GSK Hillingdon

Noise and Vibration Assessment

Prologis UK Limited

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Quality information

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1. Introduction

AECOM has been appointed to carry out a noise and vibration assessment to support a planning application for the redevelopment of the site to provide two industrial units providing industrial floorspace (Use Class B1c/B2/B8) and ancillary officers together with associated parking, access arrangements, landscaping and infrastructure.

This report presents the following:

- Establishment of background noise levels at nearby sensitive receptors;
- Assessment of operational noise levels from site activities and vehicle movements;
- Assessment of change in traffic noise along the local road network.
- Recommendations for operational noise limits applicable to fixed plant and building services; and
- A qualitative construction noise and vibration assessment to include generic mitigation and best practise measures.

A glossary of acoustic terminology can be found in Appendix A.

2. Application Site Description

Figure 1 presents the site location within the approximate red line boundary within the London Borough of Hillingdon (LBH). The nearest noise sensitive receptors (residential properties along Emden Close) approximately 135 metres from the southern site boundary and are illustrated in Figure 1 along with monitoring locations LT1 and ST1.

The site is currently occupied by GSK and comprises office buildings with associated car parking. The site is bounded by Iron Bridge Road North to the east, Iron Bridge Road South to the south, Horton Road to the north and the A408 Stockley Road along the eastern boundary. Rail lines, which are used by both local and mainline services, are located approximately 100 metres from the southern boundary.

Figure 1. Site location with redline boundary

3. Noise Guidance and Assessment Criteria

Policy, Legislation and Guidance

The noise assessment has been carried out with reference to the following policy, legislation and guidance.

- National Planning Policy Framework (2019);
- Noise Policy Statement for England (2010);
- Planning Practice Guidance Noise (July 2019);
- Hillingdon Local Plan Part 1 (2012), Part 2 (2020);
- London Borough of Hillingdon Supplementary Planning Document (SPD) (2006);
- BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (2014);
- Calculation of Road Traffic Noise (CRTN) (1988);
- Design Manual for Roads and Bridges (DMRB) (2011); and
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

Detailed information on the referenced planning policy context is provided in Appendix B.

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

The assessment methodology presented in BS 4142:2014+A1:2019 has been used to assess the potential impact of site activity noise on nearby receptors.

A key aspect of the BS 4142 assessment method is a comparison between the background noise level in the vicinity of receptor locations and the rating level of the noise source under consideration. The relevant parameters in this instance are as follows:

- Background sound level – $L_{A90,T}$ – defined in the Standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels;
- Specific sound level – $L_{Aeq,Tr}$ – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr; and
- Rating level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.

BS 4142 recommends that the specified interval over which the specific sound level is determined as 1 hour during the day from 07:00 to 23:00 hours and a shorter period of 15 minutes at night from 23:00 to 07:00 hours.

The standard recognises that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:

- Tonality - a penalty of 2 dB is applied for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;
- Impulsivity - a penalty of 3 dB is applied for impulsivity which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;
- Intermittency - a penalty of 3 dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions;
- Other sound characteristics - a penalty of 3 dB can be applied where the specific sound features characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment.

Once any adjustments have been made, the background level and the rating levels are compared. BS 4142 advises the following

a. *Typically, the greater the difference, the greater the magnitude of impact.*

b. *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.*

c. *A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.*

d. *The lower the rating level is to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context.*

With reference to Noise Policy Statement for England (NPSE), the Lowest Observed Adverse Effect Level (LOAEL) is defined in this assessment as where there rating level is equal to the background level, and the Significant Observed Adverse Effect Level (SOAEL) as where the rating level is 10 dB greater than the background level.

Calculation of Road Traffic Noise (1988)

The Department of Transport/Welsh Office Memorandum 'Calculation of Road Traffic Noise (CRTN)' describes procedures for traffic noise calculation and is suitable for environmental assessments of schemes where road traffic noise may have an impact.

Design Manual for Roads and Bridges (2011)

Highways Agency (2011); Design Manual for Roads and Bridges Volume 11 Section 3 Part 7-Traffic Noise and Vibration provides criteria for the assessment of traffic noise changes. These criteria are presented in Table 1 and are based upon Table 3.2 of DMRB HD 213/11 Revision 1.

With reference to NPSE, the LOAEL is defined in this assessment as a change of 3 dB and the SOAEL as a change of 10 dB.

Table 1. Classification of Magnitude of Noise Impacts in the Long Term

Relative Change in Road Traffic Noise Level (dB)	Magnitude of Impact as per DMRB Guidance	Effect
0	No change	NOEL
0.1 – 2.9	Negligible	
3.0 – 4.9	Minor	LOAEL
5.0 – 9.9	Moderate	
10.0+	Major	SOAEL

British Standard 5228:2009 (+A1:2014)

BS 5228 'Noise and Vibration Control on Construction and Open Sites' provides a 'best practice' guide for noise and vibration control and includes Sound Power Level (Lw) data for individual plant as well as a calculation method for noise from construction activities. It also provides guidance on the human response to vibration. Part 1 considers noise whilst Part 2 considers vibration.

