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ASHCOURT CONSTRUCTION LIMITED

NOISE IMPACT ASSESSMENT REPORT

DUNSWELL PARK AND RIDE (PROPOSED): LAND AT RAICH CARTER WAY, HULL

Client: Ashcourt Construction Limited

Report Ref: P7764-R1-V2

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REPORT VERSION CONTROL:

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APPENDICES

1 INTRODUCTION

1.1.1 By instruction from Ashcourt Construction Limited ('the client'), NoiseAir was commissioned to undertake a noise impact assessment (NIA) to support a full planning application for a new park and ride, a bus depot, two new vehicular accesses, a petrol filling station with a shop, and three retail/ food units to be located at land at Raich Carter Way, Hull, herein referred to as the 'development site'.

1.1.2 This noise report has been prepared in support of a proposed planning application and assesses the results of a noise survey carried out in accordance with current guidance and includes recommendations and mitigation as appropriate.

1.1.3 General limitations with respect to this NIA are outlined within **Appendix A** of this report.

1.2 Planning Information

1.2.1 East Riding of Yorkshire Council have been consulted with respect to the proposed development (Case ref: 24/00868/STPREP) and a response has been provided by Mr. Ian Hodson (Environmental Case Officer) outlining the following extract:

> *"[…]*
>
> *I would suggest that the proposed development shall not commence until a report has been submitted to and approved in writing by the LPA, giving details of the existing background noise levels in the area of the proposal and the predicted noise levels at the site boundary and boundary of the nearest noise sensitive premises (currently in Evergreen Drive, Meadow Garth and Fieldside Garth, Hull) arising from the proposed development. The information provided should cover night-time as well as daytime periods and should be undertaken by a competent acoustic consultant using a recognised methodology, such as BS 4142:2014+A1:2019. It should refer to predicted noise from all of the proposed uses shown in the document entitled 'Proposed Block Plan'.*
>
> *[…]"*

1.2.2 Limitations and recommendations for construction noise have been advised in the wider planning consultation document and are therefore outside the scope of this report. This report covers therefore the operational phase of the proposed development.

1.3 Site Description and Noise Sensitive Receptors

1.3.1 At the time of writing the development site is an open parcel of land located to the north side of Hull. The development site is flanked to the north by the A1033 (Raich Carter Way), to the west by the A1079 (Beverley Road) and to the south by residential properties.

1.3.2 At the time of writing the development site accommodated a public footpath to the southern side and is used for open grazing land for horses.

1.3.3 The A1033 (Raich Carter Way) is a dual carriageway, dual lane road accommodating high volumes of cars and commercial vehicles at moderate speeds and is considered to be the dominant source of noise in the locality.

1.3.4 The A1079 (Beverley Road) is also a dual carriageway, dual lane road accommodating high volumes of cars and commercial vehicles at moderate speeds.

1.3.5 The nearest noise sensitive receptors (NSRs) are located along the south side of the development site boundary.

1.3.6 **Figure 1** shows an aerial photograph of the development site with respect to the local area and its context.

Figure 1: Site aerial photograph.

1.4 Development Proposals

1.4.1 At the time of writing the development proposals outline a new park and ride, a bus depot, four new vehicular accesses, a petrol filling station with a shop, and three restaurant units.

1.4.2 The operational hours of the various elements of the proposed development have not been fully confirmed. It is considered however that the park and ride and bus depot maintenance areas will be operational typiclly during the daytime hours (07:00 to 19:00 hours). It is noted that the bus maintenance depot will operate 24/7 however it is considered that during the evening and night-time hours the maintenance building doors would be kept closed from a noise emission perspective.

1.4.3 It is considered likely that the drive-thru premises will be operational during the daytime and evening until 23:00 hours with the proposed petrol filling station (PFS) being operational 24 hours a day.

