

Appendix: Noise and Vibration

Annex 1: Glossary

Annex 2: Legislative, Planning Policy Context and Other Relevant Standards and Guidance

Annex 3: Environmental Noise and Vibration Report

Annex 4: Construction Plant Assumptions

Annex 5: Pedestrian Route Noise Assumptions

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Annex 5: Pedestrian Route Noise Assumptions

Annex 1 Glossary of Terms

'A' weighting	Frequency weighting based on the frequency response of the human ear which has been found to correlate well with the subjective response to sound.
Decibel (dB)	A logarithmic unit used for many acoustic values to indicate the level with respect to a reference level
Frequency	The number of cycles per second. The unit of frequency is the Hertz (Hz). Frequency gives a sound its distinctive tone.
Hz	Hertz (Hz) is the unit of frequency (see also 'Frequency')
$L_{A90,T}$	The A-weighted sound pressure level exceeded 90% of the measurement period (T) over which a noise is measured (ie, the quietest 10% of the period). When not weighted it is denoted $L_{90,T}$. This parameter is generally considered to be representative of a constant noise source, or background noise level.
$L_{Aeq,T}$	Equivalent A-weighted sound pressure level of a steady noise that has the same acoustic energy as a fluctuating noise over the measurement period (T). When not weighted it is denoted $L_{eq,T}$.
$L_{Amax,T}$	The highest A-weighted sound pressure level measured in the period (T) with either fast (L_{AFmax}) or slow (L_{ASmax}) time weightings. When not weighted it is denoted L_{Fmax} or L_{Smax} .
PPV	Peak Particle Velocity (PPV), a measure of vibration in mm/s, used to assess likelihood of damage and perceptibility of vibration.
Free-field noise level	A noise level measured at least 3 m from the building facade and does not contain reflected sound.
Facade noise level	A noise level measured close to (1-2 m) from the facade of a building, which contains a reflection of sound from the building. Facade noise levels are 3 dB higher than the equivalent free-field noise level measured

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Annex 2 Legislation and Planning Policy Context

Control of Pollution Act 1974

Powers are given to Local Planning Authorities (LPAs) under the Control of Pollution Act 1974 (COPA) for the control of noise from construction sites. Sections 60 and 61 of COPA 1974 allow LPAs to serve notices imposing conditions on the way in which construction work is conducted. It is a criminal offence to contravene such a notice without a reasonable excuse, which can be avoided provided the work is carried out under a consent issued under Section 61 of the Act. Such consents may be applied for in advance of construction work being carried out.

LPAs can produce Regulations to control noise from plant or machinery under Section 68 of COPA 1974, but the preference is generally to use codes of practice issued under Section 71 to minimise noise. Although breach of a code of practice is not a criminal offence, these may be taken into account in legal proceedings.

The Environmental Noise (England) Regulations 2006 (as amended 2008, 2009 2010 and 2018)

The Environmental Noise (England) Regulations 2006 implement the Assessment and Management of Environmental Noise Directive 2002/49/EC (END). The END requires:

- The use of harmonised noise indicators and computational measures so that data can be collected and compared in a standardised way
- Common protocols for noise mapping
- The drawing up of noise maps
- Making information available to the public
- The drawing up of local action plans
- Collection of data by the Commission to inform future Community policy.

Noise mapping of the UK has been under way for some years, with the majority of urban areas being covered.

National Planning Policy

National Planning Policy Framework, 2021

The National Planning Policy Framework (NPPF) sets out the government planning requirements. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

‘Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life;*
- *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason...’*

In addition, the following is noted:

‘Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.’

National Planning Practice Guidance, 2016

The National Planning Practice Guidance (NPPG) provides further context to the NPPF and the two documents should be read together. The document provides guidance on how to recognise when noise could be a concern and the factors that influence this, along with outline guidance on noise mitigation through engineering and design, etc.

Noise Policy Statement for England, 2010

The Noise Policy Statement for England (NPSE) sets out the long-term vision of Government noise policy. The NPSE states that its aims are as follows:

“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.”*

The NPSE adopts established concepts from toxicology that can be applied to noise impacts. The concept details noise levels, at which the effects of an exposure may be classified into a specific category. The classification categories as detailed within the NPSE are as follows:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

The SOAEL does not have a single objective noise level that is applicable to all sources of noise in all situations and therefore, the SOAEL is likely to be different for different sources, different receptors and at different times of the day.

The first aim of the NPSE is to avoid significant adverse effects on health and quality of life, taking into account the guiding principles of sustainable development. The second aim considers situations where impacts are established between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur. The third aim seeks to improve health and quality of life, where possible, through the pro-active management of noise, whilst also taking account of the guiding principles of sustainable development.

DEFRA have led a study to identify the SOAEL and LOAEL for a limited range of noise sources. The study was understood to have ended in 2012. However, no guidance from this research has been issued at the time of writing (February 2021).

ProPG: for planning and noise, 2017

The Professional Practice Guidance on Planning and Noise (ProPG) is a recently introduced document that provides guidance on the management of noise within the planning system in England.

The document emphasises that good acoustic design should avoid ‘unreasonable’ acoustic conditions and prevent ‘unacceptable’ acoustic conditions both internally (inside noise-sensitive parts within buildings), and externally in spaces intended for amenity purposes. The document highlights that care should be taken not to over-design mitigation, and states that:

“Good acoustic design should provide an integrated solution whereby the optimum acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements.”

This typically involves careful consideration of:

- Checking the feasibility of relocating or reducing noise levels from relevant sources.
- Consider options for planning the site or building layout.
- Consider the orientation of proposed building(s).
- Select construction types and methods for meeting building performance requirements.
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety cost, CDM etc.
- Assess the viability of alternative solutions.

Local Planning PolicyGravesend Local Plan Core Strategy 2014

The Local Plan Core Strategy sets out the Council’s planning framework for the district. The policies included within the Plan form the basis of decision making with respect to planning applications.

There are no policies that directly relate to noise within The Local Plan.

British standards and guidance

The following paragraphs summarise the outline assessment British Standards and guidance documents used to set target criteria for the identification of noise and vibration impacts:

Construction noise and vibration

Estimation of noise and vibration generated during each principal phase of the construction works and an assessment of the likely significant effects on surrounding sensitive receptors using the methodology set out in British Standard BS 5228:2009+A1 2014 Code of Practice for Noise and Vibration on Construction and Open Sites (Part 1: Noise, Part 2: Vibration).

Road traffic noise

For the assessment of noise associated with road traffic, reference will be made to the Calculation of Road Traffic Noise (CRTN). Further advice is also given in the Design Manual for Roads and Bridges (DMRB) for road traffic noise assessments. Each of these documents offer a means of predicting noise levels and changes in noise level and assessment of the impact of the changes. Guidance on the impact assessment of traffic noise is provided within the Institute of Environmental Management and Assessment (IEMA) Guidance Note No. 1 Guidelines for the Environmental Assessment of Road Traffic.

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Building services, commercial and industrial noise

For the assessment of building services, commercial and industrial noise egress, reference will be made to BS 4142:2014+A1 2019: Methods for Rating and Assessing Industrial and Commercial Sound. The standard provides a method of measuring background noise levels and assessing the likelihood of complaint regarding external noise levels. The noise level resulting from plant operation is measured or predicted at a distance of one metre from the facade of the nearest noise sensitive premises. The predicted noise level is compared to the existing background noise level in the area, as determined by a noise survey, over the proposed operational hours.

Human response to vibration

British Standard BS 6472-1: Guide to Evaluation of Human Exposure to Vibration in Buildings. Part 1: Vibration Sources other than Blasting. BS 6472-1 provides guidance on the measurement and assessment of vibration levels affecting humans in buildings resulting from sources such as road and rail traffic or building services systems. The probability of adverse comment is assessed by considering the vibration dose value (VDV), which quantifies the total exposure to vibration over a specified period.

IEMA Guidelines for Environmental Noise Impact Assessment, 2014

IEMA Guidelines for Environmental Noise Impact Assessment 2014. The IEMA guidelines set out guidance on significance criteria for noise impact based on the changes in noise levels.

Internal and external noise levels for residential development

For the assessment of noise ingress into the introduced dwellings and external amenity spaces, reference will be made to BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. The standard provides recommendations on acceptable internal noise levels within different building uses, including residential. Recommendations are also provided for acceptable noise levels in residential amenity spaces amongst other things.