4. Background Noise Survey

Methodology

The noise climate in the vicinity of the proposed development was established by undertaking long-term unattended and short-term attended monitoring. As a secure location was not available at the nearest noise sensitive properties, long term unattended monitoring was undertaken at the southwestern site boundary along Iron Bridge Road North.

The long-term unattended monitoring location (LT1) was considered representative of the typical noise climate in the area. The location is shown in Figure 1 and Figure 2. The measurement commenced at 12:00pm on Wednesday 8th April 2020 and concluded on Tuesday 14th April 2020.

A short-term measurement was carried out at one location (ST1) on Wednesday 8th April 2020 at 13:00 hours for a duration of 60-minutes. ST1 was located on Emden Close next to the nearest noise sensitive receptors to the GSK site at approximately 135m from the southern site boundary. This measurement was undertaken to provide an indication of any difference in noise levels at the site boundary and at the nearest residences and inform the noise climate in that area. The location of ST1 is shown in Figure 1 and Figure 3.

Noise measurements were carried out following guidance from BS 7445-1:2003 'Description and measurement of environmental noise – Part 1: Guide to quantities and procedures' and BS 4142:2014+A1:2019.

Figure 2. LT1 Monitoring Location

Figure 3. ST1 Monitoring Location

Noise Monitoring Equipment

Details of the measurement equipment used are summarised in Table 2. Monitoring equipment was programmed to measure various sound level indicators, including the $L_{Aeq,T,}$(dB), $L_{A90,T}$ (dB), and L_{AFmax} (dB).

The sound level meters are calibrated every two years by a UKAS accredited calibration laboratory to IEC 61672-3:2006. UKAS calibration certificates are available upon request. The sound level meters were checked with field calibrators immediately before and after the surveys. No significant calibration drift (±0.1 dB) was detected.

Table 2. Noise Monitoring Equipment

Equipment	Manufacturer/Model	Serial number
Class 1 Sound Level Meter (ST1)	Rion NI-52	00743081
Class 1 Sound Level Meter (LT1)	01dB DUO	12049
Class 1 Field Calibrator	Rion NC-74	50541127

Weather Conditions

The weather conditions were monitored during site visits and were noted to be favourable for noise monitoring. i.e. wind speeds less than 5 m/s and no precipitation. The temperature during LT1 measurement setup and ST1 measurement was 23 °C. There was no precipitation or cloud cover.

Noise Monitoring Results

The dominant noise source at ST1 was observed to be activity from the houses on Emden Close. The dominant noise source at LT1 was observed at the start of the survey to be road traffic from Iron Bridge Road, which primarily consisted of Heavy-Duty Vehicles (HDV). Other sources of noise included rail noise from the tracks close to the southern boundary of the site.

The results of the short-term monitoring are shown in Table 3. All noise levels are free-field values, re. 20 µPa.

Table 3. Short Term Noise Monitoring Results (ST1)

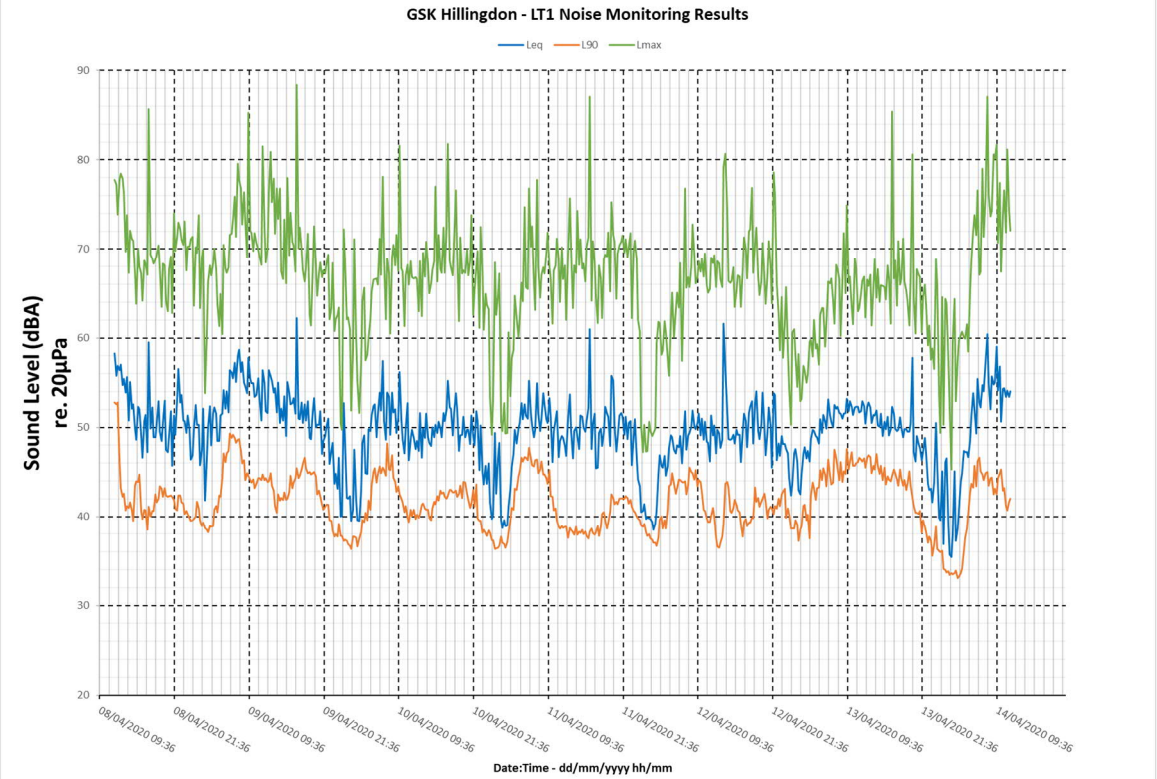
Date of measurement	Time	Duration (T)	Ambient noise level $L_{Aeq,1h}$ (dB)	Maximum L_{AFmax} (dB)	Background $L_{A90,1h}$ (dB)
Wednesday 08/04/2020	13:00	60 minutes	55	74	41

