB	Example glazing configuration
≤10	6 mm/12 mm/6 mm
10-15	6 mm/12 mm/6 mm
15-29	6 mm/12 mm/6 mm
30-32	6.4 mm/12 mm/6 mm
33-35	6.4 mm/12 mm/10 mm
36-38	12.8 mm/12 mm/10 mm
39-41	12.8 mm/20 mm/10 mm
42-44	This represents a very high sound insulation performance. To achieve this performance, the glazing would need to be similar to that of an ($R_w + C_{tr}$) 41 dB performance with the limited glazing area and a substantial facade construction or additional secondary glazing.

11.4.2 The performance required by each element depends on the construction of the solid elements, the glazing specification and the relative areas of the solid and glazed elements, and the ventilation strategy (including the acoustic performance of the trickle ventilators and the number of ventilators required to serve individual rooms, if applicable).

11.4.3 As the design progresses, a more detailed facade sound insulation assessment will be performed, taking into account the factors listed above and any changes to the design, to ensure that the overall performance requirements will be met.

12 Vibration assessment

12.0.1 Measurements of existing levels of vibration experienced at the site resulting from underground train movements have been undertaken to assess the impact of vibration and ground-borne noise from London Underground trains on the completed development.

12.1 Tactile vibration

12.1.1 BS 6472 states that the assessment should be based on the axis along which the highest vibration dose value (VDV) is measured. Accordingly, at measurement location A, the highest vibration dose value was measured on the Z axis for trains considered to be on the Central Line and on the X axis for the Northern Line trains. At measurement location B, the highest vibration dose value was measured on the Z axis, reflecting the closer proximity to the Central Line.

12.1.2 Based on information of the frequency of services displayed in the Transport for London (TFL) website, a total of 744 trains pass in the 16 hour daytime period from 07:00 to 23:00 and 66 trains in the 8 hour night period from 23:00 – 07:00 from the Central Line. On the Northern Line, a total of 544 trains pass between 07:00 – 23:00 and 60 trains between 23:00 – 07:00.

12.1.3 Based on the maximum VDV at each position given in Table 6 and the number of trains passing under the Tower between 07:00 – 23:00 and 23:00 – 07:00, the equivalent VDVs over a 16 hour day and an 8 hour night are as presented in Table 26:

Table 26 Equivalent vibration dose values

Location	Maximum VDV measured ($m/s^{1.75}$)		Equivalent total VDV ($m/s^{1.75}$)	
	Central Line	Northern Line	Daytime (07:00 – 23:00)	Night time (23:00 – 07:00)
A	0.0018	0.0019	0.0108	0.0061
B	0.0017	-	0.0088	0.014

12.1.4 By comparing the calculated day and night time vibration dose values above with the assessment tables given in Section 7.5, it can be seen that the predicted vibration dose values during the daytime and night periods are lower than the threshold of the 'Low probability of adverse comment' category. They are also below the LBC requirements. The levels of vibration experienced in the residential premises can be expected to be lower than measured as a result of the attenuation that will occur with height up the building.

12.1.5 Levels experienced may vary depending on the type of train and position within Centre Point Tower. Changes in frequency of trains will also have an effect. However, it is worthwhile bearing in mind that the measured vibration levels are below the lowest BS 6472 threshold and it is considered that it will take a significant increase in the number of trains for the threshold to be exceeded. Tactile vibration due to underground trains is therefore not considered to be problematic.

12.1.6 Crossrail running tunnels pass to the south of the site. The vibration contribution from these is not expected to be sufficient to increase the levels of tactile vibration at the site to a level sufficiently high for the threshold for a low probability of adverse comment to be exceeded.

12.2 Ground-borne noise

12.2.1 Ground-borne noise within the new residential dwellings within Centre Point Tower has been predicted using an empirical formula described in '*Guidelines for the Measurement & Assessment of Groundborne Noise and Vibration*' published by the Association of Noise Consultants (2001). The assessment is based on position A which is considered most representative of vibration affecting the Tower.

12.2.2 The predicted ground-borne re-radiated noise level in the sub-basement of the Centre Point Tower is L_{ASmax} 33 dB from Central Line underground trains and L_{ASmax} 21 dB from Northern Line underground trains.

12.2.3 The difference between the predicted ground-borne noise level in the sub-basement of Centre Point Tower and the measured ground-borne noise level in the same location shown in Section 6.3.2 is 6 dB, when measurement position and background noise contribution are accounted for.

