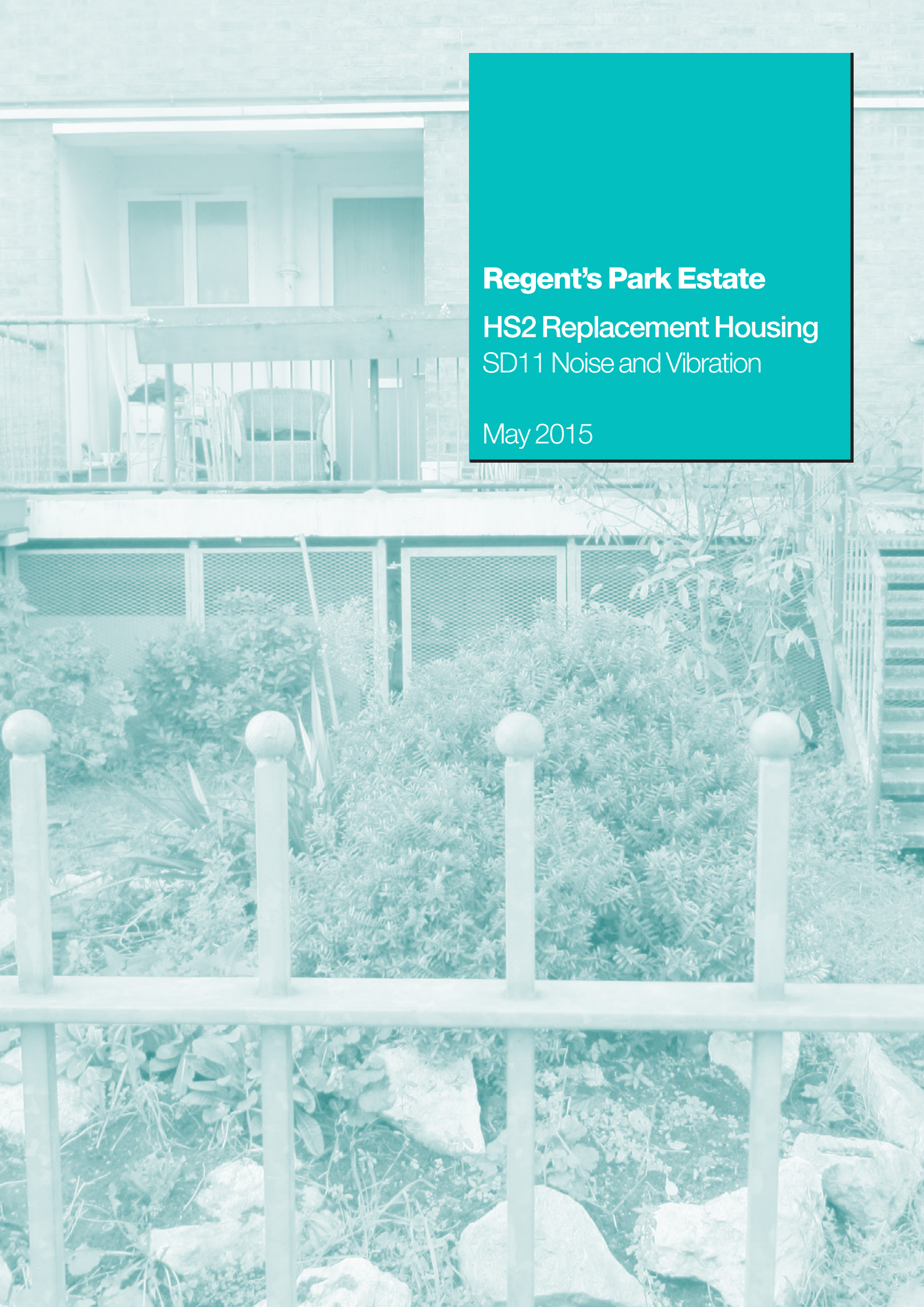
Appendix M – SD11 – Noise & Vibration Baseline Report



Regent's Park Estate

HS2 Replacement Housing

SD11 Noise and Vibration

May 2015

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Regent's Park Estate

Noise and Vibration

For

Camden

Project Number:

11775

May 2015

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Contents

Appendices

Tables

1.0 INTRODUCTION

1.1. ACCON UK Limited (ACCON) was commissioned by Campbell Reith Hill LLP ('CampbellReith') on behalf of the London Borough of Camden to carry out noise and vibration assessment which is required to support the planning application for the proposed replacement housing scheme in the Regent's Park Estate, London Borough of Camden.

1.2. This report summarises the Noise Impact Assessment (Ref: A2288/N/008) which is contained within **Appendix 1**.

1.3. Eleven sites that were assessed within the Noise Impact Assessment are listed within the first two columns of **Table 1.1** below. However, since the assessment was undertaken, the sites are now referred to as 'Plots' and only 9 of the previously identified 11 sites are being taken forward to planning. Plot 7 Camden People's Theatre (formally Site 9) will be applied for via a separate planning application. The Plots that are being taken forward to planning are listed in **Table 1.1** and will be referred to within this document.

Table 1-1: Superseded site names and plots being taken forward to planning

Sites / Blocks originally assessed		Plots being taken forward to planning	
Site / Block	Site / Block Name	Plot	Plot Name
1	Roberts Street Car Park	Plot 1:	Robert Street Car Park
2	Former One Stop Shop	Plot 2:	Former One Stop Shop
3	Varndell Street Corner	Plot 3:	Varndell Street Corner
4	Newlands Plot	Plot 4:	Newlands Plot
5	Dick Collins Hall	Plot 5:	Dick Collins Hall
6	Cape of Good Hope Public House	Plot 6:	Cape of Good Hope
7	Troutbeck Overbuilds	No longer considered	
8	Staveley / Newby Overbuilds	No longer considered	
9	Camden Peoples Theatre	Plot 7:	Camden Peoples Theatre*
10	Victory Public House	Plot 8:	The Victory Pub
11	St Bede's Mews	Plot 9:	St Bede's Mews

*Note that Plot 7 Camden Peoples Theatre will be applied for via a separate planning application

1.4. The locations of the 9 plots within the Regent's Park Estate are shown on **Figure 1.1.**

1.5. The purpose of this assessment has been to determine the effect of the existing noise and vibration environment on the proposed development. The assessment was undertaken using a combination of site monitoring and predictive modelling.

1.6. The assessment has also considered the impact of both the construction and operation of the High Speed 2 (HS2). In addition to determining the impact of noise across the various proposed development site locations, recommendations for mitigation are made where appropriate.

Sites originally assessed		Plots being taken forward to planning	
Site	Site Name	Plot	Plot Name
Site 1	Roberts Street Car Park	Plot 1:	Robert Street Car Park
Site 2:	Rydal Water Open Space	Plot 2:	Former One Stop Shop
Site 3:	Varndell Street	Plot 3:	Varndell Street Corner
Site 4:	Newlands Open Space	Plot 4:	Newlands Plot
Site 5:	Rothay / Dick Collins Community Hall	Plot 5:	Dick Collins Hall
Site 6:	Cape of Good Hope Public House	Plot 6:	Cape of Good Hope
Site 7:	Troutbeck Overbuilds	No longer considered	
Site 8:	Staveley / Newby Overbuilds	No longer considered	
Site 9:	Camden Peoples Theatre	Plot 7:	Camden People's Theatre
Site 10:	Victory Public House	Plot 8:	The Victory Pub
Site 11:	St Bede's Hall	Plot 9:	St Bede's Mews

Legend

Plot Boundary

1:10000@A4

Regents Park Estate

Client: Camden

Figure 1.1:
Location of Plots within Regent's Park Estate

Scale: 1:10000@A4

Job Number: 11775
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2.0 NOISE AND VIBRATION CRITERIA AND MEASUREMENT SURVEY

2.1. Assessment Criteria

2.1.1. An assessment of the potential impact that the current ambient noise climate may have on future residential occupiers of the proposed re-development at Regent's Park Estate has been undertaken using the noise assessment criteria within:

- National Planning Policy Framework;
- Noise Policy Statement for England;
- Planning Practice Guidance;
- London Borough of Camden DP28 – Noise and Vibration;
- British Standard BS 8233:2014;
- World Health Organisation Guidelines for Community Noise; and
- British Standard BS 6472:2008 Part 1: Vibration sources other than blasting.

2.2. Noise Monitoring

2.2.1. In order to characterise the existing noise climate, a detailed noise measurement study has been carried out at the proposed development plots. Noise measurements were carried out over a three hour period at thirteen noise monitoring positions utilising the shortened measurement procedure as described in the Technical Memorandum Calculation of Road Traffic Noise 1988 (CRTN). At the noise monitoring positions the ambient noise climate was dominated by local road traffic noise. Monitoring positions and their relation to the block designations are shown in **Table 2.1**.

Table 2-1: Monitoring positions related to block designations

Monitoring position	Plot
MP1	Plot 4 Newlands Plot (formally Site 4)
MP2	(Located near Staveley/Newby Overbuilds (North))
MP3	Plot 3 Varndell Street Corner (formally Site 3)
MP4	Plot 2 Former One Stop Shop (formally Site 2)
MP5	(Located near Staveley/Newby Overbuilds (South))
MP6	Plot 1 Roberts Street Car Park (formally Site 1)
MP7	Plot 5 Dick Collins Hall (formally Site 5)
MP8	Plot 8 The Victory Pub (formally Site 10)
MP9	(Located near Troutbeck Overbuilds)
MP10	Plot 9 St Bede's Mews (formally Site 11)
MP11	Plot 6 Cape of Good Hope (formally Site 6)
MP12	Plot 7 Camden People's Theatre (West) (formally Site 9)
MP13	Plot 7 Camden People's Theatre (North) (formally Site 9)

2.3. Road Traffic Noise

2.3.1. The level of road traffic noise currently present at the plots has been determined using the shortened measurements procedure, as presented in the technical Memorandum Calculation of Road Traffic Noise (CRTN). The results of the road traffic measurement survey and calculations are presented in **Table 2.2**.

Table 2-2: Road Noise Assessment Averaged Results

Block numbers used in assessment (Revised Plot number)	Measured Noise Levels	LA1018h (0600-0000)	LAeq, 16h (0700-2300)	LAeq, 12h (0700-1900)	LAeq,4h (1900-2300)	LAeq,8h (2300-0700)
1 (Plot 1)	62	61	59	59	56	51
2 (Plot 2)	74	73	70	71	68	62
3 (Plot 3)	63	62	60	60	57	52
4 (Plot 4)	74	73	70	71	68	62
5 (Plot 5)	64	63	61	61	58	53
6 (Plot 6)	73	72	69	70	67	61
7	72	71	68	69	66	60
8	67	66	64	64	61	56
9 (Plot 7)	75	74	71	72	69	63
10 (Plot 8)	72	71	68	69	66	60
11 (Plot 9)	57	56	54	55	51	47

2.4. Vibration Monitoring

2.4.1. The vibration assessment was carried out over a period of 6 hours between 1100 hrs and 1700 hrs on Tuesday 23rd September 2014 and Thursday 25th September 2014 and was used to obtain total vibration dose values (VDV) at four measurement positions. The major sources of vibration were heavy goods vehicles driving through Regents Park Estate and potentially from the railway lines serving Euston Station.