A time-history of data logged at LT1 is presented in Figure 4 and a summary of data is presented in Table 4. The measured levels at LT1 between 13:00 and 14:00hrs on 8th April were 55dB $L_{Aeq,1h,}$ 79dB L_{AFmax} and 41dB $L_{A90,1h.}$ These measurements are in line with those measured at ST1 during the same time period; therefore it is demonstrated that LT1 is a representative proxy location for assessing ambient noise levels at the nearest residences.

Table 4. Long Term Noise Monitoring Results (LT1)

Date of measurement	Daytime (0700-2300)		Night-time (2300-0700)		
	Ambient noise level $L_{Aeq,16h}$ (dB)	Background $L_{A90,1h}$ (dB)	Ambient noise level $L_{Aeq,8h}$ (dB)	Background $L_{A90,1h}$ (dB)	Maximum L_{AFmax} (dB)
Wednesday 08/04/2020	53	39	51	38	74
Thursday 09/04/2020	54	40	48	36	72
Friday 10/04/2020	51	39	48	36	77
Saturday 11//04/2020	51	38	46	37	71
Sunday 12/04/2020	51	37	48	37	66
Monday 13/04/2020	51	37	48	33	77
Tuesday 14/04/2020	55	41			
Mean	52	38	48	36	73

Figure 4. Noise Monitoring Results LT1



Impact of COVID-19 on Survey data

Traffic patterns, operation and frequency have been affected by the COVID-19 outbreak in the UK.

With regards to the noise data presented in this report, the absolute level of the dominant noise sources has not changed; however, the frequency of occurrence of the noise sources has reduced, for instance, changes to rail operation has been altered, meaning trains may operate less frequently, as the UK lockdown rules were implemented. Additionally, traffic flow around the UK has decreased significantly since the UK lockdown was implemented as less cars are on the roads due to an 'essential travel only' scheme.

In considering the effect of Covid-19 on the assessment, it is likely the measured $L_{A90,T}$ background noise levels are lower than would be typical; therefore, assessment criteria based on measured $L_{A90,T}$ background noise levels is likely to be lower than what may be expected during normality. As such, the assessment may be taken to represent a conservative worst-case then would be usual and thus is considered to be robust.

5. Operational Noise Assessment – HDVs

The predominant source of noise from operation of the proposed development is likely to be due to HDV movements, loading and unloading. The proposed development layout is shown in Figure 5. It may be noted that Unit 1 is proposed to be constructed 60 metres from the southern boundary of the site with the loading bay to the south of the building.