1.4.4 The report assessment is based on the above assumptions.

1.4.5 Development proposals are outlined in **Figure 2** below.

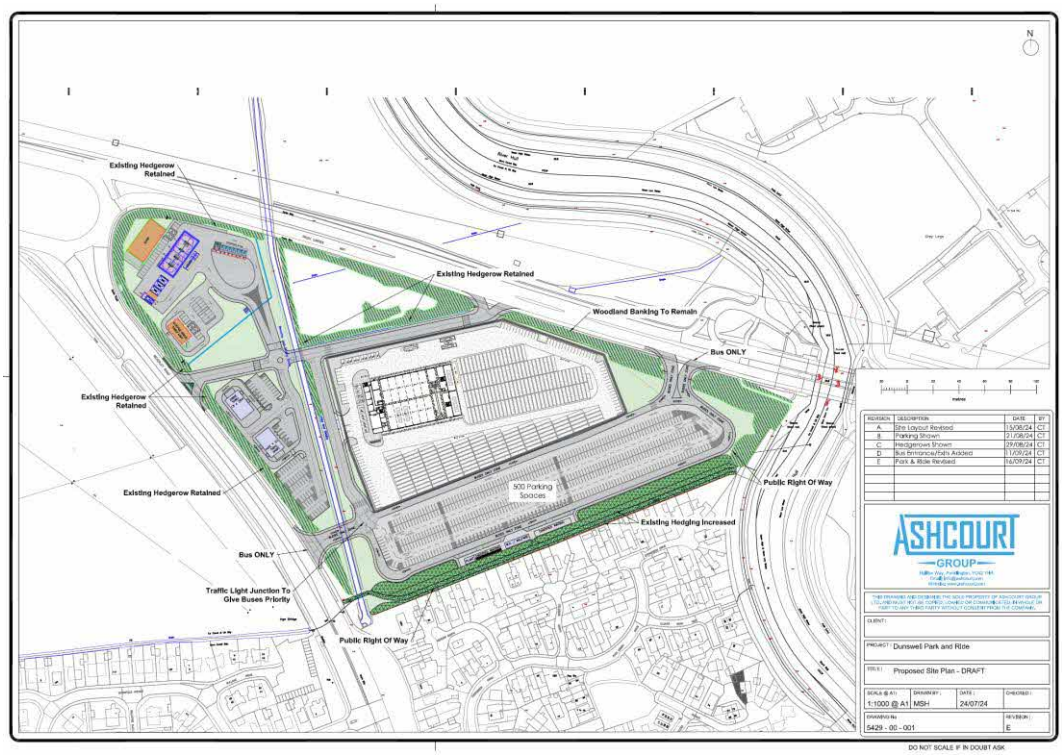

Figure 2: Proposed development drawing.

2 ASSESSMENT METHODOLOGY AND SCOPE OF WORKS

2.1 Planning Guidance and Noise

2.1.1 This acoustic report has been prepared in support of a proposed planning application and therefore it is considered that reference should be made to the appropriate planning guidance documentation, specifically:

National Planning Policy Framework (NPPF), 2023;
Noise Policy Statement for England (NPSE), 2010;
Planning Practice Guidance – Noise, 2019;

2.1.2 A summary of the relevant planning documentation and its relevance with respect to noise is provided below.

2.2 National Planning Policy Framework [NPPF 2023]

2.2.1 The NPPF was published in March 2012 with the most recent version updated in 2023. The NPPF sets out the Governments planning policies for England and how these are expected to be applied across a number of areas.

2.2.2 With respect to noise specifically, Section 15, Paragraph 174 of the NPPF 2023 states:

'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;'

2.2.3 The NPPF 2023 continues to state in Paragraph 185:

'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 the 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; and;

2.3 Noise Policy Statement for England [NPSE 2010]

2.3.1 The Noise Policy Statement for England (NPSE), published in March 2010, states the long-term vision of Government noise policy is to "*promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development*".

2.3.2 This long-term vision is supported by the following aims; 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;
Where possible, contribute to the improvement of health and quality of life.

2.3.3 The NPSE also introduces the below categories with respect to 'adverse impacts'.

'NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur'.