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Annex 3 – Environmental noise and vibration surveys

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22240-R01-A

1 July 2022

Northfleet, Gravesham

Environmental noise measurements during a match day

London, Manchester, Edinburgh, Birmingham, Belfast, Leeds

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Consultants in Acoustics, Noise & Vibration

Version	Date	Comments	Author	Reviewer
A	1 July 22		Gunes Dincer	Philip Owen

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Summary

Sandy Brown has been commissioned to provide acoustic advice in relation to the proposed mixed use development at Northfleet, Gravesham.

Noise measurements were completed before, during and after a football match at residential receptors closest to Ebbsfleet United’s stadium. These measurements were taken to determine the existing sound levels in the area during a match day. The noise survey was carried out between 13:00 and 19:00 on 15 May 2022.

Data from the survey will be used to inform the design and to evaluate future impacts due to change in the operation of the football club.

Contents

1 Introduction5

2 Site description5

3 Noise survey method5

4 Noise survey results6

5 Conclusion7

Appendix A8

 Survey details8

1 Introduction

Sandy Brown has been commissioned to provide acoustic advice in relation to the proposed development at Northfleet, Gravesham.

As part of this, a noise survey of the existing football club’s operation is required, the purpose of which is to establish the existing sound levels on and around the site during a match day.

This report presents the survey method and results.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1.



Figure 1 Aerial view of site (courtesy of Google Earth Pro)

3 Noise survey method

The survey included attended noise measurements.

3.1 Attended measurements

Attended sample measurements were taken by Gunes Dincer on 22 May 2022 at five positions around the site. Measurements were taken before, during and after a football match. The football match taking place was between Ebbsfleet United and Chippenham Town, with a reported attendance of 2,166.

Monitoring before and after the football match was completed at positions PM1 and PM2, as indicated on Figure 1. These positions were chosen to represent the existing worst-case noise along the pedestrian routes used by the supporters to get to the stadium.

Monitoring during the football match was completed at positions MM1, MM2 and MM3, as indicated on Figure 1. These positions were chosen to represent the closest existing residential properties to the stadium and to capture the noise emissions from the stadium.

All measurements were carried out over 15-minute periods.

At each position the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 3.5 m from any other reflective surface. Details of the equipment used and the noise indices measured are provided in Appendix A.

Dominant noise sources occurring during the measurements were noted.

3.2 Weather conditions

Weather conditions during the survey are described in Appendix A.

4 Noise survey results

4.1 Observations

The dominant noise source observed at the site before and after the football match was road traffic from the A226 and B2175. During the football match chanting and other noise emissions from the stadium was noted.

4.2 Noise measurement results

4.2.1 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 1. Measurements were taken in free field conditions.

Table 1 Noise levels and key noise sources from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15mn}$	
Before the match					
PM1	13:00	69	83	54	Road traffic
PM1	13:42	68	80	52	Road traffic
PM2	13:19	72	83	57	Road traffic
PM2	14:20	72	92	59	Road traffic
MM2	14:39	65	77	58	Road traffic
During the match					
MM1	15:00	50	66	47	Fans chanting
MM1	15:15	51	68	47	Fans chanting
MM3	15:39	53	73	47	Fans chanting
MM3	15:56	51	69	47	Chanting and music
MM2	16:18	64	74	58	Road traffic and fans chanting
MM2	16:35	64	79	56	Road traffic and fans chanting
MM2	17:12	67	77	59	Road traffic and fans chanting
After the match					
PM1	17:40	72	80	60	Road traffic

5 Conclusion

A noise survey has been carried out at the site. Key noise sources at the site before the football game were noted as road traffic on A226 and B2175. During the game, fans chanting from the stadium was audible, though generally the environmental noise levels were determined by road traffic, in particular along the pedestrian routes to the stadium.

Appendix A

Survey details

Equipment

The attended noise measurements were taken using a B&K 2250 sound level meter.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
2250				
Sound level meter	2250/2590403	Brüel & Kjær	30 Jun 23	2021-0651
Microphone	4189/1869017	Brüel & Kjær	28 Jun 23	2021-0655
Pre-amp	ZC0032/25644	Brüel & Kjær	30 Jun 23	2021-0659
Calibrator	4231/3017675	Brüel & Kjær	13 Jan 24	2022-0155

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meter used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

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.

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*.

Weather conditions

During the attended noise measurements, the weather was rainy. Wind speeds were varied between 2 m/s and 6 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

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22240-R02-A

1 July 2022

Northfleet, Gravesham

Environmental noise and vibration survey report

London, Manchester, Edinburgh, Birmingham, Belfast, Leeds

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A	1 Jul 22		Mollie Mitchell	Philip Owen

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Summary

Sandy Brown has been commissioned to undertake assessment of noise and vibration for the proposed development at Northfleet, Gravesham.

Environmental noise and vibration surveys have been carried out to determine the existing sound and vibration levels in the area.

The noise survey was carried out between 7 June 2022 and 22 June 2022. The vibration surveys were undertaken on 15 June 2022 and 22 June 2022.

The results of the assessment will be used to form the basis of design and future assessments.

Contents

1 Introduction 5

2 Site description 5

3 Noise survey method 6

4 Noise survey results 11

5 Vibration survey results 16

6 Conclusion 17

Appendix A 19

 Survey details 19

Appendix B 22

 Results of unattended measurements at Location X 22

Appendix C 27

 Measured VDV_s at V1 27

Appendix D 33

 Measured VDV_s at V2 33

Appendix E 39

 Predicted reradiated noise levels 39

1 Introduction

Sandy Brown has been commissioned to provide complete noise and vibration assessments in relation to the proposed development at Northfleet, Gravesham.

Environmental noise and vibration surveys have been carried out to establish:

- Background sound levels around the site
- Ambient and maximum noise levels at the site
- Vibration levels affecting the site.

This report presents the survey method and results.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is shown in Figure 1, the site is highlighted white.

It is bound by Britannia Refined Metals and Lower Road to the North, WE Roberts (Corrugated) and residential properties near Wallis Park to the East, train tracks to the South and residential properties on Taunton Road to the West.

The nearest residential properties to the site are highlighted in red in Figure 1 and the nearest commercial properties are highlighted in blue.

Northfleet train station is located approximately 240 m to the south east of the site and Ebbsfleet International train station is located approximately 400 m to the south of the site.

The site lies within the jurisdiction for Gravesham Borough Council.



Figure 1 Aerial view of site (courtesy of Google Earth Pro)

3 Noise survey method

The survey included unattended and attended noise measurements.

3.1 Unattended measurements

Unattended noise monitoring was undertaken at the site over 7 days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements were taken over 15 minute periods during the following times at each position:

- Location N1 – 12:39 on 7 June 2022 to 12:24 on 15 June 2022
- Location N2 - 12:09 on 7 June 2022 to 12:39 on 15 June 2022
- Location N3 - 14:16 on 7 June 2022 to 13:16 on 15 June 2022
- Location N4 – 14:03 on 15 June 2022 to 10:48 on 22 June 2022

The equipment was installed by Paul Monaghan and Gunes Dincer and collected by Paul Monaghan.

The measurement positions used during the survey are indicated in Figure 1, denoted by N1 – 4. Photographs showing the measurement locations are provided in Figure 2 to Figure 5.

At positions N1-N3 the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 3 m from any other reflective surface. The measured noise levels are considered free field.

At position N4 the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 1 m from any other reflective surface. The measurement results are considered facade noise levels.

These locations were chosen to be reasonably representative of noise levels experienced throughout the site and outside the nearest noise sensitive premises.



Figure 2 Photograph showing measurement location N1



Figure 3 Photograph showing measurement location N2



Figure 4 Photograph showing measurement location N3



Figure 5 Photograph showing measurement location N4

3.2 Attended measurements

Attended sample measurements were taken by Gunes Dincer at 1 location, indicated in Figure 1 as N5. The measurements were carried out on 15 June 2022, over 15 minute periods.

At N5, the microphone was mounted on a tripod approximately 1.2 m above the ground level and at least 1 m from any other reflective surface. Details of the equipment used and the noise indices measured are provided in Appendix A.

Figure 6 presents an image of the measurement location and set up.

Dominant noise sources occurring during the measurements were noted.