12.2.4 The levels of ground-borne noise experienced in the residential premises on the level 3 of the Tower and above will vary from those experienced in the sub-basement as a result of attenuation with distance and amplification from the suspended floor. The ground-borne noise levels on level 3 have been predicted based on published guidance for attenuation and amplification.

12.2.5 Accounting for the corrections resulting from height of building and vibration amplification and the 6 dB difference between the predicted and measured ground-borne noise levels at position A, the predicted ground-borne re-radiated noise levels experienced in residential premises on level 3 of Centre Point Tower are between L_{ASmax} 30 dB and L_{ASmax} 31 dB.

12.2.6 The predicted highest level on the third floor is L_{ASmax} 31 dB which meets the criteria indicated in Section 7.6. Ground-borne noise levels can be expected to reduce further with height up the Tower.

12.2.7 Ground-borne noise from Crossrail has the potential to affect residential premises within the Proposed Development. The Crossrail running tunnels are located to the south of the site. As part of their committed undertakings Crossrail will have been required to assess the level of ground-borne noise affecting Centre Point House and mitigate it to ensure that in all reasonably foreseeable circumstances levels will not exceed the Crossrail criterion of L_{ASmax} 40 dB is residential dwellings.

12.2.8 As Centre Point Tower is located further from the Crossrail running tunnels than Centre Point House it is expected that ground-borne noise levels will fall below the Crossrail criterion and additionally be lower than at Centre Point House.

13 Conclusions

13.0.1 A noise and vibration assessment has been performed for the Centre Point Development.

13.0.2 Environmental noise measurements indicate that the Centre Point Tower site is suitable for residential development provided that suitable attenuation measures are incorporated into the design.

13.0.3 Measurements of tactile vibration and ground-borne noise indicate that levels of tactile vibration are below a level at which there is a 'low probability of adverse comment' and the LBC requirement. Anticipated ground-borne noise levels within Centre Point Tower are below the LBC criteria for residential premises.

13.0.4 Plant noise limits have been determined from the results of environmental noise measurements in accordance with the requirements of LBC to apply at 1 m from the façade of surrounding residential premises. The mechanical plant design will be developed to achieve these limits and comply with the LBC requirements.

13.0.5 Sound insulation requirements for the façade of residential areas of Centre Point Tower, Centre Point House and the proposed new affordable housing block have been determined. The requirements are based on expected future traffic noise levels.

Appendix A

Tactile vibration measurements – Vibration dose values

Table 27 Equivalent vibration dose values measured in the sub-basement of Centre Point Tower

Start time	Duration (min)	VDV ($m/s^{1.75}$)			Comments
		X	Y	Z	
11:11	00:17	0.0018	0.0014	0.0018	Loud train
11:13	00:13	0.0019	0.0009	0.0017	Quiet train
11:16	00:15	0.0009	0.0008	0.0014	Loud train
11:19	00:13	0.0007	0.0007	0.0016	Loud train
11:23	00:11	0.0009	0.0008	0.0009	Quiet train
11:24	00:14	0.0006	0.0008	0.0014	Loud train
11:30	00:13	0.0007	0.001	0.0016	Loud train
11:34	00:15	0.0006	0.0009	0.0018	Loud train
11:37	00:12	0.0009	0.001	0.0016	Loud train
11:37	00:13	0.0009	0.0009	0.0014	Quiet train
11:40	00:19	0.0007	0.0008	0.0010	Quiet train
11:46	00:22	0.0006	0.0007	0.0008	Quiet train
11:48	00:12	0.0006	0.0006	0.0013	Quiet train