2.4.2. Vibration levels are presented in **Tables 2.3** and **2.4**.

Table 2-3: Measured Daytime Vibration Dose Values

Position	Vibration Dose Value (VDV) $m/s^{1.75}$		
Direction	X	Y	Z
MP1	0.11	0.17	0.09
MP6	0.01	0.04	0.04
MP7	0.05	0.11	0.06
MP10	0.02	0.07	0.05

Table 2-4: Derived Night-time Vibration Dose Values

Position	Vibration Dose Value (VDV) $m/s^{1.75}$		
Direction	X	Y	Z
MP1	0.09	0.14	0.08
MP6	0.01	0.03	0.04
MP7	0.04	0.09	0.05
MP10	0.02	0.06	0.04

2.4.3. The findings of the vibration impact assessment show that the VDV levels are between the BS 6472 criteria of 'low probability of adverse comment' and "adverse comment possible" and are below LBC's maximum criteria for 'residential sites at which planning permission will not be granted' for the daytime period. In comparison, the derived VDV measures at MP1 (Plot 4 Newlands Plot) exceed LBC's criteria for vibration during the night-time period. However, the derived values will tend to over-estimate the actual vibration values due to differences in traffic composition; proportion, and frequency, of high vibration vehicles (HGV/Trains) decreases at night. Therefore it is highly likely that during the night-time period vibration impacts will be less.

2.4.4. This vibration analysis provides a very good indication that adverse comments will not be made in relation to vibration and therefore vibration mitigation would not be required to comply with the vibration criteria set by LBC and within BS 6472. The results of the assessment are shown in **Table 2.5**.

Table 2-5: Vibration Impact Assessment

Direction	VDV ($m/s^{-1.75}$		BS6472: Residential Criterion	
	Daytime	Night-time	Daytime	Night-time
X	0.22	0.18	"Low probability of adverse comment"	"Low probability of adverse comment"
Y	0.32	0.28	"Low probability of adverse comment"	"Adverse comment possible"
Z	0.18	0.16	Blow "Low probability of adverse comment"	"Low probability of adverse comment"

3.0 HIGH SPEED 2 OPERATIONAL NOISE AND VIBRATION

3.1.1. ACCON have reviewed the Environmental Statement (ES) for HS2 to determine the impact it will have on noise levels at the proposed development plots at Regents Park Estate. **Table 3.1** identifies the baseline and operational free-field noise levels, as shown within the ES, at locations in close proximity to the specific development plots for the Regents Park Estate development.

Table 3-1: HS2 Baseline and Operational Noise Levels as Reported in the ES

Block numbers used within the assessment (Revised Plot numbers)	Closest HS2 Assessment Location	Baseline Noise Level			Operational Noise Level	
		Day (LAeq 12hr)	Evening (LAeq 4hr)	Night (LAeq 8hr)	Day (Laeq 16hr)	Night (LAeq 8hr)
1 (Plot 1)	710966	60.7	57.8	55.9	52	50
2 (Plot 2)	700394	60.3	58.4	56.1	60	56
3 (Plot 3)	525686	52.4	50.6	49.9	54	50
4 (Plot 4)	535768	64.0	59.2	56.9	65	58
5 (Plot 5)	710965	52.4	50.6	49.9	52	50
6 (Plot 6)	710960	67.7	65.8	63.5	68	64
7	710967	52.4	50.6	49.9	52	50
8	700394	60.3	58.4	56.1	60	56
9 (Plot 7)	539626	54.5	52.1	47.3	55	47
10 (Plot 8)	710960	67.7	65.8	63.5	68	64
11 (Plot 9)	710967	52.4	50.6	49.9	52	50

3.1.2. With respect to vibration, the predicted levels presented within the ES are approximately 0.02m/s1.75 during the daytime period and 0.01m/s1.75 during the night-time period, which is below the vibration criteria set by LBC and within BS 6472 which is a good indication that vibration from HS2 will not be a concern.

3.1.3. The future noise levels at each individual development plot has been determined by combining the baseline noise level and the future operational noise level from HS2. The higher baseline noise level from either ACCON's measurements or the HS2 ES has been used to determine a worst case for future day, evening and night-time noise levels. These are presented within **Tables 3.2** to **3.4**.

Table 3-2: Future Daytime Noise Levels (0700hrs – 1900hrs)

Blocks used within the assessment (Revised Plot numbers)	Baseline (LAeq 12hr)	HS2 future operational noise (LAeq 12hr)	Future Noise Level (LAeq 12hr)
1 (Plot 1)	61	52	61
2 (Plot 2)	71	60	71
3 (Plot 3)	60	54	61

Blocks used within the assessment (Revised Plot numbers)	Baseline (LAeq 12hr)	HS2 future operational noise (LAeq 12hr)	Future Noise Level (LAeq 12hr)
4 (Plot 4)	71	65	72
5 (Plot 5)	61	52	62
6 (Plot 6)	70	68	72
7	69	52	69
8	64	60	66
9 (Plot 7)	72	55	72
10 (Plot 8)	69	68	72
11 (Plot 9)	55	52	57

Table 3-3: Future Evening Noise Levels (1900hrs-2300hrs)

Blocks used within the assessment (Revised Plot numbers)	Baseline (LAeq 4hr)	HS2 future operational noise (LAeq 4hr)	Future Noise Level (LAeq 4hr)
1 (Plot 1)	56	52	59
2 (Plot 2)	68	60	69
3 (Plot 3)	57	54	59
4 (Plot 4)	68	65	70
5 (Plot 5)	58	52	59
6 (Plot 6)	67	68	71
7	66	52	66
8	61	60	64
9 (Plot 7)	69	55	69
10 (Plot 8)	66	68	70
11 (Plot 9)	51	52	55

Table 3-4: Future Night-time Noise Levels (2300hrs-0700hrs)

Blocks used within the assessment (Revised Plot numbers)	Baseline (LAeq 8hr)	HS2 future operational noise (LAeq 8hr)	Future Noise Level
1 (Plot 1)	56	50	57
2 (Plot 2)	62	56	63
3 (Plot 3)	52	50	54
4 (Plot 4)	62	58	64
5 (Plot 5)	53	50	55
6 (Plot 6)	64	64	67
7	60	50	60
8	56	56	59
9 (Plot 7)	63	47	63

Blocks used within the assessment (Revised Plot numbers)	Baseline (LAeq 8hr)	HS2 future operational noise (LAeq 8hr)	Future Noise Level
10 (Plot 8)	64	64	67
11 (Plot 9)	50	50	53

4.0 NOISE IMPACT ASSESSMENT

4.1. The predicted future noise levels at each plot have been compared with LBC noise criteria which gives noise levels above which planning permissions would not normally be granted. ACCON have added a +3dB correction to the noise levels in order to present the equivalent façade noise levels.

4.2. To summarise, planning permission would normally be granted for Plot 1 Robert Street Car Park (formally Site / Block 1), Plot 2 Former One Stop Shop (formally Site / Block 2) (evening and night), Plot 3 Varndell Street Corner (formally Site / Block 3), Plot 5 Dick Collins Hall (formally Site / Block 5) and Plot 7 Camden People's Theatre (formally Site / Block 9) (evening and night) and Plot 9 St Bede's Mews (formally Site / Block 11).

4.3. Noise mitigation is required for those plots which do not comply with LBC noise criteria which are Plot 4 Newlands Plot (formally Site / Block 4), Plot 6 Cape of Good Hope (formally Site / Block 6) and Plot 8 The Victory Pub (formally Site / Block 10).

5.0 DESIGN REQUIREMENTS

5.1. To ensure that the internal living conditions are acceptable in accordance with both BS 8233 and the WHO guidelines, the external building elements will need to be designed to provide appropriate levels of sound insulation. The sound insulation requirements have been considered specifically for those rooms in each block (**Table 5.1**) that will be subject to the highest noise levels and are representative of the different external building constructions proposed. Demonstrating that the appropriate internal noise levels can be achieved for these rooms will also demonstrate that the appropriate standards can be achieved for the rest of the development.

5.2. The predicted internal noise levels meet the BS8233 / WHO criteria for daytime noise levels for living rooms and night-time noise levels for bedrooms.

Table 5-1: Building Façade Element Construction Assumptions

Blocks used within the assessment (Revised Plot numbers)	Façade Element	Construction Assumption
1 (Plot 1)	External	Brick and block cavity wall Rw 49 dB
	Window	All floors – 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
2 (Plot 2)	External	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation Rw 50 dB
	Window	First floor - 6/10/8 acoustic laminate glazing Rw 32 dB Second to sixth floor – 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
3 (Plot 3)	External	Brick and block cavity wall Rw 49 dB
	Window	All floors – 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
4 (Plot4)	External	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation Rw 50 dB
	Window	First to Third floor - 6/10/8 acoustic laminate glazing Rw 32 dB Fourth to Tenth floor - 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
5 (Plot 5)	External	Brick and block cavity wall Rw 49 dB
	Window	All floors – 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
6 (Plot 6)	External	102mm brick outer wall and 150mm metal frame partition

Blocks used within the assessment (Revised Plot numbers)	Façade Element	Construction Assumption
		filled with rigid insulation Rw 50 dB
	Window	Ground Floor – 6/12/12 acoustic laminate glazing Rw 40 dB First to Second floor – 4/16/4 acoustic laminate glazing Rw 35 dB Third to Fourth floor – 6/10/8 acoustic laminate glazing Rw 32 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
9 (Plot 7)	External	Existing solid masonry Rw 49 dB
	Window	First and second floor - 6/10/8 acoustic laminate glazing Rw 32 dB Third floor - 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
10 (Plot 8)	External	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation Rw 50 dB
	Window	Ground Floor - 6/10/8 acoustic laminate glazing Rw 34 dB First floor to Fourth floor - 4/10/6 acoustic laminate glazing Rw 30 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows
11 (Plot 9)	External	Brick and block cavity wall filled with rigid insulation Rw 52 dB
	Window	All floors – 4/10/6 acoustic laminate glazing Rw 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows

6.0 BALCONY NOISE ASSESSMENT

6.1. The development proposals include balconies for each of the proposed flats, which will serve as the main outdoor amenity area. The following blocks, facades and floors that do not comply with the maximum external noise criteria set out in the WHO guidelines, which is 55 dB $L_{Aeq,16hr}$ are listed below:

- Block 2 East Façade Floors 1 – 6 (Plot 2)
- Block 2 West Façade Floors 1 – 2 (Plot 2)
- Block 4 East Façade Floors 1 – 10 (Plot 4)
- Block 4 West Façade Floors 1 – 2 (Plot 4)
- Block 6 West Façade Floors 1 – 3 (Plot 6)
- Block 10 West Façade Floors 1-3 (Plot 8)

6.2. To achieve noise reduction limits required for the above, a combination of Winter Gardens, solid balustrades (with a barrier height of 1100mm) and perforated balustrades (which a barrier height of 1100mm) should be utilised. The specific mitigation required for each floor and block is detailed in **Table 6.1** below.