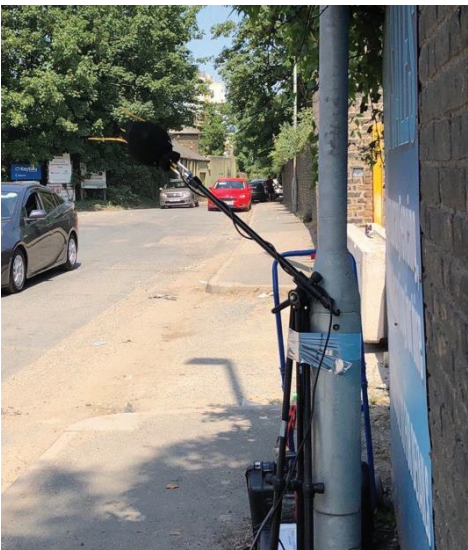


Figure 6 Photograph showing measurement location N5

3.3 Vibration measurements

Vibration measurements were taken at 2 locations around the site in order to determine:

- The vibration levels resulting from the passage of trains on the railway tracks adjacent to the site
- The vibration levels resulting from the operation of the commercial activities.

The vibration measurement locations are indicated in Figure 1 as positions V1 and V2.

The measurements were taken on 15 June 2022 and 22 June 2022 by Paul Monaghan.

Dominant vibration sources during the measurements were noted, along with measurement periods when trains were passing at V1.

Vibration time histories were recorded using a tri-axial accelerometer and data recorder. The accelerometers were arranged on a mounting block that was connected to a ground-bearing concrete slab.

The vibration measurements at position V1 were conducted in three axes as follows:

- X axis - Horizontal vibration approximately perpendicular to the railway tracks
- Y axis - Horizontal vibration approximately parallel to the railway tracks
- Z axis - Vertical vibration.

The vibration measurements at position V2 were conducted in three axes as follows:

- X axis - Horizontal vibration facing the north east
- Y axis - Horizontal vibration facing the north west
- Z axis - Vertical vibration.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The vibration measurements taken at locations V1 and V2 are reasonably representative of the vibration levels to be experienced by the proposed residential premises.



Figure 7 Photograph showing the vibration measurement equipment set up

Weather conditions during the survey are described in Appendix A.

4 Noise survey results

4.1 Observations

At positions N1 and N2 the dominant noise sources were plant noise, intermittent construction noise and traffic noise from operations of the commercial properties surrounding the measurement location.

At position N3 the dominant noise was road traffic on Galley Hill Road, Stonebridge Road and Lower Road.

At location N4 the dominant noise source was train passing through Ebbsfleet International and Northfleet and road traffic on the A226.

The noise sources at position N5 are described within Section 4.2.5.

4.2 Noise measurement results

4.2.1 Unattended measurement results – Location N1

Day and night-time ambient noise levels measured at location N1 during the unattended survey are presented in Table 1.

Measured minimum background sound levels at location N1 are given in Table 2.

Table 1 Ambient noise levels measured during the unattended survey at N1

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{Aeq,16h}$ (dB)	$L_{Aeq,8h}$ (dB)
Tuesday 7 June 2022	-	53
Wednesday 8 June 2022	61	49
Thursday 9 June 2022	66	50
Friday 10 June 2022	59	46
Saturday 11 June 2022	55	43
Sunday 12 June 2022	50	49
Monday 13 June 2022	72	51
Tuesday 14 June 2022	62	50
Average	61	49

Table 2 Minimum background sound levels measured during the unattended survey at N1

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)
Tuesday 7 June 2022	52 ^[1]	40
Wednesday 8 June 2022	43	40
Thursday 9 June 2022	43	39
Friday 10 June 2022	43	41
Saturday 11 June 2022	42	40
Sunday 12 June 2022	41	41
Monday 13 June 2022	42	40
Tuesday 14 June 2022	42	41
Wednesday 15 June 2022	48 ^[1]	-

^[1] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 41 dB during the daytime and $L_{A90,15min}$ 39 dB at night.

4.2.2 Unattended measurement results – Location N2

Day and night-time ambient noise levels measured at location N2 during the unattended survey are presented in Table 3.

Measured minimum background sound levels at location N2 are given in Table 4.

Table 3 Ambient noise levels measured during the unattended survey at N2

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{Aeq,16h}$ (dB)	$L_{Aeq,8h}$ (dB)
Tuesday 7 June 2022	-	52
Wednesday 8 June 2022	56	51
Thursday 9 June 2022	56	53
Friday 10 June 2022	56	46
Saturday 11 June 2022	54	41
Sunday 12 June 2022	51	50
Monday 13 June 2022	55	50
Tuesday 14 June 2022	58	52
Average	55	50

Table 4 Minimum background sound levels measured during the unattended survey at N2

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)
Tuesday 7 June 2022	42 ^[1]	39
Wednesday 8 June 2022	40	39
Thursday 9 June 2022	42	38
Friday 10 June 2022	43	39
Saturday 11 June 2022	40	38
Sunday 12 June 2022	39	39
Monday 13 June 2022	42	39
Tuesday 14 June 2022	42	41
Wednesday 15 June 2022	48 ^[1]	-

^[1] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 39 dB during the daytime and $L_{A90,15min}$ 38 dB at night.

4.2.3 Unattended measurement results – Location N3

Day and night-time ambient noise levels measured at location N3 during the unattended survey are presented in Table 5. Measured minimum background sound levels at location N3 are given in Table 6.

Table 5 Ambient noise levels measured during the unattended survey at N3

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{Aeq,16h}$ (dB)	$L_{Aeq,8h}$ (dB)
Tuesday 7 June 2022	-	64
Wednesday 8 June 2022	68	64
Thursday 9 June 2022	68	64
Friday 10 June 2022	68	63
Saturday 11 June 2022	67	61
Sunday 12 June 2022	66	64
Monday 13 June 2022	68	64
Tuesday 14 June 2022	68	64
Average	68	64

Table 6 Minimum background sound levels measured during the unattended survey at N3

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)
Tuesday 7 June 2022	44 ^[1]	37
Wednesday 8 June 2022	44	37
Thursday 9 June 2022	45	35
Friday 10 June 2022	48	40
Saturday 11 June 2022	47	36
Sunday 12 June 2022	42	39
Monday 13 June 2022	46	39
Tuesday 14 June 2022	48	44
Wednesday 15 June 2022	54 ^[1]	-

^[1] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 39 dB during the daytime and $L_{A90,15min}$ 38 dB at night.

4.2.4 Unattended measurement results – Location N4

Day and night-time ambient noise levels measured at location N4 during the unattended survey are presented in Table 7. Measured minimum background sound levels at location N4 are given in Table 8.

Table 7 Ambient noise levels measured during the unattended survey at N4

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{Aeq,16h}$ (dB)	$L_{Aeq,8h}$ (dB)
Wednesday 15 June 2022	-	49
Thursday 16 June 2022	53	48
Friday 17 June 2022	54	48
Saturday 18 June 2022	53	52
Sunday 19 June 2022	51	49
Monday 20 June 2022	53	48
Tuesday 21 June 2022	52	47
Average	53	49

Table 8 Minimum background sound levels measured during the unattended survey at N4

Date	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
	$L_{A90,15min}$ (dB)	$L_{A90,15min}$ (dB)
Wednesday 15 June 2022	33 ^[1]	31
Thursday 16 June 2022	32	28
Friday 17 June 2022	35	30
Saturday 18 June 2022	35	32
Sunday 19 June 2022	35	31
Monday 20 June 2022	34	28
Tuesday 21 June 2022	35	31
Wednesday 22 June 2022	38 ^[1]	-

^[2] Measurement not made over full period due to monitoring start and end time.

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 32 dB during the daytime and $L_{A90,15min}$ 28 dB at night.

4.2.5 Attended measurement results

Noise levels and key sources recorded during the attended measurements are summarised in Table 9. The measured noise levels are facade noise levels.

Table 9 Noise levels and key noise sources from attended measurements

Start time	Sound pressure levels (dB)			Noise sources
	$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
14:00	69	98	52	The dominant noise source was road traffic on Grove Road. The maximum noise levels were caused by frequent HGV pass bys.
14:15	70	95	52	
14:30	66	86	52	
14:45	71	91	52	
15:00	68	88	53	
15:15	68	87	52	
15:30	65	83	54	
15:45	75	93	54	

5 Vibration survey results

5.1 Measurement results

At position V1 the dominant vibration source was passing trains which occurred approximately every 6-10 minutes.