2.3.4 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided. The second aim refers to the situation where the impact lies somewhere between LOAEL and SOAEL, and it requires that all reasonable steps are taken to mitigate and minimise the adverse effects of noise. However, the requirement to mitigate and minimise the adverse effects of noise does not mean that such adverse effects cannot occur.

2.4 Planning Practice Guidance - Noise [PPG 2019]

2.4.1 The National Planning Practice Guidance (PPG) is a web-based resource, launched by the Department for Communities and Local Government (DCLG) in March 2014 to support the NPPF[1].

2.4.2 The PPG advises on how planning can manage potential noise impacts in new development. The guidance is regularly reviewed and updated and noise is listed as a specific category, the noise category was most recently updated in July 2019.

2.4.3 The PPG provides further detail about how the effect levels can be recognised. Above the NOEL noise becomes noticeable, however it has no adverse effect as it does not cause any change in behaviour or attitude. Once noise crosses the LOAEL threshold it begins to have an adverse effect and consideration needs to be given to mitigating and minimising those effects, taking account of the economic and social benefits being derived from the activity causing the noise.

2.4.4 Increasing noise exposure further might cause the SOAEL threshold to be crossed. If the exposure is above this level the planning process should be used to avoid the effect occurring by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.

2.4.5 At the highest extreme the situation should be prevented from occurring regardless of the benefits which might arise.

2.4.6 **Table 1** summarises the noise exposure hierarchy outlined within the PPG.

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

Table 1: National Planning Practice Guidance noise exposure hierarchy			
Perception	**Examples of Outcomes**	**Increasing Effect Level**	**Action**
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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 non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g., auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.5 Consultation and Scope of Works

2.5.1 The proposed development is to introduce a new park and ride, a bus depot, four new vehicular accesses, a petrol filling station with a shop, and three restaurant units to the locality. The nearest NSRs are located immediately to the south side of the development site.

2.5.2 The development is commercial in nature and therefore an NIA is required to assess the likely impact with respect to the identified NSRs.

2.6 Assessment Criteria

2.6.1 In order to achieve noise levels which are considered to be in alignment with the planning approaches and policies discussed in Section 2.1, it is considered that all efforts are made to ensure that future occupants are unlikely to be exposed to noise levels which might breach the LOEL criteria.

2.6.2 It should be noted however that planning guidance does not preclude development where the LOEL is likely to be breached in certain circumstances as long as reasonable efforts are made to mitigate and reduce such an effect.

2.6.3 The proposed development is considered commercial in nature and therefore assessment has been undertaken in accordance with BS 4142:2014+A1+2019 (BS 4142:2014), a summary of BS 4142:2014 has been provided below for reference.

2.6.4 It is considered that BS 8233:2014 also has reference with respect to acceptable internal noise levels within habitable rooms and therefore a summary of this document is also provided for reference.

2.7 British Standard 4142:2014 (BS 4142:2014)

2.7.1 British Standard 4142:2014 - Methods for rating and assessing industrial and commercial sound, sets the methodology for rating and assessing sound of an industrial and commercial nature, which includes sound from fixed installations such as mechanical and electrical plant and equipment.

2.7.2 In BS 4142:2014, a noise rating is determined and compared with the existing local background sound level based on several more cumulative acoustic feature corrections to apply where appropriate. For example if the noise includes a distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristic, then additional cumulative penalties individually ranging from 0 to 9 dB may be applied depending on the type of noise.

2.7.3 BS 4142:2014 seeks to determine a “representative” background sound level, stating that “..the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods”.

2.7.4 The assessment of the impact depends upon the margin by which the rating level of the specific sound source exceeds the background sound level but also promotes a consideration of the context in which the sound occurs when making an assessment. BS 4142:2014 states that an initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level, while considering the following points:

Typically, the greater this difference, the greater the magnitude of the impact;
A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;

A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and,

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source 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 on the context.

2.7.5 Therefore, a BS 4142:2014 assessment may deduce a low impact where the specific sound level is below the background sound level.