Table 6-1: Balustrade Specifications

Plot	Floor	Floor	Required Mitigation	Maximum Perforation %
Plot 2 Former One Stop Shop	Block 2 East Façade	1	Winter garden	-
	Block 2 East Façade	2	Winter garden	-
	Block 2 East Façade	3	Solid Barrier	0
	Block 2 East Façade	4	Solid Barrier	0
	Block 2 East Façade	5	Solid Barrier	0
	Block 2 East Façade	6	Solid Barrier	0
Plot 2 Former One Stop Shop	Block 2 West Facade	1	Perforated Barrier	5
	Block 2 West Facade	2	Perforated Barrier	8
	Block 2 West Facade	3	Perforated Barrier	9
	Block 2 West Facade	4	Perforated Barrier	10
	Block 2 West Facade	5	Perforated Barrier	11
	Block 2 West Facade	6	Perforated Barrier	12
Plot 4 Newlands Plot	Block 4 East Facade	1	Winter Garden	-
	Block 4 East Facade	2	Winter Garden	-
	Block 4 East Facade	3	Winter Garden	-
	Block 4 East Facade	4	Solid Barrier	0
	Block 4 East Facade	5	Solid Barrier	0
	Block 4 East Facade	6	Solid Barrier	0
	Block 4 East Facade	7	Solid Barrier	0

Plot	Floor	Floor	Required Mitigation	Maximum Perforation %
	Block 4 East Facade	8	Solid Barrier	0
	Block 4 East Facade	9	Solid Barrier	0
	Block 4 East Facade	10	Solid Barrier	0
Plot 4 Newlands Plot	Block 4 West Façade	1	Solid Barrier	0
	Block 4 West Façade	2	Perforated Barrier	5
	Block 4 West Façade	3	Perforated Barrier	7
	Block 4 West Façade	4	Perforated Barrier	11
	Block 4 West Façade	5	Perforated Barrier	13
	Block 4 West Façade	6	Perforated Barrier	13
	Block 4 West Façade	7	Perforated Barrier	13
	Block 4 West Façade	8	Perforated Barrier	13
	Block 4 West Façade	9	Perforated Barrier	13
	Block 4 West Façade	10	Perforated Barrier	13
Plot 6 Cape of Good Hope	Block 6 West Façade	1	Perforated Barrier	1
	Block 6 West Façade	2	Perforated Barrier	3
	Block 6 West Façade	3	Perforated Barrier	4
	Block 6 West Façade	4	Perforated Barrier	4
	Block 6 West Façade	5	Perforated Barrier	5
Plot 8 The Victory Pub	Block 10 West Façade	1	Perforated Barrier	1
	Block 10 West Façade	2	Perforated Barrier	3
	Block 10 West Façade	3	Perforated Barrier	4
	Block 10 West Façade	4	Perforated Barrier	5

7.0 HIGH SPEED 2 – CONSTRUCTION NOISE AND VIBRATION IMPACTS

7.1. During the construction phase of HS2, significant noise and vibration impacts are expected at the Regents Park Estate.

7.2. The vibration effects during vibratory piling (which will occur for two different operations affecting the Regents Park Estate) are not expected to cause any damage to buildings, but are at a level where they could cause annoyance and disturbance to occupants of the flats.

Temporary Vibration Effects

7.3. The ES has identified during the Hampstead Road bridge construction works, that VDV level of 0.33 $m/s^{1.75}$ could occur at the south end of Cartmel House, which could therefore potentially effect the proposed Plot 4 Newlands Plot (formally Site / Block 4). The impact is expected to occur for approximately six weeks.

7.4. During 'pipe jacking' works it has been predicted that properties on Varndell Street could experience VDV levels of 0.96$m/s^{1.75}$. This could potentially effect the proposed Plot 3 Varndell Street Corner (formally Site / Blocks 3) and Plot 4 Newlands Plot (formally Site / Block 4) directly and may also be experienced at the proposed Plot 1 Robert Street Car Park (formally Site / Block 1) and Plot 2 Former One Stop Shop (Site / Block 2) The impact is expected to occur for approximately two weeks.

Temporary Noise Effects

7.5. Significant noise effects have been identified at the following plots for various aspects of the HS2 construction works:

- Plot 2 Former One Stop Shop (Site / Block 2)
- Plot 3 Varndell Street Corner (formally Site / Blocks 3)
- Plot 4 Newlands Plot (formally Site / Block 4)
- Plot 7 Camden People's Theatre (formally Site / Block 9)
- Plot 8 The Victory Pub (formally Site / Block 10)

7.6. At Plot 2 Former One Stop Shop (formally Site / Block 2) the significant noise impacts are during the daytime only and are from passing construction traffic. The predicted noise levels are 75-80 dB L_{Aeq}, although it is not clearly stated over what period of time these noise levels would occur.

7.7. At Plot 3 Varndell Street Corner (formally Site / Block 3, Plot 7 Camden People's Theatre (formally Site / Block 9) and Plot 8 The Victory Pub (formally Site / Block 10) the significant noise impacts are during the daytime only and are from utility trenching works. The predicted noise levels are 63-79 dB L_{Aeq} at Plot 3 and 7 and 70-80 dB L_{Aeq} Plot 8. It is not clearly over what period of time these noise levels would occur.

7.8. Significant noise effects have been identified during both the daytime and night-time periods for the south end of Cartmel House, and it is likely that the proposed Plot 4 Newlands Plot will experience similar noise levels. During the daytime, noise levels of 68-80 dB L_{Aeq} have been predicted due to demolition works. During the night-time, noise levels of 59-68 dB L_{Aeq} have

been predicted due to bridge construction works. Again, it is not clearly stated over what period of time these noise levels would occur.

7.9. The facade sound insulation measures proposed in **Table 5.1** would offer mitigation against the predicted construction noise effects. The residual noise level from HS2 construction noise inside the proposed flats, with windows closed, is detailed in **Table 7.1**.

Table 7-1: Residual Construction Noise Levels

Blocks used in assessment (Revised Plot numbers)	Floor	Highest Predicted Noise Level (L_{Aeq})	Day/Night	Glazing Specification	Likely Internal Noise Level with Windows Closed (L_{Aeq})
2 (Plot 2)	1	80	Day	32	48
2 (Plot 2)	2 to 6	80	Day	28	52
3 (Plot 3)	All	79	Day	28	51
9 (Plot 7)	1 to 2	79	Day	32	47
9 (Plot 7)	3	79	Day	28	51
10 (Plot 8)	G to 2	80	Day	34	46
10 (Plot 8)	3 to 4	80	Day	30	50
4 (Plot 4)	1 to 3	80	Day	34	46
4 (Plot 4)	4 to 10	80	Day	30	50
4 (Plot 4)	**1 to 3**	**68**	**Night**	**34**	**34**
4 (Plot 4)	**4 to 10**	**68**	**Night**	**30**	**38**

Trigger Action Plan

7.10. It is likely that a Trigger Action Plan (TAP) will be produced for HS2 construction works before the construction works begin, and it should include the proposed new blocks with respect to noise and vibration mitigation measures.

8.0 CONCLUSION

8.1. In order to support a planning application for the proposed re-development of Regents Park Estate in Camden, a detailed noise and vibration assessment has been carried out.

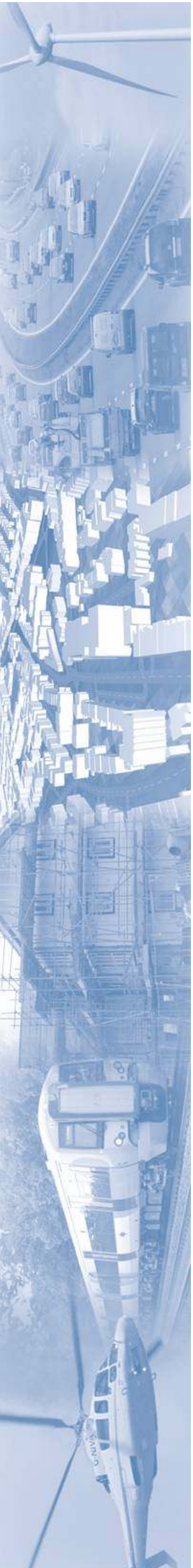
8.2. The assessment has identified the level of façade sound insulation that will be required for each proposed block, and has taken into account the future noise levels once High Speed 2 (HS2) is operational. The noise levels on the proposed balconies have also been assessed and, where necessary, noise mitigation has been specified. The level of sound insulation identified would achieve compliance with the guidelines of LBC, BS8233 and the WHO guidelines for the daytime and night-time periods.

8.3. It has been identified that the levels of vibration from existing sources at the proposed blocks are below the "*low probability of adverse comment*" set out in BS 6472 and LBCs vibration criteria during the daytime period. The derived night-time vibration levels exceed the criteria set by LBC and BS 6472, however, this is highly unlikely to occur as the number of heavy goods vehicles will be greatly reduced during the night-time period. Therefore the derived vibration levels are significantly higher than that which would actually be experienced. This indicates that it is extremely unlikely that any adverse comment will be generated with respect to vibration and therefore no mitigation for vibration is considered necessary.

8.4. Achievement of the target noise criteria ensures compliance with the overall aims of paragraph 123 of the NPPF in that noise will not result in any significant adverse effects on health or quality of life for future occupants of the proposed developments.

8.5. The noise and vibration effects of the construction phase of HS2 have also been assessed within Chapter 7 and it has been identified that the construction noise levels are not likely to have a significant effect during the day, or at night.

Appendix 1: Noise Impact Assessment (ACCON UK, May2015)



ENVIRONMENTAL CONSULTANTS

Report for

Campbell Reith Hill LLP

Regents Park Estate, Camden

Noise Impact Assessment

Status: Final **Date: 14.05.2015**

Campbell Reith Hill LLP

Noise and Vibration Assessment – Regents Park Estate, Camden

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1. INTRODUCTION

ACCON have been commissioned by Campbell Reith Hill LLP to carry out a noise and vibration assessment, which is required to be submitted in support of the planning application for the proposed rehousing scheme in Regents Park Estate.

The site is located to the west of London Euston Railway Station and to the east of Regents Park. The site is within the administrative boundary of the London Borough of Camden (LBC).