The dominant vibration sources at position V2 were intermittent passing lorries and forklifts at the Seacon Wharf and the movement of diggers and trucks carrying gravel on the adjacent site.

The Vibration Dose Values (VDVs) measured at position V1 and V2 are presented in Appendix C and Appendix D, respectively.

At position V1, the measured VDVs ranged between 0.00055 $m/s^{1.75}$ and 0.03487 $m/s^{1.75}$ and between 0.00109 $m/s^{1.75}$ and 0.00833 $m/s^{1.75}$ at position V2.

5.2 Assessment

5.2.1 Tactile vibration

BS 6472 states that the assessment should be based on the axis along which the highest VDV is measured. At measurement position V1, the highest VDV was measured on the Z axis.

Published timetables indicate that approximately 16 trains pass the site per hour during the day. This will result in approximately 256 trains passing on the tracks between 07:00 – 23:00. At night, between 23:00 – 07:00, the maximum number of trains operating along this line is expected to be approximately 42.

Based on the maximum vibration values and on the number of trains passing on the tracks between 07:00 – 23:00 and 23:00 – 07:00, the equivalent VDV over a 16 hour day and an 8 hour night are given in Table 10.

Table 10 Equivalent vibration dose values

Location	Equivalent VDV ($\text{m/s}^{1.75}$)	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
V1	0.11	0.06

5.2.2 Reradiated noise

The measured acceleration levels have been used to predicted reradiated noise within the proposed residential buildings.

The predicted reradiated noise levels are presented in Appendix E.

The highest predicted reradiated noise level is L_{AFmax} 28 dB.

6 Conclusion

A noise and vibration survey has been carried out at the site. Key noise sources at the site were noted as road traffic on Galley Hill Road, Stonebridge Road, Lower Road and the A226. Other dominant noise sources included train passbys and noise from the operational of the commercial properties surrounding the site.

Measured ambient noise levels were in the range $L_{Aeq,15min}$ 50 dB to 72 dB during the day, and $L_{Aeq,15min}$ 41 dB to 64 dB during the night. The lowest background sound levels measured during the survey were recorded at position N4. The levels were $L_{A90,15min}$ 32 dB during the daytime and $L_{A90,15min}$ 28 dB at night.

The measured vibration dose values were in the range of $0.00055 \text{ m/s}^{1.75}$ and $0.03487 \text{ m/s}^{1.75}$. The highest predicted reradiated noise level is L_{AFmax} 28 dB.

The equivalent VDV over a 16 hour day is $0.11 \text{ m/s}^{1.75}$ and $0.06 \text{ m/s}^{1.75}$ over an 8 hour night.

The results of the assessment will be used to form the basis of design and future assessments.

Appendix A

Survey details

Equipment

The unattended noise measurements were taken using two NL-52 sound level meters and one NL-32 sound level meter. The attended noise measurements were taken using the NL-52 sound level meter, previously located for unattended noise monitoring at location N2.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Locations N1 and N5				
Sound level meter	NL-52/00242702	Rion	22 Feb 23	TCRT21/1125
Microphone	UC-59/06185	Rion	22 Feb 23	TCRT21/1125
Pre-amp	NH-25/32730	Rion	22 Feb 23	TCRT21/1125
Calibrator	CAL200/4499	Larson Davis	19 Feb 23	TCRT21/1121
Location N2				
Sound level meter	NL-52/00375679	Rion	19 Jul 23	TCRT21/1501
Microphone	UC-59/11168	Rion	19 Jul 23	TCRT21/1501
Pre-amp	NH-25/65806	Rion	19 Jul 23	TCRT21/1501
Calibrator	SV30A/10576	Svan	16 Jul 23	TCRT21/1500
Locations N3-N4				
Sound level meter	NL-32/00623769	Rion	14 Oct 23	TCRT21/1713
Microphone	UC-53A/319244	Rion	14 Oct 23	TCRT21/1713
Pre-amp	NH-21/36677	Rion	14 Oct 23	TCRT21/1713
Calibrator	NC-74/34336009	Rion	13 Oct 23	TCRT21/1707
Locations V1-V2				
Data recorder	VM-56 / 34310135	Rion	18 Oct 23	TCRT21/1720
Accelerometer	PV-83D / 90136	Rion	18 Oct 23	TCRT21/1720

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

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.

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*.