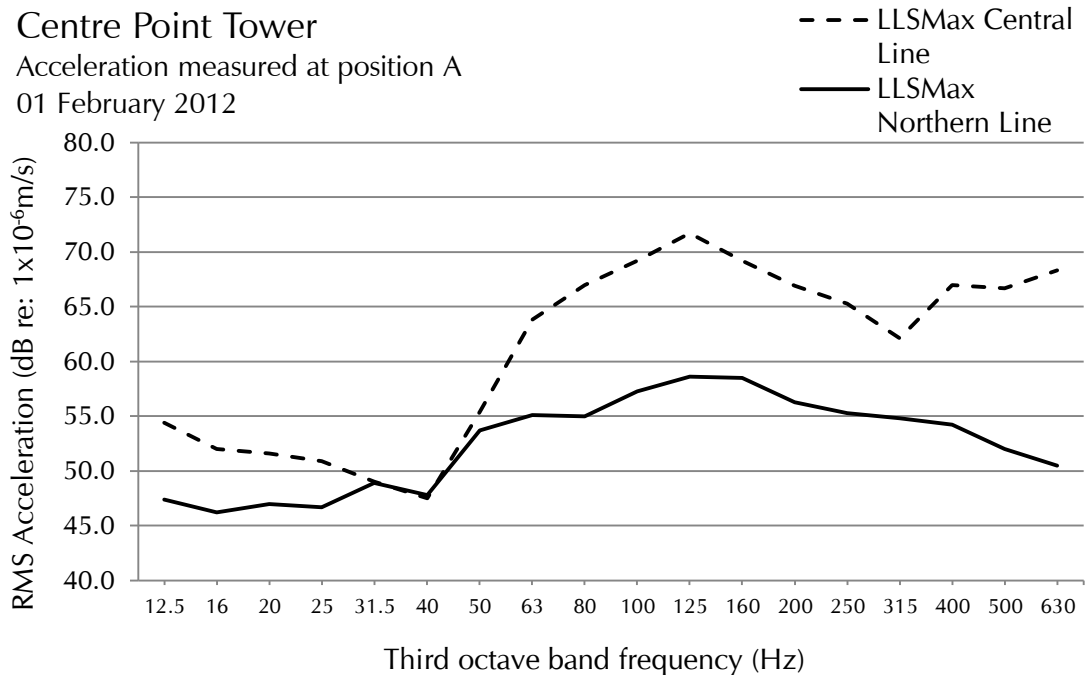
Table 28 Equivalent vibration dose values measured in the sub-basement of Centre Point House

Start time	Duration (min)	VDV ($m/s^{1.75}$)			Comments
		X	Y	Z	
12:20	00:21	0.0005	0.0007	0.0017	Train pass
12:23	00:16	0.0005	0.0006	0.0014	Train pass
12:24	00:12	0.0005	0.0005	0.0016	Train pass
12:27	00:21	0.0006	0.001	0.0016	Train pass
12:31	00:13	0.0004	0.001	0.0016	Train pass
12:32	00:19	0.0005	0.0008	0.0017	Train pass

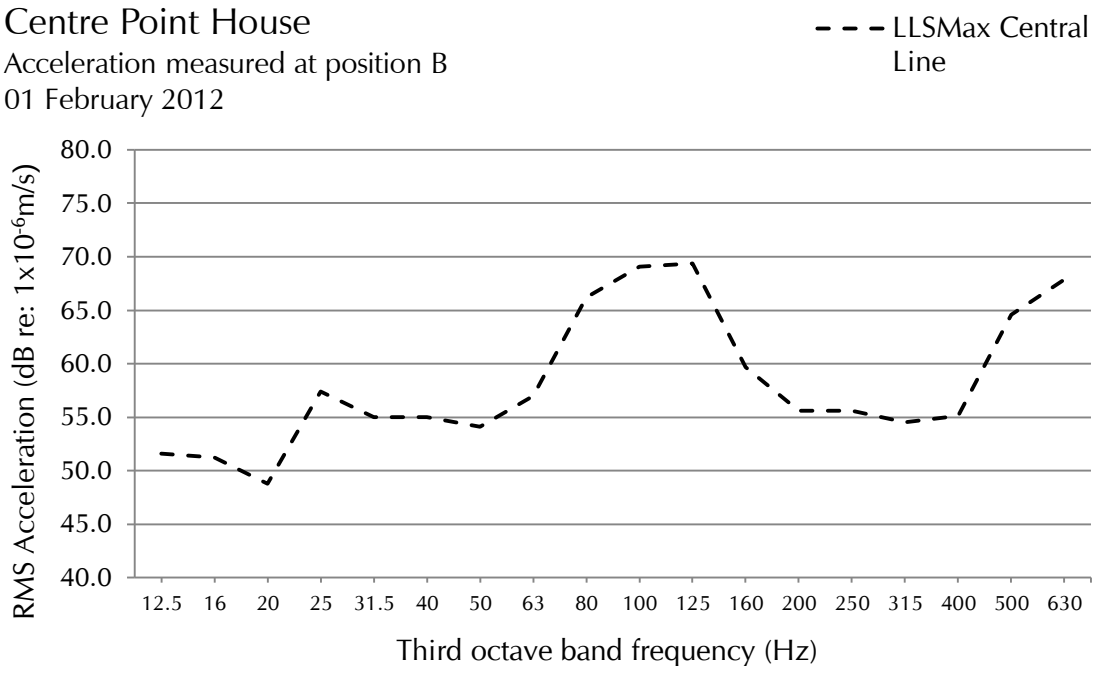
Appendix B

Tactile vibration measurements – Acceleration values

Typical RMS Acceleration measured at Location A (Centre Point Tower)