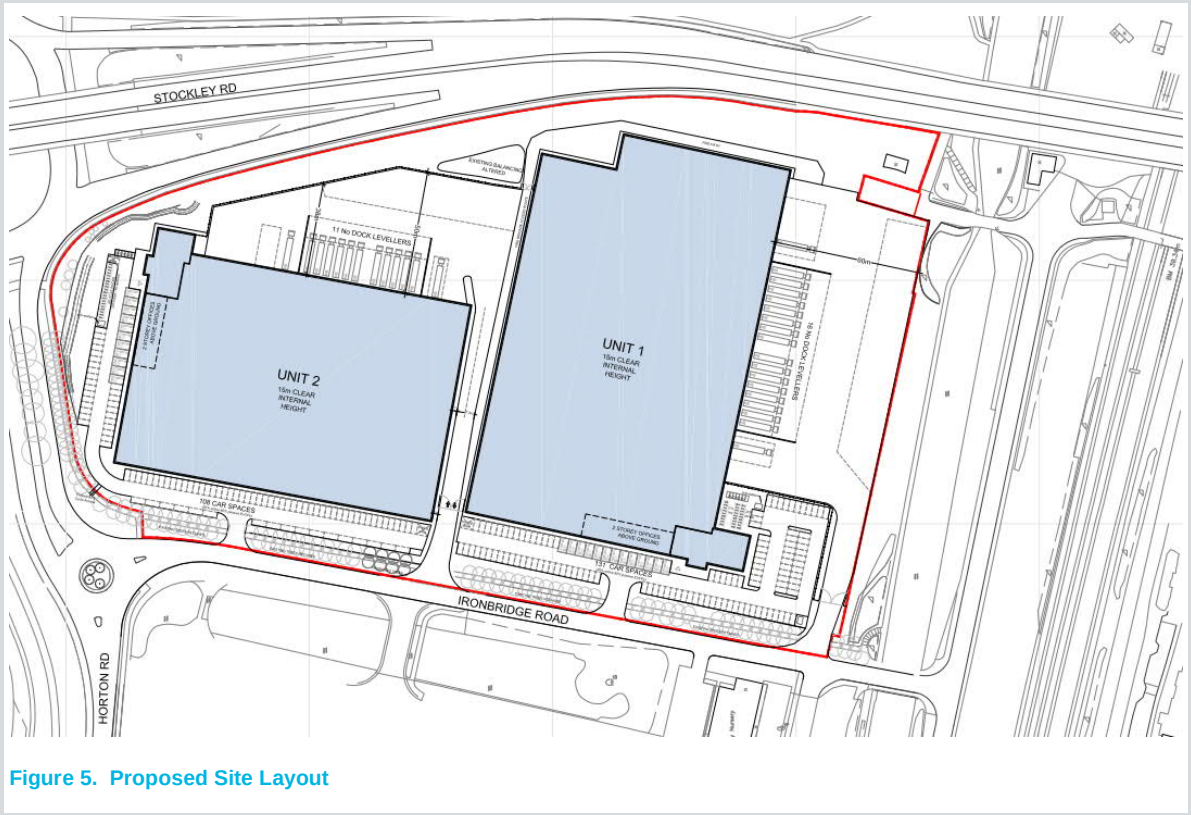


Figure 5. Proposed Site Layout

It is noted the Hillingdon Noise SPD refers to BS 4142 as the appropriate assessment methodology for noise due to "*Premises, such as warehouse distribution premises, where delivery lorries are driven and manoeuvred, and are loaded or unloaded by forklift trucks etc; Premises where there are manoeuvring lorries on which on-board refrigeration plant is run; Loaders, dumpers and haulage vehicles operating in yards handling building materials or at waste disposal sites*".

For the purposes of this assessment, an $L_{Aeq,T}$ of 70 dB at 10 metres has been used as a noise source term for HDV movements from AECOM's in-house database. Noise due to HDV loading and unloading has been defined as 65 dB $L_{Aeq,T}$ at 10 metres based on AECOM's in-house database.

The distance from the site boundary to the residences is approximately 140 metres. It is proposed to construct a 2.5 metre high solid barrier along the southern site boundary. A source height of 1 metre has been assumed for the HDV noise and receive heights of 1 metre (ground floor level) and 4 metres (first floor level) for daytime and night-time respectively. Using Maekawa's formula the barrier is calculated to provide 5 dB screening attenuation.

Noise due to HDVs arriving, loading and unloading is not considered to be tonal or impulsive but could be described as intermittent. A +3 dB penalty has therefore been added in accordance with BS 4142 guidance. A further +3dB penalty has also been applied as the HDV noise may be readily distinctive against the residual acoustic environment.

For the daytime assessment it is assumed that each of the dock levellers would be occupied during a typical hour. BS 4142 specifies one hour is the reference time period for daytime noise assessments. Vehicles would enter the yard and reverse into a dock. This would take 2.5 minutes per vehicle. Loading/unloading would take 30 minutes. The vehicle would then take 0.5 minute to depart. As the HDVs are parked at the dock leveller, the body of the vehicle would provide acoustic screening, with loading activity noise directed into the unit (away from residences). A 5dB reduction has been subtracted for this screening. Table 5 presents the daytime calculation and BS 4142 assessment.

Table 5. Daytime BS 4142 Assessment

Activity	Noise Level (dB L_{Aeq})		
HDV movement (arrive, depart, manoeuvre)	70		70
HDV unloading/loading		65	
Screening		-5	
Correction for No of docks in use (16)	12	12	12
Correction for Time of event (2.5/30/0.5 minutes)	-14	-3	-21
Distance Correction	-26	-26	-26
Barrier Correction	-5	-5	-5
Total Activity noise	37	38	30
Specific Noise Level ($L_{Aeq,1hr}$)		41	
Intermittency Correction		+3	
Other feature correction		+3	
Rating Noise Level		47	
$L_{A90,1h}$		38	
Difference		+9	

For the night-time assessment it is assumed two of the dock levellers would be occupied in a typical 15 minute period. BS 4142 specifies 15 minutes as the reference time period for night-time noise assessments. The assessment assumes one HDV arrives, manoeuvres commences unloading. At the same time one HDV is being loaded, completes loading and departs from site. Table 6 presents the night-time calculation and BS 4142 assessment.

Table 6. Night-time BS 4142 Assessment

Activity	Noise Level (dB L_{Aeq})		
HDV movement (arrive, depart, manoeuvre)	70		70
HDV unloading/loading		65	
Screening		-5	
Correction for No of docks in use (2)	0	+3	0
Correction for Time of event (2.5/30/0.5 minutes)	-8	0	-15
Distance Correction	-26	-26	-26
Barrier Correction	-5	-5	-5
Total Activity noise	31	32	24
Specific Noise Level ($L_{Aeq,15min}$)		35	
Intermittency Correction		+3	
‘Other’ feature correction		+3	
Rating Noise Level		41	
$L_{A90,1h}$		36	
Difference		+5	

As noted in Section 3, for the assessment the rating level and the background level should be compared, and BS 4142 advises the following

a. Typically, the greater the difference, the greater the magnitude of impact.

b. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.

c. A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.