The purpose of this assessment has been to assess, through on-site noise and vibration measurements and also predictions, the extent to which the existing ambient noise and vibration climate will affect the proposed residential development. The principal source of noise which affects the proposed development site is road traffic noise from the local road network. The assessment has also considered the impact of the High Speed 2 rail scheme on the proposed development during both the construction and operational phases of HS2. In addition to determining the impact of noise across the various proposed development site locations, recommendations for mitigation are made where appropriate. An acoustic glossary is provided in **Appendix 1** and a site location plan is displayed in **Figure 1.1** below, with proposed development locations being numbered 1-11.

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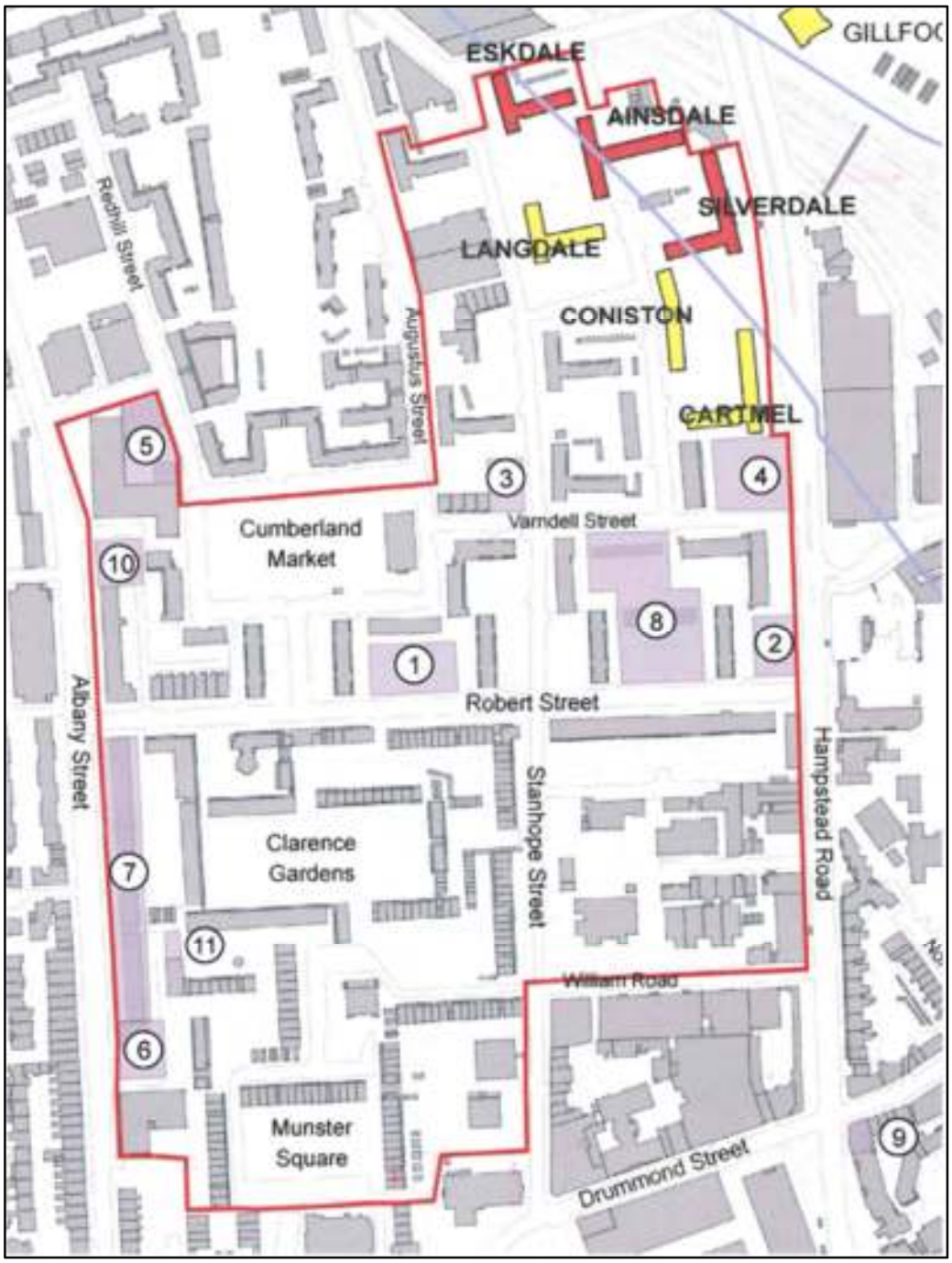
Figure 1.1: Site Location with Proposed Development Locations



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2. THE NATURE, MEASUREMENT AND EFFECT OF NOISE AND VIBRATION

2.1. Noise

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to measure the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB (A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels from say 60 dB (A) to 70 dB (A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB (A) to 60 dB (A) would represent a halving in 'loudness'. A change of 3 dB (A) is generally considered to be just perceptible[1]. **Table 2.1** details typical noise levels.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

[1] Communities & Local Government (1994). Planning Policy Guidance 24: Planning & Noise (now revoked)

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2.2. Vibration

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

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

The effects of groundborne vibration on buildings are dependent upon a whole range of factors, not least the magnitude and duration of the vibration, the structure of the soil, the properties and quality of the building materials, the design of the structure, as well as the general condition and age of the structure. In extreme cases, vibration can cause severe structural damage, but most vibration damage manifests itself in minor cosmetic damage such as cracks in rendering and roof tiles slipping, which in turn can cause other problems such as damp. Groundborne vibration impacts on buildings is generally measured using the Peak Particle Velocity (PPV) expressed in mm/s. This is the maximum instantaneous velocity of a particle at a point during a given time interval.

Human exposure to vibration can cause annoyance, but in some cases can also cause health problems, especially from the stress and anxiety of prolonged annoyance. Humans are known to be very sensitive to vibration, with a threshold of perception typically in the particle velocity range of 0.15 mm/s to 0.3 mm/s at frequencies between 1 Hz and 80 Hz. Human exposure to vibration is measured using a Vibration Dose Value (VDV) expressed in $m/s^{1.75}$. This measures the overall exposure to vibration that a person might receive over a given time period within a building.

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3. NOISE AND VIBRATION ASSESSMENT CRITERIA

An assessment of the potential impact that the current ambient noise climate may have on future residential occupiers of the proposed re-development at Regents Park Estate is required. This section of the report therefore outlines those noise assessment criteria which are considered to be applicable for this type of assessment.

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was released in March 2012 and has replaced the Planning Policy Guidance which previously covered planning and pollution control and new development in England. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.

Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life arising from noise from new development, including through the use of conditions;
- 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 use since they were established (Subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and
- 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.

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3.2. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The vision of the NPSE is to '*Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.*

The NPSE aims to *'through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life'*

3.3. Planning Practice Guidance

The Planning Practice Guidance (PPG), published March 2014, provides advice on how to determine the noise impact on development:

"*Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:*

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy."

The document goes on to provide a definition for the levels of noise exposure at which an effect may occur:

"***Significant observed adverse effect level:*** *this is the level of noise exposure above which significant adverse effects on health and quality of life occur.*

Lowest observed adverse effect level: *this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*

No observed effect level: *this is the level of noise exposure below which no effect at all on health and quality of life can be detected.*"

It is important to understand that as the PPG does not provide any advice with respect to specific noise levels/ limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment.

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3.4. London Borough of Camden DP28 – Noise and Vibration

LBC's Development Policy 28 (adopted November 2010) gives guidance on noise and vibration within the Camden area and contains criteria, by way of Noise and Vibration Thresholds, which when assessing planning applications LBC will have regard to the Noise and Vibration Thresholds. The policy is reproduced below.

Policy DP28 - Noise and vibration

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 (sic) harm to amenity and does not exceed our noise thresholds.

The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.

The criteria relevant to the proposed development are summarised in **Tables 3.1** to **3.3** below.

Table 3.1: Noise levels on residential sites above which planning permission will not be granted

Noise description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	74 dB $L_{Aeq'12h}$	72 dB $L_{Aeq'12h}$
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	74 dB $L_{Aeq'4h}$	72 dB $L_{Aeq'4h}$
Noise at 1 metre external to a sensitive façade	Night	2300-0700	66 dB $L_{Aeq'8h}$	66 dB $L_{Aeq'8h}$

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Table 3.2: Noise levels on residential sites at and above which attenuation measures will be required

Noise description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	65 dB $L_{Aeq'12h}$	62 dB $L_{Aeq'12h}$
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	60 dB $L_{Aeq'4h}$	57 dB $L_{Aeq'4h}$
Noise at 1 metre external to a sensitive façade	Night	2300-0700	55 dB $L_{Aeq'1h}$	52 dB $L_{Aeq'1h}$
Individual Noise events several times an hour	Night	2300-0700	>82 dB L_{ASmax}	>82 dB L_{ASmax}

Table 3.3: Vibration levels on residential sites at which planning permission will not be granted

Vibration description and location of measurement	Period	Time	Vibration levels
Noise at 1 metre external to a sensitive façade	Day and Evening	0700 - 2300	0.2 to 0.4 VDV $ms^{-1.75}$
Noise at 1 metre external to a sensitive façade	Night	2300 - 0700	0.13 VDV $ms^{-1.75}$

3.5. British Standard BS 8233:2014

BS 8233: *Sound Insulation and Noise Reduction for Buildings – Code of Practice* has a number of design criteria and limits for intrusive external noise. The guidelines are designed to achieve reasonable resting/sleeping conditions in bedrooms and good listening conditions in other rooms and the most appropriate to the residential environment are reproduced in **Table 3.4**.

Table 3.4: Indoor Ambient Noise Levels for Dwellings

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

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3.6. World Health Organisation Guidelines for Community Noise

The World Health Organisation (WHO) has developed guidelines designed to minimise the adverse effects of noise. The guidelines relevant to residential noise exposure are detailed in **Table 3.5**. For each specific environment the stated noise levels are the maximum noise levels to avoid the health effect noted.

Table 3.5: WHO Community Noise Guideline Values

Specific Environment	Critical health effect(s)	L_{Aeq} dB	Time Base (hours)	L_{Amax} (fast) dB
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

The WHO guidelines state that with respect to the L_{Amax} threshold that, '*For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10 – 15 times per night'* (Vallet and Vernet 1991).

3.7. Human Response to Vibration

British Standard BS 6472 Part 1 is the main guidance document utilised for this vibration assessment. It provides guidance for measuring and evaluating human exposure to vibration.

British Standard BS 6472:2008 Part 1: Vibration sources other than blasting

This is the British Standard methodology used for measuring and evaluating human exposure to vibration where the source of vibration does not arise from blasting activities. **Table 3.8** below summarises the levels of vibration dose values (VDV) and the corresponding probability of adverse comments.

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Table 3.6: BS 6472 - Vibration dose values which might result in various probabilities of adverse comment within residential buildings.