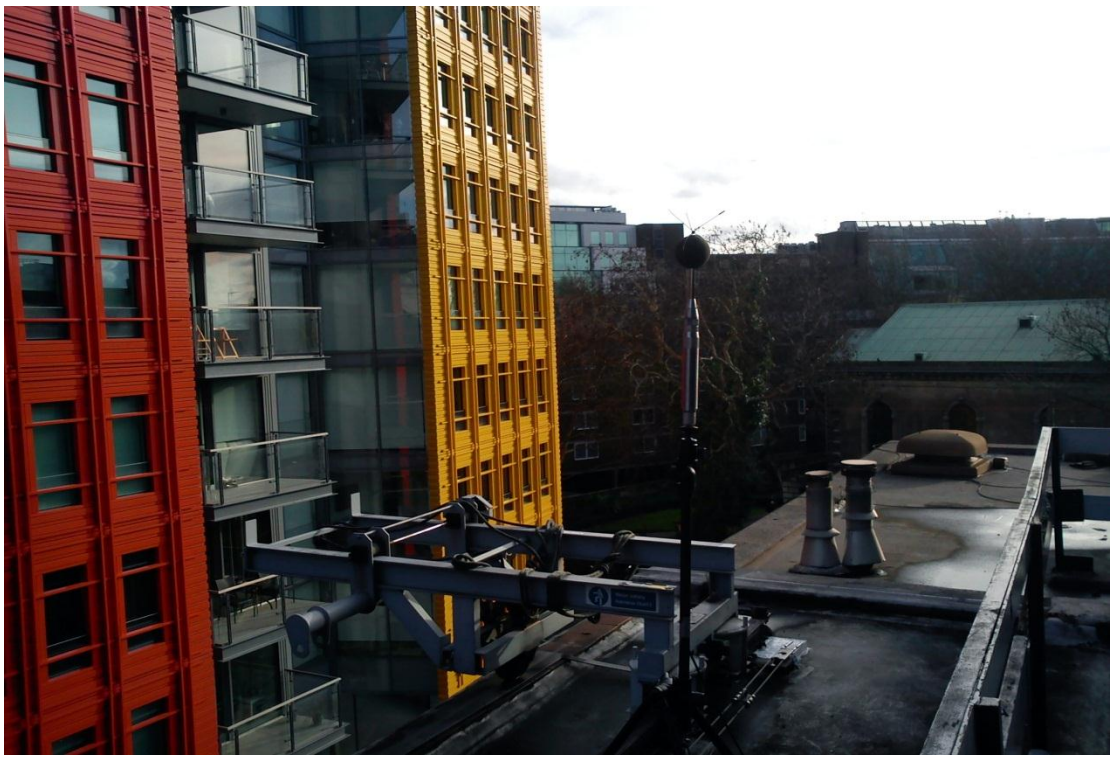


Typical RMS Acceleration measured at Location B (Centre Point House)