On the basis of the above, the assessment indicates a significant adverse impact during the daytime depending on the context and an adverse impact at night depending on the context.

Context

BS 4142 advises the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

The follow factors have been considered;

The absolute level of sound: BS 4142 suggests that the magnitude of an impact may be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. In this instance the residual sound (the ambient sound at the assessment location in the absence of the specific sound) is 52dB L_{Aeq} during the day and 48dB L_{Aeq} during the night. These are considered to be typical for an outer London location, neither low nor high. The absolute level of sound due to the new development are 41dB L_{Aeq} during the day 35dB L_{Aeq} at night. The typical sound reduction through a partially open window is 10-15dBA. Even assuming the lower of these, the level inside a dwelling would be 31dB L_{Aeq} during the day 25dB L_{Aeq} at night. This is below the guideline levels advised in BS 8233:2014[1] which are 35dB L_{Aeq} and 30dB L_{Aeq} respectively.

The character and level of the residual sound compared to the character and level of the specific sound: The specific sound during the day is 41dB L_{Aeq} whilst the residual sound level is 52dB $L_{Aeq.}$ At night, the specific sound is 35dB L_{Aeq} whilst the residual is 48dB $L_{Aeq.}$ The specific sound is therefore more than 10dB below the residual sound for both time periods. The residual sound environment is characterised by road and rail traffic. In particular during the day Iron Bridge Road South is used by HDVs accessing the Hanson aggregates and ready-mix concrete site. Passenger trains operate throughout much of the night, with occasional goods trains throughout the entire night. There are other existing distribution depots in the area which already operate 24/7 and will also influence the existing acoustic environment. Noise from the proposed development will be very similar in character to that which already exists.

The receptors. The nearest noise sensitive receptors are dwellings on Emden Close. These are two storey terraced houses. The majority face north, toward the development site, but the areas to the front of the dwellings are primarily used for car parking and it is considered unlikely residents spend much time in the external areas to the front of the properties. The gardens serving the properties are at the rear and so would be acoustically screened from activities at the development site such they would be below guideline levels in BS 8233 for external amenity areas. The properties appear to be relatively recent in construction in that it is likely they have double glazed windows. These would be expected to provide at least 30dB sound reduction of external noise and hence noise from activities at the development site would be less than 20dBA internal when windows are closed. As noted above, even with windows open at night, noise from activities at the site would be below the guideline levels in BS 8233. There are two strips of mature vegetation 6-11 metres high along each bank of the Grand Union Canal which separates the site from the residences. Whilst this will not reduce noise levels, it will act as a visual screen which can have a psychological benefit when considering the effects of noise.

Overall, taking context into account, the noise impact is considered to be less significant than the initial assessment would suggest. The absolute level of noise is calculated to be low, the character of the noise is similar to existing and the levels expected in the rear gardens and inside dwellings are below guideline levels.

[1] BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings – BSi

Uncertainty

Some uncertainty in the measured data and calculations is unavoidable. With regards to the measured data, this has been minimised as follows:

- Attended measurements at the receptors to corroborate the selected long term monitoring position was an acceptable proxy location.
- Automated sound level measurements were undertaken over a full week (7 days) to capture typical weekday and weekend situations.
- Use of suitable Class 1 sound level meter which complies with the relevant standards and has been calibrated at a UKAS accredited laboratory within the previous year;
- Field calibration of the measurement system on site at the start and end of each monitoring period; and
- Consideration of weather conditions on site.

With regards to the calculations, uncertainties have been minimised as follows:

- Use of established acoustic formulae to predict façade noise levels.
- Use of worst case L_{A90} noise levels to ensure a robust assessment.

Noise Minimisation

The following noise minimisation measures are to be implemented:

- There will be adequate signage and instruction to ensure that all drivers and staff follow the site noise management measures;
- All engines will be switched off as soon as vehicles are parked at the unloading dock;
- Whilst vehicles remain stationary in the service yard, no engines are to be left idling;
- Refrigeration units are not to be operated using running vehicle engines whilst stationary in the service yard. Any refrigeration units on stationary vehicles shall be operated by means of an electrical system;
- All delivery vehicles are to be driven in as quiet manner as possible, avoiding unnecessary engine revving;
- No radios or stereos to be left on in vehicles at any time;
- Staff instructed to work quietly outside;
- All components of the delivery system to be maintained in good working order (lifts, gates, forklifts);
- No external tannoys; and
- No goods pallets and roll cages to be moved in open areas of the service yard.

6. Fixed Plant and Building Services Noise Limits

It is assumed that the development will include the provision of various mechanical and electrical services. With reference to the LBH SPD it is noted that the stated requirement is "*that the rating level of the noise from the proposed development determined according to BS4142 is at least 5 dB below the background noise level $L_{A90,T}$. Ideally, the assessment of noise should give a positive indication that complaints are unlikely*".

It is noted that the LBH SPD refers to the 1997 version of BS 4142. This has been superseded by the 2014 version in which the rating level of noise is calculated differently, and the assessment outcomes are expressed in terms of adverse impacts as detailed in Section 3.2. This revised version of BS 4142 states that "*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context*". Therefore, it is considered reasonable that any new plant and equipment should be designed and operated such that the rating noise level does not exceed the measured background ($L_{A90,1h}$) noise level when plant is operational.