Weather conditions

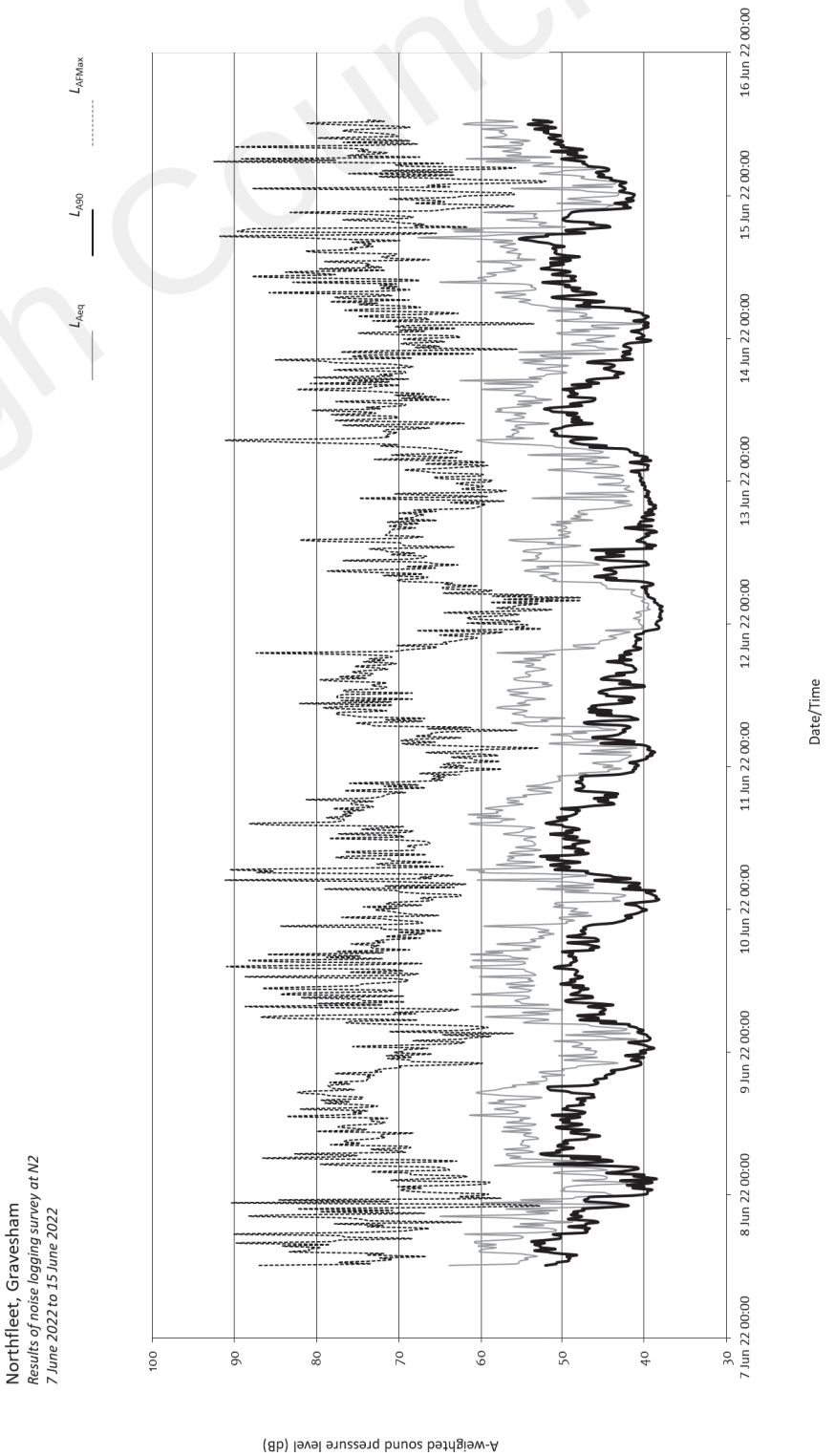
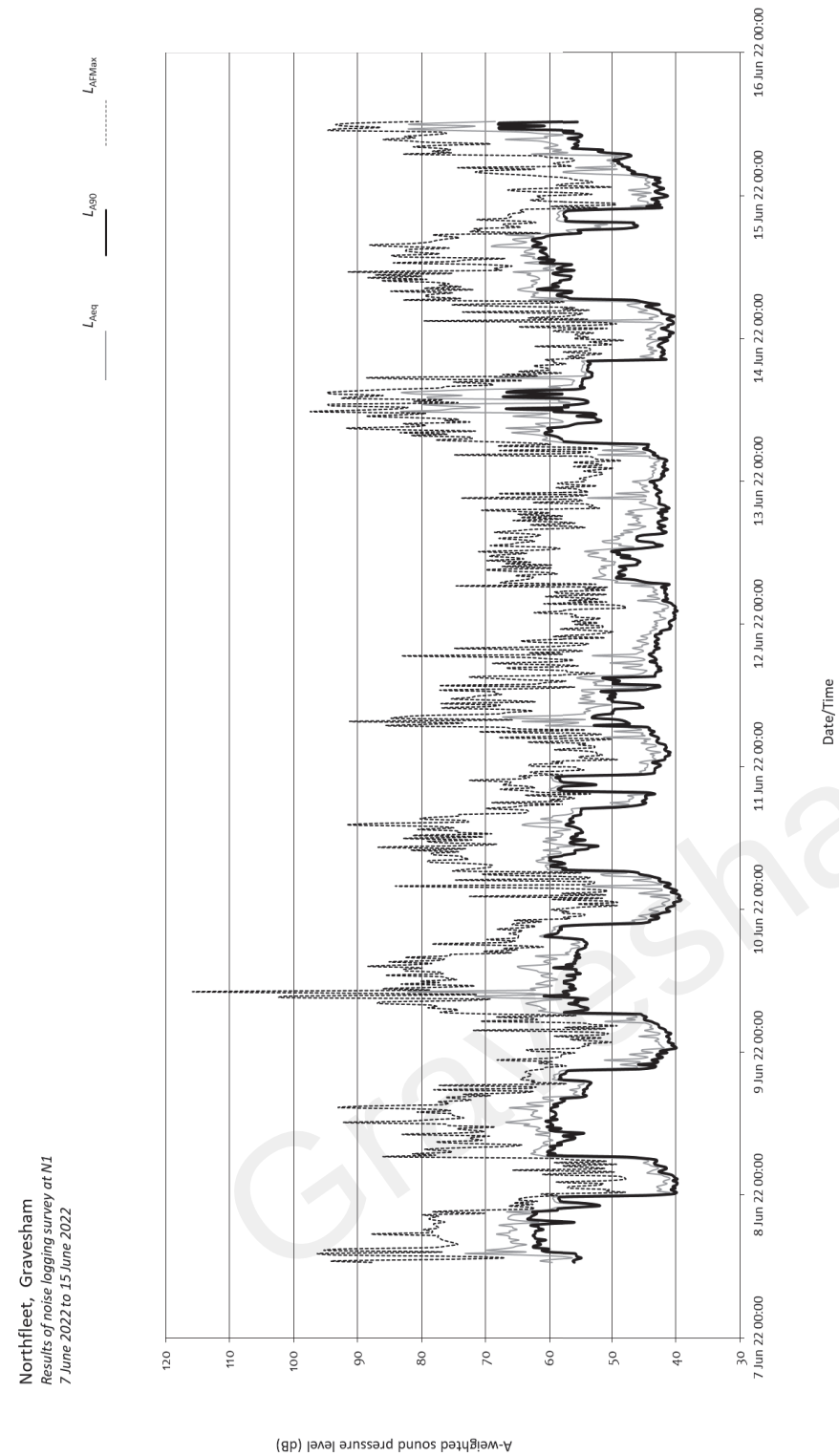
During the attended noise measurements, the weather was generally clear and dry and no rain occurred.

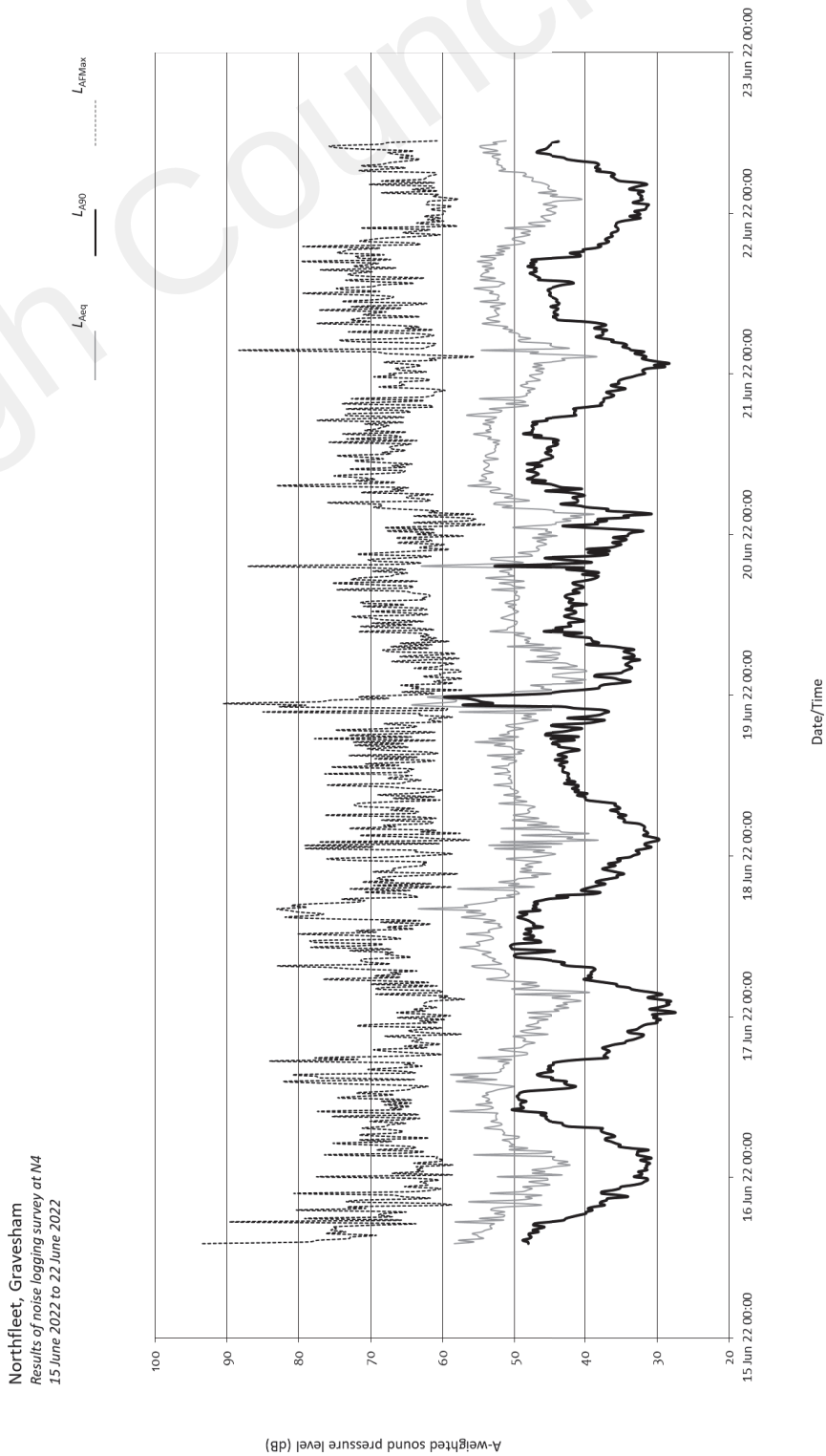
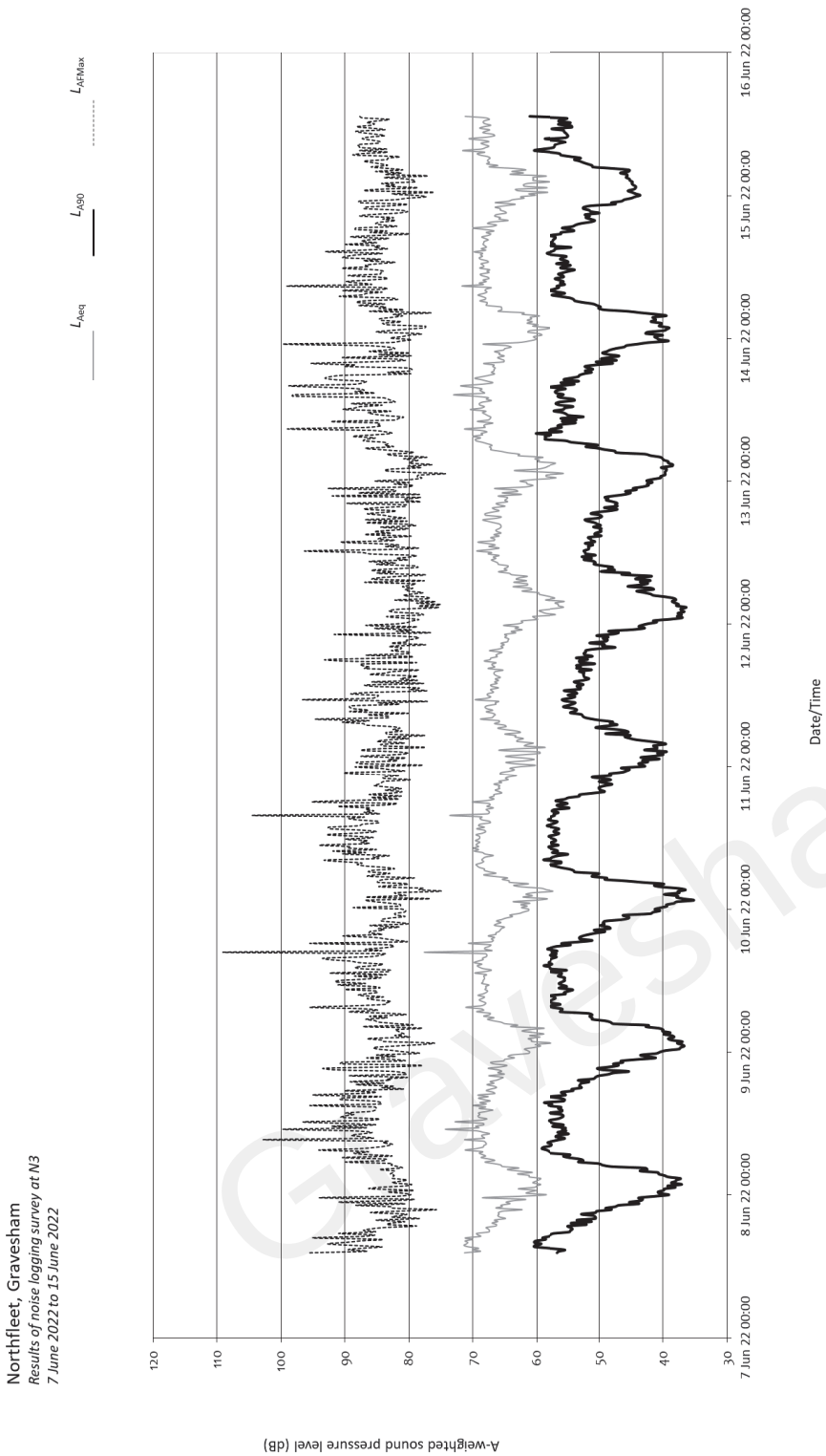
During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 8°C at night and 27°C during the day, and the wind speed was less than 7 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Results of unattended measurements at Locations N1, N2, N3 and N4