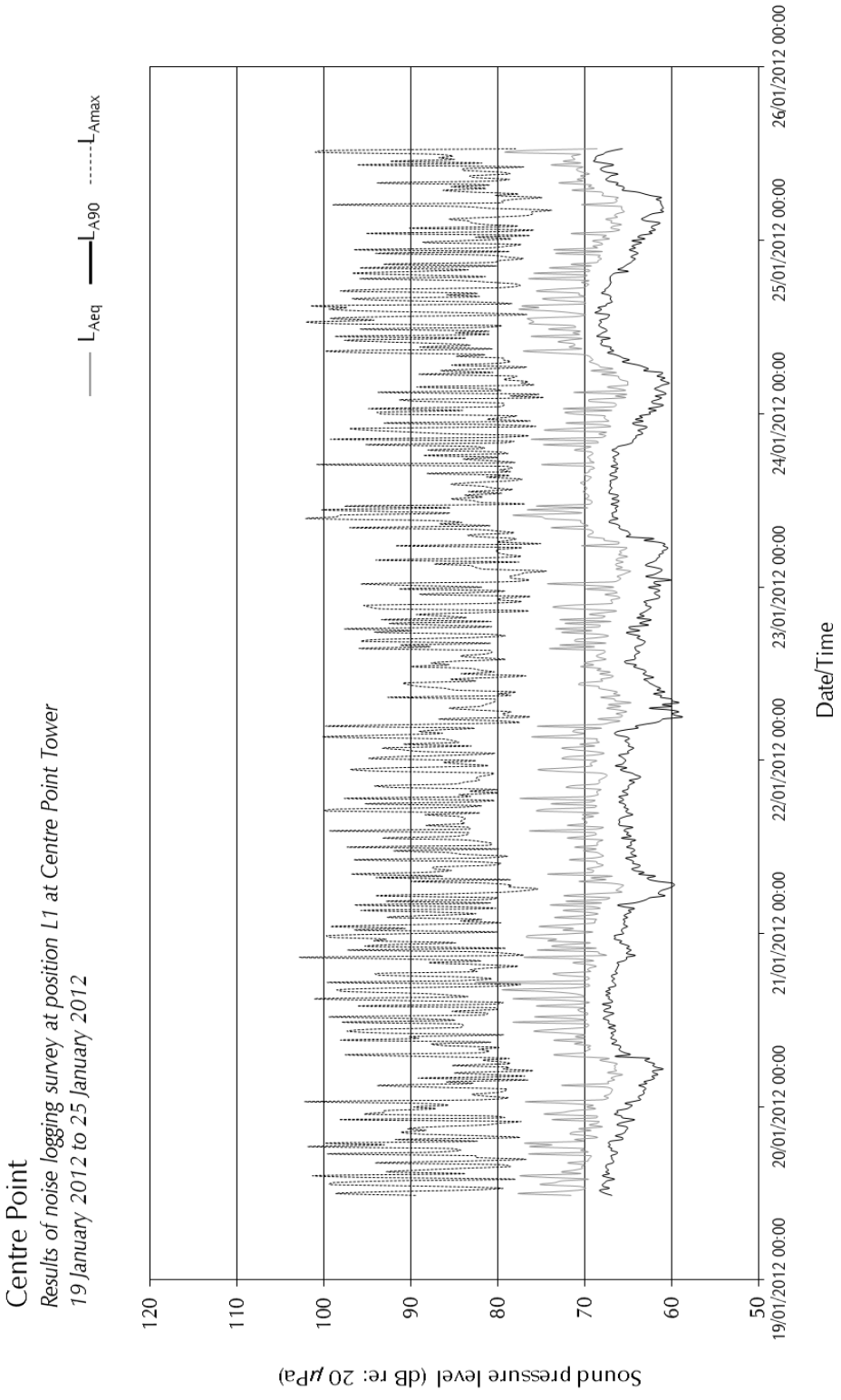
Appendix C

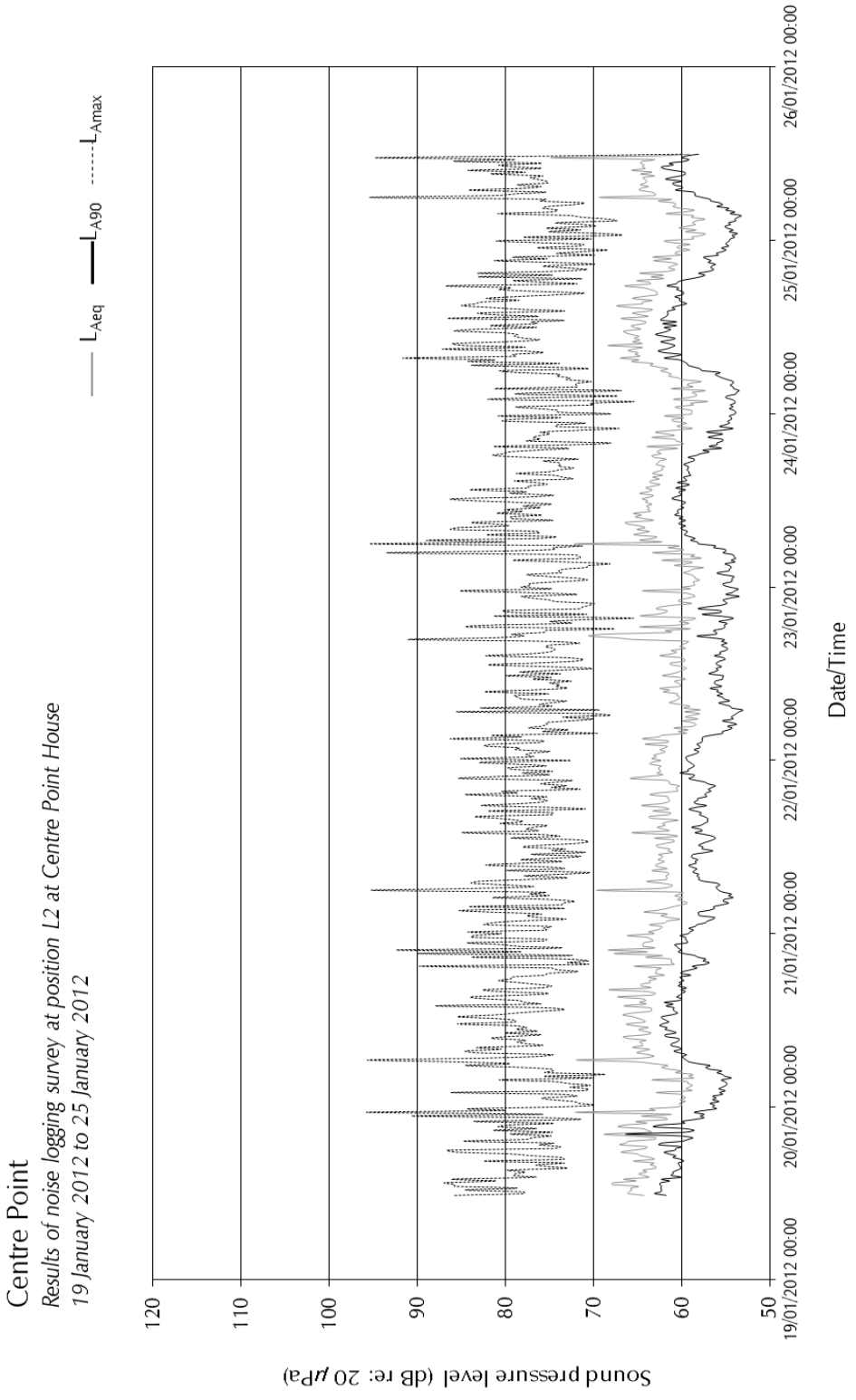
Photographs of the logging measurement locations



Appendix D

Results of unattended measurements at positions L1 and L2


Centre Point
Results of noise logging survey at position L1 at Centre Point Tower
19 January 2012 to 25 January 2012
LAeq
LA90
LAmax
Sound pressure level (dB re: 20 μPa)
120
110
100
90
80
70
60
50
19/01/2012 00:00
20/01/2012 00:00
21/01/2012 00:00
22/01/2012 00:00
23/01/2012 00:00
24/01/2012 00:00
25/01/2012 00:00
26/01/2012 00:00
Date/Time


Centre Point
Results of noise logging survey at position L2 at Centre Point House
19 January 2012 to 25 January 2012
LAeq
LA90
LAmax
Sound pressure level (dB re: 20 μPa)
120
110
100
90
80
70
60
50
19/01/2012 00:00
20/01/2012 00:00
21/01/2012 00:00
22/01/2012 00:00
23/01/2012 00:00
24/01/2012 00:00
25/01/2012 00:00
26/01/2012 00:00
Date/Time

Appendix E

Equipment details

The calibration data for the equipment used during the survey is provided below.

Table 29 Equipment calibration data

Sound level meter	Type/serial number	Calibration expiry	Calibration certification number
Larson Davis 820	0188	03/03/2012	1003094
Svantek 957	12327	17/10/2013	1110493
B&K 2260	2459184	13/07/2013	05970/1
B&K 2260	2553982	10/12/2012	C1101382

The calibration certificates for the sound level meters stated above are available upon request.

Calibration of the sound level meters used for the measurements is traceable to national standards. The sound level meters and the respective measurement chains were calibrated at the beginning and end of the measurements using their respective sound level calibrators. No significant calibration deviation occurred.