Table 7 presents proposed operational noise limits for any fixed plant and building services associated with the Proposed Development, experienced at nearby sensitive receptors. All noise sources should be designed such that they do not produce any distinguishable, discrete or continuous notes (e.g. whine, hiss, screech, hum, etc.) or distinct impulses (e.g. bangs, clicks, clatters, or thumps). Where this is not the case, consideration will need to be given to additional penalties that need to be applied to the rating noise level when assessed during detailed design.

Table 7. Proposed Building Services Design Criteria at the Nearest Residential Receptor

Location	Rating Level of Operational Noise $L_{Ar,Tr}$, dB	
	Day (07:00 – 23:00)	Night (23:00-07:00)
Emden Close – 1m from façade of building	38	36

7. Development Road Traffic Noise

Changes to road traffic noise levels have been calculated with reference to the methodology within the CRTN which contains an equation for the calculation of the Baseline Noise Level (BNL) from a road in terms of the 18-hour AAWT (Average Annual Weekday Traffic) flow from 06:00 to 24:00 (i.e. over an 18-hr period) and have been assessed using the criteria specified within Table 1. The results of road traffic noise and the resultant noise impact are presented in Table 8.

Table 8. Development Road Traffic Assessment

Road link Table text	Baseline Traffic Flow		Baseline + Development Traffic Flow		Relative change in noise level, $L_{A10,18h}$	Impact
	Total vehicles 18hr AAWT	Total HDV (%)	Total vehicles 18hr AAWT	Total HDV (%)		
Horton Rd West	7981	1848 (23%)	6893	1916 (28%)	-0.1 dB	Negligible
Stockley Rd North	41619	487 (1%)	43098	553 (1%)	+0.2 dB	Negligible
Stockley Rd South	48638	2118 (4%)	50760	2676 (5%)	+0.5 dB	Negligible
Horton Rd East	14085	1544 (11%)	16243	2166 (13%)	+1.1 dB	Negligible

Changes in road traffic noise levels are calculated to range from -0.1 to +1.1 dB. Changes in road traffic noise are considered to be equivalent to a negligible impact and below the LOAEL. No mitigation measures to address development road traffic noise are considered to be required.

8. Demolition and Construction Noise and Vibration

Specific details of the demolition and construction methodology will not be available until a Principal Contractor has been appointed, following completion of the detailed design. Therefore, at this stage, a qualitative assessment of construction noise and vibration has been carried out based on previous experience of similar sites and professional judgement.

Qualitative Assessment of Airborne Demolition and Construction Noise

Criteria for assessing demolition and construction noise effects have been defined with reference to 'Example method 1 – the ABC method' as defined in BS 5228 1:2009+A1:2014. Category A criteria in the ABC method are interpreted as LOAEL and Category C criteria are considered equivalent to SOAEL. It is assumed that all construction works will be undertaken during core daytime working periods (08:00 – 18:00 weekdays, 08:00 – 13:00 Saturdays). Consequently, for residential receptors, the LOAEL has been defined as 65 dB $L_{Aeq,T}$ during the daytime. The SOAEL threshold has been defined as 75 dB $L_{Aeq,T}$ during the daytime.

The highest noise emissions tend to be generated due to concrete breaking during the demolition phase and the use of piling rigs during the construction phase. Demolition using excavators fitted with hydraulic breakers are expected to be used to break out existing concrete foundations. The use of auger piling rigs is expected to be used during foundation works for the new commercial buildings. The existing and new buildings at the site are approximately 135 m away from the nearest sensitive receptor façade. The sound pressure level at 10m for a backhoe mounted hydraulic breaker is 116dBA (from Table C5 of BS 5228). The calculated noise level at the nearest receptor is therefore 65dB L_{Aeq}. This would be equivalent to the LOAEL at nearby sensitive receptors and would not exceed the SOAEL. Noise emissions during auger piling are calculated to be 57dB L_{Aeq} and will therefore not exceed the LOAEL at nearby sensitive receptors based on a typical sound power level of 108dBA (Table D4 of BS 5228).

An exceedance of the LOAEL represents noise that may be present and intrusive; therefore, measures should be put into place to ensure that demolition and construction noise is controlled as far as reasonably practicable throughout the demolition and construction programmes.

Qualitative Assessment of Ground-borne Construction Vibration

Criteria for assessing demolition and construction vibration effects have been defined with reference to Table B.1 of BS 5228-2:2009 with is reproduced in Table 9.

Table 9. Guidance of Effects of Vibration Levels

Peak Particle Velocity Level	Description
0.14 to < 0.3 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 to < 1 mm/s	Vibration might be just perceptible in residential environments.
1.0 to < 10 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
>= 10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

For residential receptors and other high sensitivity receptors, the LOAEL has been defined as a peak particle velocity (PPV) of 0.3 mm/s (millimetres per second), this being the point at which construction vibration is likely to become perceptible. The SOAEL has been defined as a PPV of 1.0 mm/s, this being the level at which construction vibration can be tolerated with prior warning.