Appendix C

Measured VDV_s at V1

Table 11 Measured VDV_s at V1

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
14:25	0.00038	0.00059	0.0097
14:26	0.00037	0.00054	0.00938
14:27	0.00036	0.0005	0.00226
14:28	0.00034	0.00044	0.00238
14:29	0.00023	0.00035	0.00221
14:30	0.00024	0.00041	0.00203
14:31	0.00021	0.00024	0.00213
14:32	0.00019	0.00026	0.00078
14:33	0.0003	0.00043	0.0082
14:34	0.00022	0.0003	0.00501
14:35	0.00043	0.00035	0.00245
14:36	0.00022	0.00028	0.00307
14:37	0.00023	0.00028	0.00218
14:38	0.00018	0.00021	0.00079
14:39	0.0002	0.00031	0.00482
14:40	0.00028	0.00032	0.00192
14:41	0.00022	0.00024	0.00124
14:42	0.00032	0.00037	0.0009
14:43	0.00025	0.00025	0.0016
14:44	0.00019	0.00023	0.00101
14:45	0.0002	0.00027	0.00202
14:46	0.00025	0.00034	0.00763
14:47	0.00023	0.00028	0.00215
14:48	0.00031	0.00033	0.00184
14:49	0.00028	0.00029	0.00258
14:50	0.0002	0.00025	0.00219

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
14:51	0.0002	0.0002	0.00092
14:52	0.00041	0.0006	0.01339
14:53	0.00058	0.00031	0.00163
14:54	0.00024	0.00025	0.00172
14:55	0.00031	0.00034	0.0012
14:56	0.0002	0.00022	0.00174
14:57	0.00021	0.00023	0.00185
14:58	0.00026	0.00027	0.00297
14:59	0.00033	0.00031	0.00178
15:00	0.00032	0.00038	0.00203
15:01	0.00054	0.00039	0.00136
15:02	0.00914	0.02646	0.03487
15:03	0.00026	0.00033	0.0066
15:04	0.00023	0.00027	0.00235
15:05	0.00028	0.00028	0.00087
15:06	0.00043	0.00041	0.00327
15:07	0.0003	0.00035	0.00212
15:08	0.00031	0.00031	0.00367
15:09	0.00034	0.00042	0.00444
15:10	0.00024	0.0003	0.00168
15:11	0.00028	0.00032	0.00207
15:12	0.0003	0.00043	0.00132
15:13	0.00025	0.00032	0.00209
15:14	0.00082	0.00048	0.00231
15:15	0.00028	0.00031	0.00226
15:16	0.0004	0.00053	0.00106
15:17	0.00045	0.00055	0.00527

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
15:18	0.00028	0.0003	0.00213
15:19	0.00028	0.00044	0.00222
15:20	0.00035	0.00037	0.00641
15:21	0.00228	0.00048	0.00244
15:22	0.00044	0.0006	0.01328
15:23	0.00031	0.00034	0.00191
15:24	0.00036	0.00041	0.00215
15:25	0.00023	0.00031	0.00082
15:26	0.0002	0.00029	0.00304
15:27	0.00021	0.00025	0.00515
15:28	0.00022	0.00029	0.00177
15:29	0.00019	0.00024	0.00124
15:30	0.0004	0.00045	0.0022
15:31	0.00019	0.00024	0.00156
15:32	0.00033	0.00043	0.00782
15:33	0.00023	0.00029	0.00163
15:34	0.00025	0.0003	0.00161
15:35	0.00017	0.00022	0.00055
15:36	0.00021	0.00023	0.00146
15:37	0.00039	0.00039	0.00114
15:38	0.00028	0.00039	0.00074
15:39	0.00019	0.00023	0.00146
15:40	0.00017	0.00021	0.0007
15:41	0.00018	0.00019	0.00081
15:42	0.0002	0.00021	0.00198
15:43	0.00025	0.00025	0.00155
15:44	0.00019	0.00022	0.00189

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
15:45	0.00018	0.00022	0.00137
15:46	0.00022	0.0003	0.00476
15:47	0.00021	0.00023	0.00353
15:48	0.00033	0.00033	0.00086
15:49	0.0002	0.00023	0.00244
15:50	0.00029	0.00032	0.0059
15:51	0.0002	0.00023	0.00103
15:52	0.00029	0.00038	0.00865
15:53	0.00024	0.00024	0.00215
15:54	0.00023	0.00033	0.00532
15:55	0.00017	0.00024	0.00393
15:56	0.00017	0.00022	0.00453
15:57	0.00019	0.00019	0.00122
15:58	0.00021	0.00024	0.00239
15:59	0.00024	0.00022	0.00122
16:00	0.00017	0.00018	0.00074
16:01	0.0002	0.00023	0.00102
16:02	0.0002	0.00027	0.00602
16:03	0.00032	0.00035	0.00695
16:04	0.00019	0.00019	0.00212
16:05	0.00035	0.00039	0.00139
16:06	0.00019	0.00022	0.00205
16:07	0.00017	0.00016	0.00076
16:08	0.00018	0.00019	0.00151
16:09	0.00018	0.00018	0.00189
16:10	0.00017	0.00016	0.00108
16:11	0.00018	0.00023	0.00484