Place and Time	Low probability of adverse comment ($m/s^{1.75}$)	Adverse comment possible ($m/s^{1.75}$)	Adverse comment probable ($m/s^{1.75}$)
Residential buildings - 16hr day	0.2 - 0.4	0.4 - 0.8	0.8 - 1.6
Residential buildings - 8hr night	0.1 - 0.2	0.2 - 0.4	0.4 - 0.8

Accordingly, the design aim is to ensure that the possibility of adverse comment does not occur.

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4. NOISE AND VIBRATION MEASUREMENT SURVEY

4.1. Noise Monitoring

In order to characterise the existing noise climate, a detailed noise measurement study has been carried out at the proposed development sites. Noise measurements were carried out over a three hour period at thirteen noise monitoring positions utilising the shortened measurement procedure as described in the Technical Memorandum Calculation of Road Traffic Noise 1988 (CRTN).

Noise measurements were obtained at a height of 1.5m at the proposed boundary of each of the development sites, 1 – 11, as identified in **Figure 1.1**.

At the noise monitoring positions the ambient noise climate was dominated by local road traffic noise. The noise monitoring positions are shown on a site layout plan in **Appendix 2**.

The noise measurements utilised Norsonic 118 and Rion NL-52 Type 1 Precision Sound Level Meters, which hold current certificates of calibration. Before and after the measurement period, the equipment was calibrated in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB). Measurements were carried out between 1100 hrs and 1700 hrs on Tuesday 23rd and Thursday 25th September 2013. The weather was dry and sunny with some very light wind (<1 m/s) and a temperature of between 11°C and 18°C.

The measured noise levels from the free-field noise measurement positions are shown in **Table 4.1** below. The detailed noise measurement results are displayed in **Appendix 3**.

4.2. Road Traffic Noise

The level of road traffic noise currently present at the site has been determined using the shortened measurement procedure, as presented in the Technical Memorandum Calculation of Road Traffic Noise (CRTN), first published in 1988. The shortened measurement procedure allows for measurement of the L_{A10} for just three hours, between 1100 and 1700 hrs. The measured $L_{A10,3h}$ can then be converted to $L_{A10,18h}$ by use of the simple formula:

$L_{A10,18h} = L_{A10,3h} – 1$ dB

The relationship between $L_{A10,18h}$ and both the $L_{Aeq,16h}$ and $L_{Aeq,8h}$ has been defined by TRL and Casella Stanger for Defra in their report 'Method for converting the UK road traffic noise index $L_{A10,18h}$ to the EU noise indices for road noise mapping' dated 24th January 2006 as:

L_{day} ($L_{Aeq,12h}$) = 0.98 x $L_{A10,18h}$ + 1.44 dB

$L_{evening}$ ($L_{Aeq,4h}$) = 0.97 x $L_{A10,18h}$ - 2.87 dB

L_{night} ($L_{Aeq,8h}$) = 0.87 x $L_{A10,18h}$ - 3.77 dB

The results of the road traffic measurement survey and calculations of the $L_{Aeq,18h}$, $L_{Aeq,16h}$, $L_{Aeq,12h}$, $L_{Aeq,4h}$ and $L_{Aeq,8h}$ are presented in **Table 4.1**. A table showing the names and numbers of each of the proposed blocks is presented in **Appendix 4**.

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Table 4.1: Road Noise Assessment Averaged Results

Block	Measured Noise Level $L_{A10,3h}$	$L_{A10,18h}$ (0600 – 0000)	$L_{Aeq,16h}$ (0700 – 2300)	$L_{Aeq,12h}$ (0700 – 1900)	$L_{Aeq,4h}$ (1900 – 2300)	$L_{Aeq,8h}$ (2300 – 0700)
1	62	61	59	59	56	51
2	74	73	70	71	68	62
3	63	62	60	60	57	52
4	74	73	70	71	68	62
5	64	63	61	61	58	53
6	73	72	69	70	67	61
7	72	71	68	69	66	60
8	67	66	64	64	61	56
9	75	74	71	72	69	63
10	72	71	68	69	66	60
11	57	56	54	55	51	47

4.3. Vibration Monitoring

The vibration assessment was carried out over a period of 6 hours between 1100 hrs and 1700 hrs on Tuesday 23rd September 2014 and Thursday 25th September 2014 and was used to obtain total vibration dose values (VDV) at four measurement positions.

A Rion DA-20 Data Logger was utilised with a PCB accelerometer, which due to soft ground was mounted on a ground spike at MP1. At MP6, MP7 and MP10 the accelerometer was placed onto a metal plate placed directly onto the hard ground. The mounting plate (DIN plate) is in accordance with the requirements identified in the DIN standard 45669-2:2005. Measurements were made for three hours at MP1, one hour at MP6 and two hours at MP7 and MP10.

The major sources of vibration were heavy goods vehicles driving through Regents Park estate and potentially from the railway lines serving Euston Station.

The vibration dose value is used as a metric to define the level of exposure of the human population to vibration. The measurement period has been utilised to represent the whole daytime period; it has been assumed that the measurement period contained typical vibration levels. The daytime levels were then energetically summed over the daytime period. The VDV for the 16 hr daytime period has been determined from the measurement data by using the procedure stated in BS 6472, using the following formula:

$$VDV_{b/d,day} = \left(\frac{t_{day}}{t_{\tau}}\right)^{0.25} \times VDV_{b/d,\tau}$$

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The total energy levels for each directional axis (X being north facing, Y being east facing and Z being vertical) over the measurement period are presented in **Table 4.2**.

Table 4.2: Measured Daytime Vibration Dose Values

Position	Vibration Dose Value (VDV) $m/s^{1.75}$		
Direction	**X**	**Y**	**Z**
MP1	0.11	0.17	0.09
MP6	0.01	0.04	0.04
MP7	0.05	0.11	0.06
MP10	0.02	0.07	0.05

Night-time vibration levels, shown in **Table 4.3** below have been derived from the daytime vibration measurements. The levels shown are a very worst case as the proportion of heavy goods vehicles and trains passing by would be greatly reduced during the night-time period.

Table 4.3: Derived Night-time Vibration Dose Values

Position	Vibration Dose Value (VDV) $m/s^{1.75}$		
Direction	**X**	**Y**	**Z**
MP1	0.09	0.14	0.08
MP6	0.01	0.03	0.04
MP7	0.04	0.09	0.05
MP10	0.02	0.06	0.04

It has been assumed that an amplification factor of 2, due to the height of the building and floor resonances, will occur from the ground vibration measurements obtained on site. The measured vibration data from the worst case measurement location (MP1), when adjusted using the amplification factor, has been compared against the criteria presented in BS 6472. The results of this comparison is presented in **Table 4.4**.

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Table 4.4: Vibration impact assessment

Direction	VDV ($m/s^{-1.75}$)		BS6472: Residential Criterion	
	Daytime	Night-time	Daytime	Night-time
X	0.22	0.18	*"Low probability of adverse comment"*	*"Low probability of adverse comment"*
Y	0.32	0.28	*"Low probability of adverse comment"*	*"Adverse comment possible"*
Z	0.18	0.16	*Below "Low probability of adverse comment"*	*""Low probability of adverse comment"*

It can be seen from the values in **Table 4.4**, in comparison to the values in **Table 3.3** and **Table 3.6**, that the VDV levels are within or below the BS 6472 criteria of '*low probability of adverse comment*' and is below LBC's maximum criteria for '*residential sites at which planning permission will not be granted*' for the daytime period as shown in **Table 3.3** and **Table 3.6** respectively.

Table 4.4 indicates that, in comparison to the values in **Table 3.3**, the VDV measured at MP1 exceeds LBC's criteria for vibration during the night-time period. However, because the vibration levels are derived from measurements during the daytime period, it is highly likely that the vibration levels presented in **Table 4.4** will be significantly higher than the actual levels that would be experienced during the night-time period. The vibration levels at night will be lower than during the daytime as the proportion of heavy goods vehicles and trains passing by would be greatly reduced during the night-time period.

This vibration analysis provides a very good indication that adverse comments will not be made in relation to vibration and therefore vibration mitigation would not be required to comply with the vibration criteria set by LBC and within BS 6472.

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5. HIGH SPEED 2 OPERATIONAL NOISE AND VIBRATION

5.1. Review of HS2 Environmental Statement

ACCON have reviewed the Environmental Statement (ES) for HS2 to determine the impact it will have on noise levels at the proposed developments at Regents Park Estate. **Table 5.1** identifies the baseline and operational free-field noise levels, as shown within the ES, at locations in close proximity to the specific development blocks for the Regents Park Estate development. A table showing the names and numbers of each of the proposed blocks is presented in **Appendix 4**.

Table 5.1: HS2 Baseline and Operational Noise Levels as Reported in the ES

Block	Closest HS2 Assessment Location	Baseline Noise Level			Operational Noise Level	
		Day ($L_{Aeq\ 12hr}$)	Evening ($L_{Aeq\ 4hr}$)	Night ($L_{Aeq\ 8hr}$)	Day ($L_{Aeq\ 16hr}$)	Night ($L_{Aeq\ 8hr}$)
1	710966	60.7	57.8	55.9	52	50
2	700394	60.3	58.4	56.1	60	56
3	535686	52.4	50.6	49.9	54	50
4	535768	64.0	59.2	56.9	65	58
5	710965	52.4	50.6	49.9	52	50
6	710960	67.7	65.8	63.5	68	64
7	710967	52.4	50.6	49.9	52	50
8	700394	60.3	58.4	56.1	60	56
9	539626	54.5	52.1	47.3	55	47
10	710960	67.7	65.8	63.5	68	64
11	710967	52.4	50.6	49.9	52	50

With respect to vibration, the predicted levels presented within the ES are approximately $0.02m/s^{1.75}$ during the daytime period and $0.01m/s^{1.75}$ during the night-time period, which is below the vibration criteria set by LBC and within BS 6472 which is a good indication that vibration from HS2 will not be a concern.

5.2. Future Noise Levels

The future noise levels at each of the individual development blocks has been determined by combining the baseline noise level and the future operational noise level from HS2. The higher baseline noise level from either ACCON's measurements or the HS2 ES has been used to determine a worst case for future day, evening and night-time noise levels. These future noise free-field levels are presented in **Tables 5.2** to **5.4** respectively.