High levels of vibration are only likely to be generated during the demolition of existing ground level floor slabs. Based on measurements of concrete breaking undertaken by AECOM it is estimated that PPV levels due to breaking at the closest distance to residential receptors may exceed the LOAEL. During auger piling works and based on data in Table D4 of BS 5228-2:2009, it is not expected that vibration levels would exceed the LOAEL given the intervening distance from the site to residences...

Demolition and Construction Noise Mitigation

Noise effects on nearby receptors may occur during the demolition and construction phases, although these would be of a temporary nature and have no lasting residual impact. BS 5228 provides practical information on construction noise and vibration reduction measures and promotes a 'Best Practicable Means' approach to noise control. Sometimes, a greater noise level may be acceptable if the overall construction time and therefore length of disruption is reduced.

BS 5228 is a useful reference document and provides additional advice for mitigation measures. The following example mitigation measures have been prepared in order to provide a methodology for controlling noise emissions during works such that noise limits may be adhered to during the demolition and construction works programme:

- Unnecessary revving of engines will be avoided, and equipment will be switched off when not in use;
- Internal haul routes will be kept well maintained;
- Rubber linings in, for example, chutes and dumpers will be used to reduce impact noise;
- Drop heights of materials will be minimised;
- Plant and vehicles will be sequentially started up rather than all together;
- Use of effective exhaust silence systems or acoustic engine covers as appropriate;
- As far as reasonably practicable, sources of significant noise will be enclosed;
- Plant will always be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading will also be carried out away from such areas;
- Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturers specifications; and
- Screening e.g. noise barriers and blinds will be used as appropriate.

Demolition Vibration Mitigation

A risk assessment identifying the probability of vibration from any activities will be carried out prior to commencement of demolition activities, to determine the need for periodic or continuous vibration monitoring. The contractor will use techniques least likely to cause vibration or effect damage to the surrounding residential properties. Should the need arise, additional means of mitigating potential effects will be considered as the construction arrangements are developed further. It is likely that the magnitude of the potential vibration effects can be reduced, if not avoided altogether, as a result of these further considerations.

9. Conclusions

AECOM has undertaken a noise and vibration assessment for the Proposed Development at the GSK site at Stockley Park.

A baseline survey was carried out in April 2020 at both the GSK site and the nearest receptors at Emden Close.

A BS 4142 assessment has been undertaken of HDV movements and loading/unloading noise. The results of the assessment indicate a significant adverse impact during the day and an adverse impact at night. However, when context is taken into account, the impact is substantially reduced with absolute noise levels below existing levels, the character of the noise similar to existing and external and internal levels below recommended guidelines.

A number of noise minimisation measures are proposed to control noise emissions from the site.

Operational noise limits at nearby sensitive receptors have been defined in accordance with the LBH noise policy for building services and fixed plant. These noise limits will be adhered to in the design of building services and fixed plant.

An assessment of changes to road traffic noise levels along the local road networks has identified that there will be a negligible impact. No mitigation measures for development traffic noise is required.

A qualitative assessment of demolition and construction noise and vibration has been undertaken. This indicates noise and vibration levels may exceed the LOAEL.

Best practice measures have been identified to reduce demolition and construction noise emissions and vibration levels as far as reasonably practicable. These measures should be adopted as standard working practices throughout the demolition and construction programme.

Whilst the noise survey was carried out during a period affected by the Covid-19 outbreak, it is considered the noise levels are likely to be lower than typical, which results in stricter assessment criteria. Consequently, the assessment is considered to be robust.

Appendix A Acoustic Terminology

Decibel (dB)	The range of audible sound pressures is approximately 2 x 10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0dB to 140dB. Mathematically Sound Pressure level = 20 log {p(t)/p_0} Where P_0 = 2 x 10^{-5} Pa.
A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of risk of damage of hearing due to noise.
Frequency (Hz)	The number of cycles per second, for sound this is subjectively perceived as pitch.
Frequency Spectrum	Analysis of the relative contributions of different frequencies that make up a noise.
Ambient Sound	Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far (*The ambient sound comprises the residual sound and the specific sound when present)*.
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = $t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t1}^{t2}\left[p_A\frac{(t)^2}{{p_0}^2}\right]dt\right\}$$ Where p_0 is the reference sound pressure (20μPA); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t
Measurement Time Interval T_m	Total time over which measurements are taken (*This may consist of the sum of a number of non-contiguous, short-term measurement time intervals)*
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (*This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h*)
Residual Sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound
Residual sound level L_r = $L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Specific sound level L_s = $L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed
$L_{A10,T}$	The A-weighted sound pressure level of the residual noise in decibels exceeded for 10% for a given time interval. This is the parameter defined by the government to describe road traffic noise
L_{AFmax}	The maximum RMS A-weighted sound pressure level occurring within a specified time period. Fast time weighting indicates sound pressure level measurements undertaken using a 125-millisecond moving average time weighting period
Weighted sound reduction index R_w	A single-figure value of sound reduction index, derived according to procedures given in BS5821, used for rating and comparing partitions and based on the values of sound reduction index at different frequencies.

Appendix B

B.1 National Policy

National Planning Policy Framework (2019)

The revised National Planning Policy Framework (NPPF) was published in February 2019[2]. The NPPF sets out the Government planning policies for England and how these are expected to be applied.