2.8 British Standard 8233:2014 (BS 8233:2014)

2.8.1 British Standard 8233:2014 – *Guidance on sound insulation and noise reduction for buildings* (BS 8233) provides guidance on internal ambient noise levels, resulting from break-in of external environmental noise that should not be exceeded in various locations within dwellings.

2.8.2 Guidelines for buildings in terms of internal noise level are reported in **Table 2**.

Table 2: Summary of internal noise guidelines.

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

2.8.3 The standard clarifies that these values are based on the existing guidelines issued by the World Health Organisation (WHO). In addition, it states that the internal noise levels may be relaxed by up to 5 dB whilst maintaining a reasonable living condition. Conversely, in terms of internal maximum levels to be achieved during the night, the standard does not recommend any limits for individual noise events. However, a guideline value may be set in terms of SEL or L_{AFmax}, depending on the type and the number of events per night.

Furthermore, BS 8233:2014 provides guidance on desirable noise levels in areas that are intended to be used for external amenity space, such as gardens, balconies and roof gardens which are intended to be used for relaxation. For these spaces it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ up to a level of 55 dB $L_{Aeq,T}$ for noisier environments.

3 ACOUSTIC SURVEY

3.1 Acoustic Survey Details

3.1.1 NoiseAir carried out fixed position noise monitoring between 13th September 2024 to 18th September 2024 at the development site.

3.1.2 Noise monitoring was undertaken at one monitoring location (ML1). The noise monitoring location is shown in **Figure 3** and described in **Table 3** below.

Figure 3: Site layout plan and noise monitoring locations.

Table 3: Summary of Noise Monitoring Locations

Monitor Location Number	Location Description	Time Period Monitored		Attended or Unattended Monitoring
		Start	End / Duration	
ML1	To the south side of the development site located approx. 20 m from the rear boundary of the existing closest identified noise sensitive receptors. The sound level meter microphone was tripod mounted at 1.5 m above ground level.	14:45 13/09/24	15:15 18/09/24	Unattended

3.1.3 ML1 was positioned to be representative of the typical background sound levels at the closest noise sensitive receptor (NSR) location.

3.1.4 The noise measurements were made using one Class 1, integrating sound level meter (SLM).

3.1.5 The acoustic equipment was calibrated to comply with Section 4.2 of BS 7445-1:2003[2] before and after the noise monitoring periods.

3.1.6 Details of the SLM and associated field calibration can be found in **Table 4** below;

Table 4: Summary of SLM's used for survey and associated field calibration

SLM (Serial Number)	Preamp (Serial Number	Microphone (Serial Number)	Calibrator (Serial Number)	Start Calibration	End Calibration	Drift
NOR140 (1405015)	NOR1209 (14517)	NOR1225 (42327)	B&K4231 (2431761)	-25.5 dB	-25.3 dB	-0.2 dB

3.1.7 The weather conditions were noted to be as outlined in **Table 5** during the site visits at the start and end of the monitoring period.

Table 5: Summary of weather conditions noted at the start and end of the monitoring duration.

	13th September 2024	18th September 2024
Roads (Wet / Dry)	Dry	Dry
Temperature (˚C)	15	14
Wind speed (ms^{-1})	Up to 3.6 S (gusts)	Up to 4.7 SW (gusts)
Cloud Cover (Approx. %)	70	60
Humidity (%)	77	68

3.1.8 A-weighted[3] L_{eq}[4], L_{90}[5] and L_{AMax}[6] noise levels were measured to comply with the requirements of BS 4142:2014.

3.1.9 Attending the development site at the start and end of the survey monitoring period provided opportunity for observations and detailed notes to be made of the significant noise sources which contribute to each of the measured levels.

ML1 – Background Sound Levels

Non Descript Local Road Traffic Noise from the A1033 & A1079: Continuous residual road traffic noise was considered dominant at ML1.

[2] BS 7445-2003 "Description and measurement of environmental noise – Part 1: Guide to quantities and procedures.
[3] An electronic filter in a sound level meter which mimics the human ear's response to sounds at different frequencies under defined conditions.
[4] Equivalent continuous noise level; the steady sound pressure which contains an equivalent quantity of sound energy as the time-varying sound pressure levels.
[5] The noise level which is exceeded for 90% of the measurement period.
[6] The instantaneous maximum noise level recorded for a measurement period.