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Table 5.2: Future Daytime Noise Levels (0700hrs-1900hrs)

Block	Baseline ($L_{Aeq\ 12hr}$)	HS2 future operational noise ($L_{Aeq\ 12hr}$)	Future Noise Level ($L_{Aeq\ 12hr}$)
1	61	52	61
2	71	60	71
3	60	54	61
4	71	65	72
5	61	52	62
6	70	68	72
7	69	52	69
8	64	60	66
9	72	55	72
10	69	68	72
11	55	52	57

Table 5.3: Future Evening Noise Levels (1900hrs-2300hrs)

Block	Baseline ($L_{Aeq\ 4hr}$)	HS2 future operational noise ($L_{Aeq\ 4hr}$)	Future Noise Level ($L_{Aeq\ 4hr}$)
1	56	52	59
2	68	60	69
3	57	54	59
4	68	65	70
5	58	52	59
6	67	68	71
7	66	52	66
8	61	60	64
9	69	55	69
10	66	68	70
11	51	52	55

Table 5.4: Future Night-time Noise Levels (2300hrs-0700hrs)

Block	Baseline ($L_{Aeq\ 8hr}$)	HS2 future operational noise ($L_{Aeq\ 8hr}$)	Future Noise Level ($L_{Aeq\ 8hr}$)
1	56	50	57
2	62	56	63
3	52	50	54
4	62	58	64
5	53	50	55
6	64	64	67
7	60	50	60
8	56	56	59
9	63	47	63
10	64	64	67
11	50	50	53

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6. NOISE IMPACT ASSESSMENT

The predicted future noise levels at each block have been compared with the LBC noise criteria given in **Table 3.1** which gives noise levels above which planning permission would not normally be granted. We have added a +3dB correction to the noise levels presented in **Tables 5.2** to **5.4** above in order present the equivalent façade noise levels. This comparison is presented in **Table 6.1** below. A table showing the names and numbers of each of the proposed blocks is presented in **Appendix 4**.

Table 6.1: Comparison with Planning Permission Criteria

Block	Period	Period (hrs)	Predicted Future Ground Floor Façade Noise Level (L_{Aeq})	Noise Level Criteria (L_{Aeq})	Planning Permission Normally Granted
1	Day	0700 – 1900	64	72	Yes
	Evening	1900 – 2300	62	72	Yes
	Night	2300 – 0700	60	66	Yes
2	Day	0700 – 1900	74	72	No
	Evening	1900 – 2300	72	72	Yes
	Night	2300 – 0700	66	66	Yes
3	Day	0700 – 1900	64	72	Yes
	Evening	1900 – 2300	62	72	Yes
	Night	2300 – 0700	57	66	Yes
4	Day	0700 – 1900	75	72	No
	Evening	1900 – 2300	73	72	No
	Night	2300 – 0700	67	66	No
5	Day	0700 – 1900	65	72	Yes
	Evening	1900 – 2300	62	72	Yes
	Night	2300 – 0700	58	66	Yes
6	Day	0700 – 1900	75	72	No
	Evening	1900 – 2300	74	72	No
	Night	2300 – 0700	70	66	No
7	Day	0700 – 1900	72	72	Yes
	Evening	1900 – 2300	69	72	Yes
	Night	2300 – 0700	63	66	Yes
8	Day	0700 – 1900	69	72	Yes
	Evening	1900 – 2300	67	72	Yes
	Night	2300 – 0700	62	66	Yes
9	Day	0700 – 1900	75	72	No
	Evening	1900 – 2300	72	72	Yes
	Night	2300 – 0700	66	66	Yes
10	Day	0700 – 1900	75	72	No
	Evening	1900 – 2300	73	72	No
	Night	2300 – 0700	70	66	No
11	Day	0700 – 1900	60	72	Yes
	Evening	1900 – 2300	58	72	Yes
	Night	2300 – 0700	56	66	Yes

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It can be seen, by comparison of the predicted future noise levels with the LBC noise criteria given in **Table 3.2** that noise mitigation measures are required for the majority of the proposed blocks.

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7. DESIGN REQUIREMENTS

To ensure that the internal living conditions are acceptable in accordance with both BS 8233 and the WHO guidelines, the external building elements will need to be designed to provide appropriate levels of sound insulation. The sound insulation requirements have been considered specifically for those rooms in each block that will be subject to the highest noise levels and are representative of the different external building constructions proposed. Demonstrating that the appropriate internal noise levels can be achieved for these rooms will also demonstrate that the appropriate standards can be achieved for the rest of the development.

We have assumed that each individual building element will be constructed as set out in **Table 7.1** below. Blocks 7 and 8 have not been considered as no layout plans have been provided. A table showing the names and numbers of each of the proposed blocks is presented in **Appendix 4**.

Table 7.1: Building Façade Element Construction Assumptions

Block	Façade Element	Construction Assumption
1	External wall	Brick and block cavity wall R_w 49 dB.
	Window	All floors – 4/10/6 acoustic laminate glazing R_w 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
2	External wall	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation R_w 50 dB.
	Window	First floor - 6/10/8 acoustic laminate glazing R_w 32 dB Second to sixth floor – 4/10/6 acoustic laminate glazing R_w 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
3	External wall	Brick and block cavity wall R_w 49 dB.
	Window	All floors – 4/10/6 acoustic laminate glazing R_w 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
4	External wall	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation R_w 50 dB.
	Window	First to Third floor - 6/10/8 acoustic laminate glazing R_w 32 dB Fourth to Tenth floor - 4/10/6 acoustic laminate glazing R_w 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
5	External wall	Brick and block cavity wall R_w 49 dB.
	Window	All floors – 4/10/6 acoustic laminate glazing R_w 28 dB

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Block	Façade Element	Construction Assumption
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
6	External wall	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation R_w 50 dB.
	Window	Ground Floor – 6/12/12 acoustic laminate glazing R_w 40 dB First to Second floor – 4/16/4 acoustic laminate glazing R_w 35 dB Third to Fourth floor – 6/10/8 acoustic laminate glazing R_w 32 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
9	External wall	Existing solid masonry R_w 49 dB.
	Window	First and second floor - 6/10/8 acoustic laminate glazing R_w 32 dB Third floor - 4/10/6 acoustic laminate glazing R_w 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
10	External wall	102mm brick outer wall and 150mm metal frame partition filled with rigid insulation R_w 50 dB.
	Window	Ground Floor - 6/10/8 acoustic laminate glazing R_w 34 dB First floor to Fourth floor - 4/10/6 acoustic laminate glazing R_w 30 dB
	Ventilation	Trickle Vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.
11	External wall	Brick and block cavity wall filled with rigid insulation R_w 52 dB.
	Window	All floors – 4/10/6 acoustic laminate glazing R_w 28 dB
	Ventilation	Trickle vents or mechanical ventilation in order to achieve the same noise reduction as the proposed windows.

Table 7.2 identifies the predicted internal noise levels for each of the identified rooms. **Table 7.2** also confirms that the predicted internal noise levels meet the BS 8233/WHO criteria for daytime noise levels for living rooms and night-time noise levels for bedrooms.

Table 7.2: Predicted Internal Noise Levels

Location	External Free-field Noise Levels dB		Glazing Sound Insulation dB(A)	Internal Noise Levels dB		Compliance with Criteria	
	Day $L_{Aeq\ 16\ hours}$	Night $L_{Aeq\ 8\ hours}$		Day $L_{Aeq\ 16\ hours}$	Night $L_{Aeq\ 8\ hours}$	BS 8233	WHO
Block 1, All Residential Floors	55	50	28	27	23	✓	✓
Block 2, First Floor	65	57	32	32	24	✓	✓

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Location	External Free-field Noise Levels dB		Glazing Sound Insulation dB(A)	Internal Noise Levels dB		Compliance with Criteria	
	Day $L_{Aeq\ 16\ hours}$	Night $L_{Aeq\ 8\ hours}$		Day $L_{Aeq\ 16\ hours}$	Night $L_{Aeq\ 8\ hours}$	BS 8233	WHO
Block 2, Second to Sixth Floor	63	25	28	34	25	✓	✓
Block 3, All Floors	61	54	28	31	24	✓	✓
Block 4, First to Third Floor	66	57	32	34	25	✓	✓
Block 4, Fourth to Tenth Floor	61	52	28	33	24	✓	✓
Block 5, All Floors	61	55	28	31	25	✓	✓
Block 6, Ground Floor	72	67	40	35	30	✓	✓
Block 6, First to Second Floor	67	63	35	35	30	✓	✓
Block 6, Third to Fourth Floor	65	60	32	35	30	✓	✓
Block 9, First and Second Floor	65	57	32	35	26	✓	✓
Block 9,Third Floor	61	53	28	32	23	✓	✓
Block 10, Ground to Second Floor	72	67	34	34	29	✓	✓
Block 10, Third to Fourth Floor	64	60	30	34	29	✓	✓
Block 11, All Floors	57	53	28	28	24	✓	✓

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8. BALCONY NOISE ASSESSMENT

The development proposals include balconies for each of the proposed flats, which will serve as the main outdoor amenity area. **Table 8.1** identifies the predicted external noise levels for each of the identified example balcony areas and compares this noise level against the maximum external noise criteria set out in the WHO guidelines, which is 55 dB $L_{Aeq,16hr}$. A table showing the names and numbers of each of the proposed blocks is presented in **Appendix 4**.

Table 8.1: Predicted External Noise Levels

Location	Floor	Predicted External Noise Levels on Balcony area dBA	Compliance with Criteria
Block 1	1	53	✓
Block 2, East Facade	1[1]	68	X
Block 2, East Facade	6[1]	56	X
Block 2, West Facade	1	60	X
Block 2, West Facade	3[2]	54	✓
Block 3	1	51	✓
Block 4, East Facade	1[1]	70	X
Block 4, East Facade	10[1]	56	X
Block 4, West Facade	1	62	X
Block 4, West Facade	3	54	✓
Block 5	1	53	✓
Block 6	1[1]	66	X
Block 6	3[1]	57	X
Block 6	4[2]	54	✓
Block 10	1[1]	65	X
Block 10	4[1]	54	✓

Notes: (1) – The floors between these elevations also do not comply with the criteria.

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(2) – The floors above these elevations do comply with the criteria

It can be seen, with reference to **Table 8.1**, that the external noise level criteria will not be achieved on all floors for all blocks. For those areas where the external noise level criteria are not achieved, it will be necessary to provide noise mitigation measures. **Table 8.2** below identifies the balconies that do not achieve the specified noise criteria, and the level of noise reduction that will be required.

Table 8.2: Required Noise Mitigation – Balcony Area

Location	Floor	Predicted External Noise Levels on Balcony area dBA	Noise Level Criteria dBA	Noise Reduction Required dB
Block 2, East Façade	1	68	55	13
Block 2, East Façade	2	65	55	10
Block 2, East Façade	3	61	55	6
Block 2, East Façade	4	59	55	4
Block 2, East Façade	5	57	55	2
Block 2, East Façade	6	56	55	1
Block 2, West Façade	1	60	55	5
Block 2, West Façade	2	57	55	2
Block 4, East Façade	1	70	55	15
Block 4, East Façade	2	67	55	12
Block 4, East Façade	3	63	55	8
Block 4, East Façade	4	60	55	5
Block 4, East Façade	5	59	55	4
Block 4, East Façade	6	58	55	3
Block 4, East Façade	7	58	55	3
Block 4, East Façade	8	56	55	1

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Location	Floor	Predicted External Noise Levels on Balcony area dBA	Noise Level Criteria dBA	Noise Reduction Required dB
Block 4, East Façade	9	56	55	1
Block 4, East Façade	10	56	55	1
Block 4, West Façade	1	62	55	7
Block 4, West Façade	2	58	55	3
Block 6, West Façade	1	66	55	11
Block 6, West Façade	2	61	55	6
Block 6, West Façade	3	57	55	2
Block 10, West Facade	1	65	55	10
Block 10, West Façade	2	60	55	5
Block 10, West Facade	3	56	55	1

To achieve the noise reduction requirements specified in **Table 8.2**, a combination of Winter Gardens, solid balustrades (with a barrier height of 1100mm) and perforated balustrades (with a barrier height of 1100mm) should be utilised. The specific mitigation required for each floor and block is detailed in **Table 8.3** below.