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
16:12	0.00018	0.00019	0.00176
16:13	0.00017	0.00018	0.00151
16:14	0.00015	0.00015	0.00114
16:15	0.00017	0.00018	0.00208
16:16	0.00019	0.0002	0.00169
16:17	0.00018	0.00016	0.00165
16:18	0.00023	0.00031	0.00727
16:19	0.00015	0.00015	0.0011
16:20	0.00019	0.00016	0.00144
16:21	0.00015	0.00013	0.00089
16:22	0.0003	0.00052	0.0116
16:23	0.00015	0.00015	0.00386

Appendix D

Measured VDV_s at V2

Table 12 Measured VDV_s at V2

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
12:43	0.00091	0.00097	0.00448
12:44	0.00122	0.00123	0.00548
12:45	0.00102	0.00112	0.0042
12:46	0.00101	0.00118	0.00462
12:47	0.00089	0.00097	0.00247
12:48	0.00084	0.00084	0.00179
12:49	0.00095	0.00102	0.00296
12:50	0.00156	0.00088	0.00231
12:51	0.00089	0.00091	0.00222
12:52	0.00116	0.0015	0.00784
12:53	0.00103	0.0011	0.00469
12:54	0.00089	0.00101	0.00321
12:55	0.00095	0.00099	0.0024
12:56	0.00083	0.00083	0.00183
12:57	0.00089	0.00097	0.00319
12:58	0.0008	0.00079	0.00277
12:59	0.00098	0.001	0.00428
13:00	0.00093	0.00094	0.00371
13:01	0.00088	0.00082	0.00236
13:02	0.00095	0.00099	0.00467
13:03	0.00079	0.00082	0.00219
13:04	0.00078	0.0008	0.00321
13:05	0.00093	0.00095	0.00474
13:06	0.0009	0.00089	0.00381
13:07	0.00094	0.00104	0.00376
13:08	0.0009	0.00097	0.00421

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
13:09	0.00098	0.00105	0.00339
13:10	0.0008	0.00081	0.0015
13:11	0.00091	0.00085	0.00262
13:12	0.00105	0.00096	0.00298
13:13	0.00089	0.00089	0.00226
13:14	0.00091	0.0008	0.00212
13:15	0.00136	0.0017	0.00626
13:16	0.00084	0.00089	0.00129
13:17	0.00093	0.00102	0.00388
13:18	0.00107	0.00132	0.00478
13:19	0.00084	0.00093	0.00293
13:20	0.00095	0.00096	0.00191
13:21	0.00085	0.00104	0.00305
13:22	0.0008	0.00085	0.00147
13:23	0.00088	0.00087	0.00157
13:24	0.00089	0.00084	0.00119
13:25	0.00087	0.00079	0.00125
13:26	0.00093	0.00087	0.0014
13:27	0.00107	0.00092	0.00174
13:28	0.00104	0.0008	0.00149
13:29	0.00098	0.00137	0.00682
13:30	0.00096	0.00104	0.00357
13:31	0.00092	0.00104	0.00238
13:32	0.00086	0.0009	0.00151
13:33	0.00087	0.00098	0.00197
13:34	0.00093	0.00093	0.00253
13:35	0.0008	0.00082	0.00192

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
13:36	0.00102	0.00116	0.00237
13:37	0.00082	0.00086	0.00182
13:38	0.0009	0.00087	0.00201
13:39	0.00088	0.00088	0.00203
13:40	0.00081	0.00074	0.00128
13:41	0.00082	0.00083	0.00109
13:42	0.00085	0.00082	0.0012
13:43	0.00081	0.00083	0.00138
13:44	0.00091	0.0009	0.0018
13:45	0.00083	0.00078	0.0011
13:46	0.00079	0.00098	0.00164
13:47	0.00083	0.0008	0.00166
13:48	0.00089	0.00092	0.00201
13:49	0.00091	0.00091	0.00156
13:50	0.00085	0.00086	0.00161
13:51	0.00082	0.00083	0.00119
13:52	0.00088	0.00082	0.00117
13:53	0.00082	0.00086	0.00149
13:54	0.00086	0.00088	0.00151
13:55	0.00086	0.00089	0.0022
13:56	0.00087	0.00086	0.00128
13:57	0.0009	0.00089	0.00336
13:58	0.00089	0.00086	0.00248
13:59	0.00092	0.0009	0.00308
14:00	0.00087	0.0009	0.00277
14:01	0.00097	0.00115	0.00381
14:02	0.00103	0.00133	0.00505

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
14:03	0.00105	0.00131	0.00519
14:04	0.00085	0.00088	0.00364
14:05	0.00085	0.00099	0.00211
14:06	0.00102	0.00118	0.00495
14:07	0.001	0.00108	0.00295
14:08	0.00101	0.00112	0.00414
14:09	0.00096	0.00101	0.00285
14:10	0.00092	0.00089	0.00296
14:11	0.00084	0.0008	0.00278
14:12	0.00092	0.00085	0.00319
14:13	0.00095	0.00089	0.00266
14:14	0.00087	0.00084	0.00314
14:15	0.00096	0.0009	0.00279
14:16	0.00087	0.00082	0.00231
14:17	0.00091	0.00091	0.00316
14:18	0.00088	0.00104	0.00365
14:19	0.00085	0.00104	0.0027
14:20	0.00087	0.001	0.00234
14:21	0.00095	0.00112	0.00311
14:22	0.00096	0.00093	0.00262
14:23	0.00092	0.00095	0.00315
14:24	0.00097	0.00108	0.00298
14:25	0.00088	0.00091	0.00188
14:26	0.00092	0.00114	0.00306
14:27	0.00097	0.00098	0.00384
14:28	0.00105	0.00105	0.00411
14:29	0.00095	0.00122	0.00578

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Consultants in Acoustics, Noise & Vibration

Start time	Vibration Dose Value (m/s ^{1.75})		
	X	Y	Z
14:30	0.00099	0.00118	0.00669
14:31	0.00109	0.00144	0.00833
14:32	0.00111	0.00142	0.00765
14:33	0.00101	0.00125	0.00642
14:34	0.00101	0.0013	0.00708
14:35	0.00108	0.00134	0.00637
14:36	0.00098	0.00126	0.00723
14:37	0.0011	0.00146	0.00736
14:38	0.00094	0.00115	0.00663
14:39	0.00105	0.00138	0.00708
14:40	0.00101	0.00129	0.00702
14:41	0.00098	0.00116	0.00711
14:42	0.00091	0.00125	0.00779

Appendix E

Predicted reradiated noise levels

Table 13 Predicted re radiated noise at the proposed residential receptors (based on measurements at V1)

Start time	A-weighted re-radiated sound pressure level (dB)
14:25	26
14:32	7
14:45	25
14:46	28
14:51	8
15:01	25
15:16	7
15:19	10
15:20	24
15:30	19
15:45	23
15:50	25
16:10	6
16:17	9
16:21	15

Table 14 Predicted re radiated noise at the proposed residential receptors (based on measurements at V2)

Start time	A-weighted re-radiated sound pressure level (dB)
12:43	13
12:44	11
12:45	11
12:46	12
12:47	11
12:48	8
12:49	8
12:50	11
12:51	8
12:52	12

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Consultants in Acoustics, Noise & Vibration

Start time	A-weighted re-radiated sound pressure level (dB)
12:53	13
12:54	12
12:55	12
12:56	19
12:57	14
12:58	8
12:59	10
13:00	12
13:01	14
13:02	12
13:03	9
13:04	7
13:05	8
13:06	15
13:07	8
13:08	11
13:09	7
13:10	16
13:11	6
13:12	27
13:13	12
13:14	11
13:15	12
13:16	13
13:17	7
13:18	12
13:19	11
13:20	10

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Consultants in Acoustics, Noise & Vibration