Policies and objectives which are of particular relevance to noise and vibration include:

Paragraph 170

> "planning policies and decisions should contribute to and enhance the natural and local environment by:…
>
> *"preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans…*

Paragraph 180 also relates to noise through the following statement:

> *"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:*
>
> *a) 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 the quality of life;*
>
> *b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason" and ……."*

With regards to 'adverse effects' and 'significant adverse effects', the NPPF refers to the Noise Policy Statement for England (NPSE) [3]; see below.

Noise Policy Statement for England (2010)

The NPSE seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

The statement sets out the long-term vision of the government's noise policy, which is to "*promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development*".

This long-term vision is supported by three aims:

- *'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 improvements of health and quality of life.'*

The long-term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

[2] Department for Communities and Local Government (DCLG), (2019); National Planning Policy Framework.
[3] Noise Policy Statement for England (2010); Department for Environment Food and Rural Affairs.

The Explanatory Note within the NPSE provides further guidance on defining 'significant adverse effects' and 'adverse effects' using the following concepts:

- 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.

With reference to the SOAEL, the NPSE states:

> *"It is recognised that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

For situations where noise levels are between the LOAEL and SOAEL, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur.

Planning Practice Guidance Noise (July 2019)

The national Planning Practice Guidance (PPG) for noise[4] advises that "*Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced)*" and provides guidelines that are designed to assist with the implementation of the NPPF.

The PPG states that local planning authorities 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.'*

Factors to be considered in determining whether noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative effects.

Further details on the hierarchy of noise effects are presented in the following Table which has been reproduced from PPGN.

Planning Practice Guidance Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			

[4] https://www.gov.uk/guidance/noise--2

Perception	Examples of Outcomes	Increasing Effect Level	Action
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

B.2 Local Policy

Hillingdon Local Plan: Part 1 – Strategic Policies

The Hillingdon Local Plan[5] considers noise in Policy EM8 which states:
Noise

The Council will investigate Hillingdon's target areas identified in the Defra Noise Action Plans, promote the maximum possible reduction in noise levels and will minimise the number of people potentially affected.

The Council will seek to identify and protect Quiet Areas in accordance with Government Policy on sustainable development and other Local Plan policies.

The Council will seek to ensure that noise sensitive development and noise generating development are only permitted if noise impacts can be adequately controlled and mitigated.

London Borough of Hillingdon Supplementary Planning Document (SPD)

The Noise Supplementary Planning Document[6] includes the following guidance.

The Key Point 6: Industrial Uses

4.22 Industrial uses will require particular attention as they can often cause severe noise problems due to both the character of industrial noise and its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration.

4.23 In considering new industrial development, the Council will apply policies OE1 and OE3 of the UDP and will have regard to, amongst other considerations, the British Standard 4142:1997 “Method for rating industrial noise affecting mixed residential and industrial areas”, and internal and external noise criteria. Specific consideration will also be given to the features and characteristics of the noise.

4.24 British Standard 4142:1997 gives advice on measuring and assessing the noise from machinery or plant, and is relevant if surrounding residential areas might be affected. Developments with a BS4142 assessment of marginal significance or above would not ordinarily be permitted. Consequently, the development should be controlled such that the rating level of the noise from the proposed development determined according to BS4142 is at least 5 dB below the background noise level LA90,T. Ideally, the assessment of noise should give a positive indication that complaints are unlikely.

4.25 In addition to being applied to straightforward cases where fixed industrial plant is used, BS4142 provides a useful assessment method for the following cases, and the Council adopts these categories: • Premises, such as warehouse distribution premises, where delivery lorries are driven and manoeuvred, and are loaded or unloaded by forklift trucks etc; • Premises where there are manoeuvring lorries on which on-board refrigeration plant is run; • Loaders, dumpers and haulage vehicles operating in yards handling building materials or at waste disposal sites.

4.26 In support of this use of BS4142, it should be noted that the stated scope of the standard is for assessing noise levels from “factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises”.

4.27 A dictionary definition 1 of industry is “all branches of manufacturing and trade”, with the definition of industrial being “relating to, concerned with or suitable for industry”. The categories of premises mentioned above are therefore believed to fall within the scope of the standard. What is important is the noise experienced by residents living in the vicinity of the premises. Whether the noise source is in a factory premises or warehouse distribution premises is largely irrelevant to the likelihood of complaint, as is whether the noise source is moving or fixed. Also, the standard does not restrict its applicability to fixed noise sources.

4.28 If the surrounding area is not residential, controls on noise from noise generating development may still be required if the existing noise environment is already significantly affected or where the existing noise environment is prized for its amenity value. Depending on the circumstances of the case, the Local Planning Authority may require that no detectable increase in background level takes place, or it may allow a small increase in background level, generally no more than 2 dB. Further guidance is given in Key Points 8 and 9.

4.29 Before the proposed use commences, the local planning authority may require that a noise control scheme is agreed. This will need to have regard to the British Standard 4142:1997 and internal noise criteria.

[5] London Borough of Hillingdon: A vision for 2026 Local Plan: Part 1 Strategic Policies (Adopted November 2012)
[6] London Borough of Hillingdon: Noise Supplementary Planning Document April 2006

4.30 To ensure that the proposed use does not have an unacceptable impact, conditions may be required.

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