Table 8.3: Balustrade Specifications

Development	Floor	Required Mitigation	Maximum Perforation %
Block 2, East Façade	1	Winter garden	-
Block 2, East Façade	2	Winter garden	-
Block 2, East Façade	3	Solid Barrier	0
Block 2, East Façade	4	Solid Barrier	0
Block 2, East Façade	5	Solid Barrier	0
Block 2, East Façade	6	Solid Barrier	0
Block 2, West Façade	1	Perforated Barrier	5
Block 2, West Façade	2	Perforated Barrier	8
Block 2, West Façade	3	Perforated Barrier	9
Block 2, West Façade	4	Perforated Barrier	10
Block 2, West Façade	5	Perforated Barrier	11

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Development	Floor	Required Mitigation	Maximum Perforation %
Block 2, West Façade	6	Perforated Barrier	12
Block 4, East Façade	1	Winter garden	-
Block 4, East Façade	2	Winter garden	-
Block 4, East Façade	3	Winter garden	-
Block 4, East Façade	4	Solid Barrier	0
Block 4, East Façade	5	Solid Barrier	0
Block 4, East Façade	6	Solid Barrier	0
Block 4, East Façade	7	Solid Barrier	0
Block 4, East Façade	8	Solid Barrier	0
Block 4, East Façade	9	Solid Barrier	0
Block 4, East Façade	10	Solid Barrier	0
Block 4, West Façade	1	Solid Barrier	0
Block 4, West Façade	2	Perforated Barrier	5
Block 4, West Façade	3	Perforated Barrier	7
Block 4, West Façade	4	Perforated Barrier	11
Block 4, West Façade	5	Perforated Barrier	13
Block 4, West Façade	6	Perforated Barrier	13
Block 4, West Façade	7	Perforated Barrier	13
Block 4, West Façade	8	Perforated Barrier	13
Block 4, West Façade	9	Perforated Barrier	13
Block 4, West Façade	10	Perforated Barrier	13
Block 6, West Façade	1	Perforated Barrier	1
Block 6, West Façade	2	Perforated Barrier	3
Block 6, West Façade	3	Perforated Barrier	4
Block 6, West Façade	4	Perforated Barrier	4
Block 6, West Façade	5	Perforated Barrier	5
Block 10, West Facade	1	Perforated Barrier	1
Block 10, West Facade	2	Perforated Barrier	3
Block 10, West Facade	3	Perforated Barrier	4
Block 10, West Facade	4	Perforated Barrier	5

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9. HIGH SPEED 2 - CONSTRUCTION NOISE AND VIBRATION IMPACTS

During the construction phase of HS2, significant noise and vibration impacts are expected at the Regents Park Estate. It is stated at paragraph 4.3.13 within the Construction Noise and Vibration assessment for area CFA1 (Euston) of the ES for HS2 (reference SV-003-001):

> *In the Regents Park Estate area (CSV01-C6) vibration effects may be experienced intermittently during a period of up to approximately two months at dwellings nearest the Hampstead Road Bridge work which may require vibratory piling during both the daytime and night-time. The typical community response to a minor vibration impact will be a low probability of adverse comment. Combined with simultaneous airborne noise impacts, the effects on these dwellings are considered to be a change in the acoustic character of the area and hence be perceived as an adverse effect on the quality of life. In combination these individual effects are considered significant.*

9.1. Temporary Vibration Effects

The vibration effects during vibratory piling (which will occur for two different operations affecting the Regents Park Estate) are not expected to cause any damage to buildings, but are at a level where they could cause annoyance and disturbance to occupants of the flats.

The ES has identified during the Hampstead Road bridge construction works, that VDV levels of 0.33 $m/s^{1.75}$ could occur at the south end of Cartmel House, which could therefore potentially effect the proposed Block 4. The impact is expected to occur for approximately six weeks.

During 'pipe jacking' works it has been predicted that properties on Varndell Street could experience VDV levels of 0.96$m/s^{1.75}$. This could potentially effect the proposed Blocks 3 and 4 directly and may also be experienced at the proposed Blocks 1 and 2. The impact is expected to occur for approximately two weeks.

9.2. Temporary Noise Effects

Significant noise effects have been identified at Blocks 2, 3, 4, 9 and 10 for various aspects of the HS2 construction works.

At Block 2 the significant noise impacts are during the daytime only and are from passing construction traffic. The predicted noise levels are 75-80 dB L_{Aeq}, although it is not clearly stated over what period of time these noise levels would occur.

At Blocks 3, 9 and 10 the significant noise impacts are during the daytime only and are from utility trenching works. The predicted noise levels are 63-79 dB L_{Aeq} at Blocks 3 and 9 and 70-80 dB L_{Aeq} Block 10. It is not clearly over what period of time these noise levels would occur.

Significant noise effects have been identified during both the daytime and night-time periods for the south end of Cartmel House, and it is likely that the proposed Block 4 will experience similar noise levels. During the daytime, noise levels of 68-80 dB L_{Aeq} have been predicted due to demolition works. During the night-time, noise levels of 59-68 dB L_{Aeq} have been

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predicted due to bridge construction works. Again, it is not clearly stated over what period of time these noise levels would occur.

The façade sound insulation measures proposed in **Table 7.1** would offer mitigation against the predicted construction noise effects. The residual noise level from HS2 construction noise inside the proposed flats, with windows closed, is detailed in **Table 9.1**.

Table 9.1: Residual Construction Noise Levels

Block	Floor	Highest Predicted Noise Level (L_{Aeq})	Day/Night	Glazing Specification	Likely Internal Noise Level with Windows Closed (L_{Aeq})
2	1	80	Day	32	48
2	2 to 6	80	Day	28	52
3	All	79	Day	28	51
9	1 to 2	79	Day	32	47
9	3	79	Day	28	51
10	G to 2	80	Day	34	46
10	3 to 4	80	Day	30	50
4	1 to 3	80	Day	34	46
4	4 to 10	80	Day	30	50
4	**1 to 3**	**68**	**Night**	**34**	**34**
4	**4 to 10**	**68**	**Night**	**30**	**38**

It can be seen that, with respect to night-time noise, the internal noise levels detailed in **Table 9.1** should be reduced to below 40 L_{Aeq} at Block 4 (the only block affected at night-time). This is in-line with the aims of the WHO Interim Target Night-Time Noise Level guidance (published 2009) and identified by HS2 Ltd as the Significant Observed Adverse Effect Level (SOAEL). The WHO Interim Target Night-Time Noise Level is 55 $L_{Aeq,outside}$ (from all noise sources). Within the document, a 15 dBA reduction from an open window is assumed, meaning that the 'target' internal noise level would be 40 L_{Aeq}. It is not unreasonable to assume that windows would remain closed during the construction works. An alternative form of ventilation, such as mechanical ventilation, could be installed to affected flats in order to prevent the need to open windows.

9.3. Trigger Action Plan

It is likely that a Trigger Action Plan (TAP) will be produced for HS2 construction works before the construction works begin, and it should include the proposed new blocks with respect to noise and vibration mitigation measures. As the proposed blocks will be newly built, additional sound insulation is unlikely to be offered, but rehousing and financial compensation solutions may be included.

It is important to note that elsewhere Trigger Action Plans have excluded people who move into property either once the construction works have commenced or with the full knowledge that those works would occur at some time in the future.

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10. CONCLUSION

In order to support a planning application for the proposed re-development of Regents Park Estate in Camden, a detailed noise and vibration assessment has been carried out.

The assessment has identified the level of façade sound insulation that will be required for each proposed block, and has taken into account the future noise levels once High Speed 2 (HS2) is operational. The noise levels on the proposed balconies have also been assessed and, where necessary, noise mitigation has been specified. The level of sound insulation identified would achieve compliance with the guidelines of LBC, BS8233 and the WHO guidelines for the daytime and night-time periods.

It has been identified in **Section 4.3** that the levels of vibration from existing sources at the proposed blocks are below the "*low probability of adverse comment*" set out in BS 6472 and LBCs vibration criteria during the daytime period. The derived night-time vibration levels exceed the criteria set by LBC and BS 6472, however, this is highly unlikely to occur as the number of heavy goods vehicles will be greatly reduced during the night-time period. Therefore the derived vibration levels are significantly higher than that which would actually be experienced. This indicates that it is extremely unlikely that any adverse comment will be generated with respect to vibration and therefore no mitigation for vibration is considered necessary.

Achievement of the target noise criteria ensures compliance with the overall aims of paragraph 123 of the NPPF in that noise will not result in any significant adverse effects on health or quality of life for future occupants of the proposed developments.

The noise and vibration effects of the construction phase of HS2 have also been identified within **Section 9** and it has been identified that the construction noise levels are not likely to have a significant effect at night.