Start time	A-weighted re-radiated sound pressure level (dB)
13:21	12
13:22	10
13:23	13
13:24	7
13:25	12
13:26	7
13:27	9
13:28	6
13:29	16
13:30	10
13:31	9
13:32	7
13:33	6
13:34	10
13:35	7
13:36	10
13:37	9
13:38	14
13:39	8
13:40	8
13:41	6
13:42	11
13:43	12
13:44	8
13:45	7
13:46	11
13:47	12
13:48	9

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Consultants in Acoustics, Noise & Vibration

Start time	A-weighted re-radiated sound pressure level (dB)
13:49	8
13:50	10
13:51	6
13:52	6
13:53	14
13:54	8
13:55	13
13:56	13
13:57	10
13:58	11
13:59	11
14:00	12
14:01	12
14:02	23
14:03	11
14:04	8
14:05	8
14:06	13
14:07	11
14:08	16
14:09	11
14:10	9
14:11	10
14:12	14
14:13	14
14:14	14
14:15	22
14:16	15

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Consultants in Acoustics, Noise & Vibration

Start time	A-weighted re-radiated sound pressure level (dB)
14:17	10
14:18	10
14:19	9
14:20	8
14:21	12
14:22	10
14:23	10
14:24	13
14:25	12
14:26	10
14:27	10
14:28	17
14:29	14
14:30	15
14:31	8
14:32	19
14:33	11
14:34	9
14:35	14
14:36	22
14:37	12
14:38	12
14:39	7
14:40	16
14:41	10
14:42	7

Appendix: Noise and Vibration

Annex 1: Glossary

Annex 2: Legislative, Planning Policy Context and Other Relevant Standards and Guidance

Annex 3: Environmental Noise and Vibration Report

Annex 4: Construction Plant Assumptions

Annex 5: Pedestrian Route Noise Assumptions

Annex 4 – Construction modelling assumptions

The Construction Methodology for the Proposed Development has been reviewed by Sandy Brown to assess the potential noise and vibration effects associated with the construction activities.

There are two phases of the Proposed Development. Phase 1 comprises the following:

- Demolition (into two phases)
- Highway infrastructure
- Construction of the Stadium and commercial buildings (Plots 1 and 2)
- Construction of residential Plots 3, 4, 5, 6, 7, 8, 15, 16, 17, 18, 19.

After Phase 1 is complete work on Phase 2 will commence. Phase 2 comprises the following:

- Demolition
- Highway infrastructure
- Construction of residential Plots 9, 10, 11, 12, 13 and 14.

The occupation of the plots within each phase will be staggered, so the first constructed plots will be occupied prior to the construction of the later ones. Consequentially the Proposed Development will introduce receptors throughout the construction programme.

Approach to assessment

The construction activities are anticipated to take approximately 96 months (8 years). The assessment of construction noise and vibration has considered the periods where the highest potential for adverse effects could occur, ie, when construction events across multiple plots occur simultaneously.

The periods in the construction programme that have been assessed are known as 'timeslices'. Timeslices 1, 2, 3 and 4 are within Phase 1, with Timeslices 5, 6 and 7 within Phase 2.

The following sections outline the construction activities within each assessed timeslice.

Timeslice 1 (Year 2 Q1)

Works will include:

- Demolition (plots 15 and 18)
- Infrastructure road (plot 2 piling)
- Plot 19 - substructure

Timeslice 2 (Year 2 Q4)

Works will include:

- Demolition (breakout hardstandings)
- Infrastructure road
- Plot 2 – superstructure
- Plot 19 – superstructure
- Plot 18 – substructure

Timeslice 3 (Year 3 Q3)

Works will include:

- Plot 1 – superstructure
- Plot 2 – superstructure
- Plot 19 – internal fit-out
- Plot 18 – envelope
- Plot 17 – superstructure
- Plot 16 – superstructure
- Plot 15 – substructure
- Plot 3 – substructure

Timeslice 4 (Year 4 Q2)

Works will include:

- Plots 1, 18, 17 and 16 – internal fit-out
- Plots 15 and 3 - envelope
- Plot 4 – superstructure
- Plot 5 – superstructure
- Plot 6 – superstructure
- Plot 7 – superstructure
- Plot 8 – substructure.

Introduced receptors:

- Plots 2 and 19.

Timeslice 5 (Year 6 Q2)

Works will include:

- Demolition (plots 9, 10, 11, 12, 13 and 14)
- Infrastructure road
- Plot 14 - substructure

Introduced receptors:

- Plots 1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 17, 18 and19.

Timeslice 6 (Year 6 Q4)

Works will include:

- Plot 14 – superstructure
- Plot 9 – superstructure
- Plot 13 – substructure.

Introduced receptors:

- Plots 1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 17, 18 and19.

Timeslice 7 (Year 7 Q2)

- Plot 14 – envelope and internal fit-out
- Plot 9 – superstructure
- Plot 13 – superstructure
- Plot 12 – substructure
- Plot 10 – superstructure
- Plot 11 – substructure.

Construction plant assumptions

The assessment only considers the noisiest activities, so does not include the envelope/cladding or fit-out and external works.

Demolition

The construction plant assumptions for the assessment of demolition works are presented in Table 1.

Table 1 Construction plant assumptions for demolition

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Dozer	2	50	C.2-1	75
Mobile crane (35t)	2	50	C.4-43	70
Concrete crushers	1	25	C.1-14	86
Tracked excavators with breakers	2	25	C.1-9	90
Tracked excavators	2	50	C.2-2	77

Highway infrastructure

The construction plant assumptions for the assessment of highway infrastructure are presented in Table 2

Table 2 Construction plant assumptions for highway infrastructure

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Dozer	2	50	C.2-1	75
Mobile cranes (35t)	2	50	C.4-43	70
Concrete crushers	1	25	C.1-14	86
Tracked excavator	1	50	C.2-2	77
Tracked excavator with breaker	1	25	C.1-9	90

Substructure

The construction plant assumptions for the assessment of substructure works for each plot are listed in Table 3.

Table 3 Construction plant assumptions for substructure

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Dozer	2	50	C.2-1	75
Concrete crushers	1	10	C.1-14	86
Tracked excavator	1	25	C.2-2	77
Piling rigs (CFA)	2	50	C.3-16	79
Tracked excavator with breaker	1	10	C.1-9	90
Mobile cranes (35t)	2	50	C.4-43	70
Concrete pump and concrete mixer trucks	2	25	C.4-28	75
Tower Crane	1	50	C.4-47	76

Superstructure

The construction plant assumptions for the superstructure works for each plot are listed in Table 4.

Table 4 Construction plant assumptions for superstructure

Construction plant	Number	% activity	BS5228-1 reference	L_{Aeq} at 10 m (dB)
Mobile cranes (35t)	2	50	C.4-43	70
Concrete pump and concrete mixer truck	2	50	C.4-28	75
Tower Cranes	1	50	C.4-47	76
External hoist	1	50	C.4-61	68

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Annex 5 – Pedestrian route noise assumptions

Measurements along the pedestrian route to the existing Ebbsfleet United stadium were completed on 22 May 2022, as detailed in Annex 3.

It was not possible during these measurements to establish a reliable relationship between the sound level produced by each pedestrian along the route, due to the high levels of road noise.

Consequently, assessment has been based on previous surveys completed by Sandy Brown, along a pedestrian route used before and after a football match. The noise survey was calibrated with simultaneous footfall counts.

The measurements were completed at a position approximately 5 m from the pedestrian route. The dominant noise source was caused by the football fans, rather than other environmental noise sources.

Table 1 presents the noise levels and the pedestrian foot count measurements.

Table 1 Measured noise levels and corresponding footfall counts

Measurement time	Measured sound pressure level (dB)		Footfall count
	$L_{Aeq,15min}$	$L_{AFmax,15min}$	
14:00-14:15	62	88	1,185
17:05-17:20	60	82	1,131

Using the above data, a sound power level for a single person within a moving crowd has been derived. The sound power level has been calculated on the basis that each person is a point source moving at 5 km/hr.

A sound power level of L_{wA} 77 dB has been calculated per person in a moving crowd, which is approximately equal to a raised vocal effort (as per ANSI 3.5).

The above information has been included the noise model, with the total number of pedestrians across the hour equal to the proposed capacity of the stadium, ie, 8,000.