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Appendix 1
Glossary of Acoustic Terms

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Appendix 1: Glossary of Terms

Term	Description
'A'-Weighting	*This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.*
Decibel (dB)	*This is a tenth (deci) of a bel. The decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.*
$L_{Aeq,T}$	*The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.*
L_{A10}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 per cent of a given time and is the L_{A10T}. The L_{A10} is used to describe the levels of road traffic noise at a particular location.*
L_{A50}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 per cent of a given time and is the L_{A50T}.*
L_{A90}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time and is the L_{A90T}. The L_{A90} is used to describe the background noise levels at a particular location.*
L_{Amax}	*The 'A'-weighted maximum sound pressure level measured over a measurement period.*

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Appendix 2
Noise and Vibration Monitoring Positions

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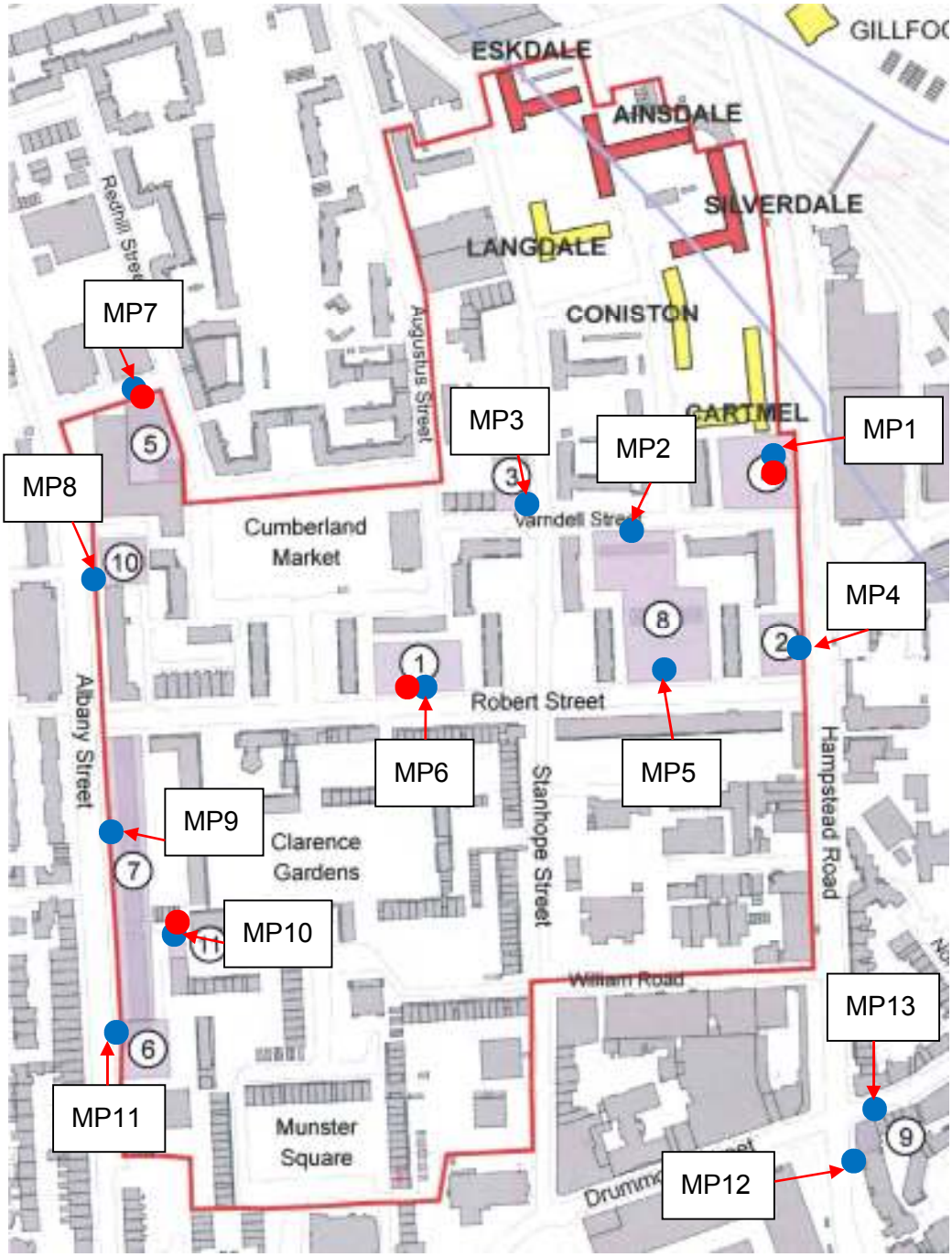

LEGEND

- Noise Monitoring Position
- Vibration Monitoring Position
- Site Boundary

N
W E
S

Client: CampbellReith		Description: Site Location with Noise and Vibration Monitoring Positions		Design	ML	26.09.2014
				Drawn	ML	26.09.2014
Rev: A	Description: FINAL	Project: A2288 Regents Park		Checked	DY	27.09.2014

Appendix Two

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Appendix 3
Summary of Noise Measurements

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Appendix 3: Summary of Noise Measurements

MP1

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
11:02 - 11:17	71.1	84	74.4	69.8	54.7
11:17 - 11:32	73	95.4	74.7	70.1	58.1
11:32 - 11:47	71	83.5	74.5	69.5	52.9
11:47 - 12:02	73.7	98.6	74.4	69.3	56.2
12:02 - 12:17	71.1	82.1	74.3	70	56.3
12:17 - 12:32	72.6	92.5	75.4	70.7	58.2
12:32 - 12:47	72.2	89.8	75	70.4	58.4
12:47 - 13:02	71.5	86.8	74.5	70	57.5
13:02 - 13:17	71.1	81.7	74.8	69.2	57.1
13:17 - 13:32	71.5	85.2	75	69.7	53.7
13:32 - 13:47	72.6	96.1	74.4	69.7	56
13:47 – 14:02	73.3	95.1	75.3	70.4	57.7
	72.2	**89.2**	**74.7**	**69.9**	**56.4**

MP2

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
15:08 – 15:23	53.6	66.4	56	52	49.3
16:42 – 16:57	56	72.2	59	52.6	49.3
17:00 – 17:15	55.8	71.7	59	53.1	50.1
	55.3	**70.1**	**58.1**	**52.6**	**49.6**

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MP3

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
11:07 – 11:22	58.8	78.4	62	52.8	49.1
12:06 – 12:21	60.6	79.4	63	53.5	49.9
13:04 – 13:19	60.3	82.3	63	53.4	49.5
	60.0	**80.0**	**62.7**	**53.2**	**49.5**

MP4

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
11:46 – 12:01	71.6	88.8	74	69.3	63.3
12:43 – 12:58	70.8	88.8	74	69.2	62.5
13:39 – 13:54	73.5	95.5	74	69.4	64
	72.1	**91.0**	**74.1**	**69.3**	**63.3**

MP5

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
11:26 – 11:41	64.9	83.1	68	61.3	55.7
12:25 – 12:40	62.8	82.4	66	57.7	53
13:22 – 13:37	63.2	78	67	58.3	53.8
	63.7	**81.2**	**67.1**	**59.1**	**54.2**

MP6

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
14:23 - 14:38	58.4	77.6	61.7	54.9	49
14:38 - 14:53	57.8	72.3	61.6	55	47.3
14:53 - 15:08	58.2	74.2	61.6	54.5	45.5
15:08 - 15:23	61.8	89.6	61.5	53.7	45.9
15:23 - 15:38	60	78.8	62.1	54.4	46.2
15:38 - 15:53	58.3	77	61.4	54.8	47.1

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Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
15:53 - 16:08	66.8	94.6	64.8	57.3	48.9
16:08 - 16:23	58.2	69.9	62.3	55.1	47.5
16:23 - 16:38	59.8	77	62.8	56.7	47.7
16:38 - 16:53	59.5	85.4	62.6	55.7	46.2
16:53 - 17:08	58.8	76.3	62	55.2	47
17:08 – 17:23	59.9	79.1	63.4	55.9	47.1
	60.7	**79.3**	**62.3**	**55.3**	**47.1**

MP7

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
10:55 – 11:10	55.4	77	57.7	53.7	48
11:10 - 11:25	55.6	71.1	58.4	53.2	46.6
11:25 - 11:40	53.8	64.2	56.9	52.4	47.3
11:40 - 11:55	54.6	66.2	58.1	52.6	47.1
11:55 - 12:10	54.3	70.2	57.1	52.3	47.4
12:10 - 12:25	57.4	76.7	57.2	52.2	47
12:25 - 12:40	54.4	74.9	56.9	52.8	47.2
12:40 - 12:55	53.4	70.7	56.5	52.1	47.2
12:55 – 13:10*	64.4	79.1	69.2	56.9	48
13:10 – 13:25*	60.6	80.1	65.1	53.1	47.6
13:25 - 13:40	53.3	73.6	56.1	51.9	46.1
13:40 – 13:55	54	72.3	56.9	52.1	46.2
	54.8	**71.7**	**57.2**	**52.5**	**47.0**

***These periods were discounted due to a low flying helicopter disrupting measurements**

MP8

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
14:42 – 14:57	69.1	78.1	73	66.7	58.9
15:29 – 15:44	68.4	78.8	72	66.3	57.2

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Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
16:11 – 16:26	68.7	82.5	72	66.3	58.6
	68.7	79.8	72.5	66.4	58.2

MP9

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
10:53 – 11:08	69.6	82.3	73	68.2	62.3
11:58 – 12:13	69.3	82.4	72	67.8	61.4
13:11 – 13:26	69.6	83.3	72	68.3	63.8
	69.5	**82.7**	**72.4**	**68.1**	**62.5**

MP10

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
25/09/2014 14:22	60.3	82.2	63.4	58.9	50.5
25/09/2014 14:37	61.1	77.7	64.4	59.2	48.1
25/09/2014 14:52	62.2	70.8	65.8	61	49.4
25/09/2014 15:07	60.5	73.3	64.1	58.7	48.7
25/09/2014 15:22	62.8	87.6	64.4	59.5	48.8
25/09/2014 15:37	61.2	89.7	63.5	59	49.8
25/09/2014 15:52	61.5	78.7	64.2	60	51.6
25/09/2014 16:07	60.6	74.1	63.8	59	48.8
25/09/2014 16:22	60.3	81.2	62.7	57.7	49.8
25/09/2014 16:37	60	69.6	63.3	59	48.9
25/09/2014 16:52	60.2	73.7	63.6	58.5	47.2
25/09/2014 17:07	61.4	72.5	64.8	59.7	49.4
	61.1	**77.6**	**64.0**	**59.2**	**49.3**

MP11

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
11:10 – 11:25	73	82.5	77	71.1	60.7
12:16 – 12:31	72.1	83	76	70.1	59.3

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Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
13:29 – 13:44	71.7	81.1	75	70.7	61.2
	72.3	**82.2**	**75.9**	**70.6**	**60.4**

MP12

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
14:38 – 14:53	70.4	81.9	74	67.8	62.6
15:28 – 15:43	71.6	91.2	75	68.6	63.4
15:45 – 16:00	71.5	85.6	75	68.1	62.9
	71.2	**86.2**	**74.5**	**68.2**	**63.0**

MP13

Time	$L_{Aeq, t}$	$L_{AF(max)}$	L_{A10}	L_{A50}	L_{A90}
15:08 – 15:23	75.4	99.6	73	68.3	63.7
16:03 – 16:18	69.8	93.2	73	68.3	63.6
16:18 – 16:33	69.5	84.4	72	68.3	62.7
	72.5	**92.4**	**72.8**	**68.3**	**63.3**

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Appendix 4
Proposed Blocks – Names and Numbers

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Appendix 4: Proposed Blocks – Names and Numbers

Site No.	Site Name
1	Robert Street car park
2	Rydal Water open space
3	Varndell Street
4	Newlands open space
5	Rothay/ Dick Collins Community Hall
6	Cape of Good Hope Public House
7	Troutbeck overbuilds
8	Staveley/ Newby overbuilds
9	Camden People's Theatre (250m south-east)
10	Victory Public House
11	St. Bede's Hall

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