3.2 Measured Background Sound Levels – ML1

3.2.1 Data is shown in detailing a level vs. time graph of the recorded L_{Amax}, L_{Aeq} and L_{A90} sound level over 15-minute time periods for ML1.

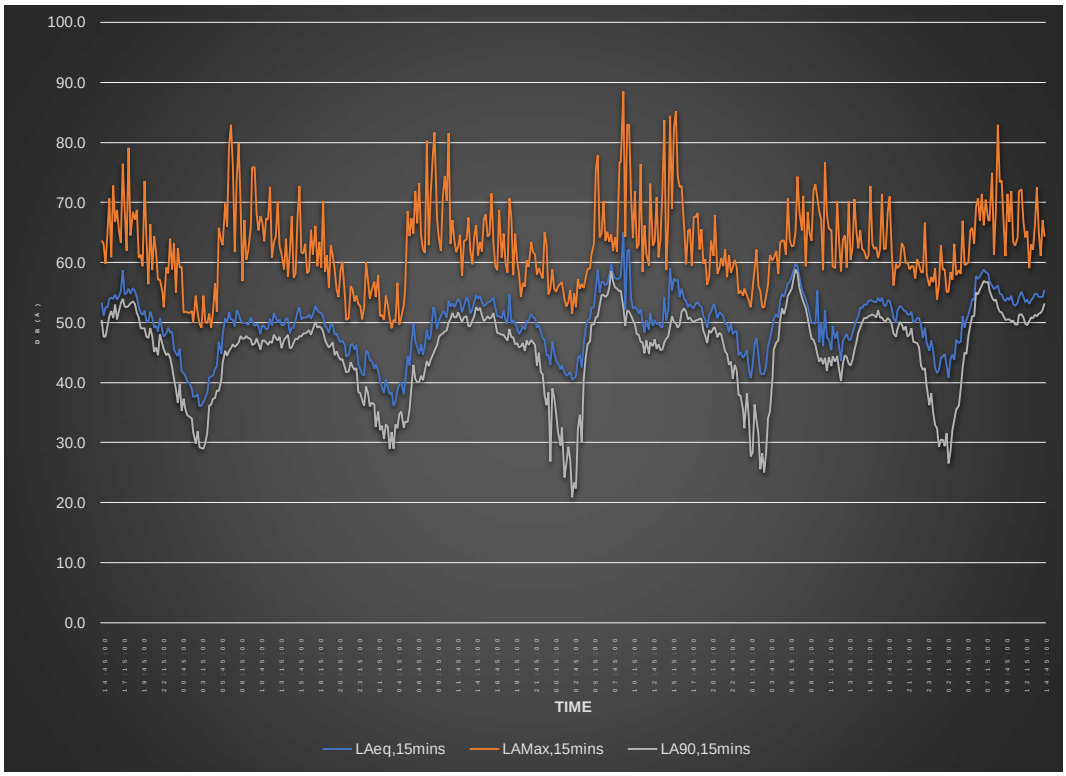

Figure 4: Level vs. time graph showing L_{Amax}, L_{Aeq} and L_{A90} sound levels – ML1.

3.2.2 The results for ML1 during the daytime hours are presented in **Table 6**.

Table 6: Measured Daytime and Night-time Noise Levels – ML1

Monitoring Location	Time	Measured Noise Level	
		dB $L_{Aeq,T}$	dB $L_{A90,T}$
ML1	07:00-19:00 (Day)	45.5 – 61.4	40.5 – 57.6
	19:00-23:00 (Evening)	45.6 – 53.7	42.4 – 51.1
	23:00-07:00 (Night)	36.0 – 58.8	20.9 – 55.6

3.2.3 A histogram showing the distribution of measured $L_{A90,T}$ sound levels during the daytime (07:00 to 19:00 hours), evening (19:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) is presented in **Figure 5, Figure 6** and **Figure 7** for ML1.

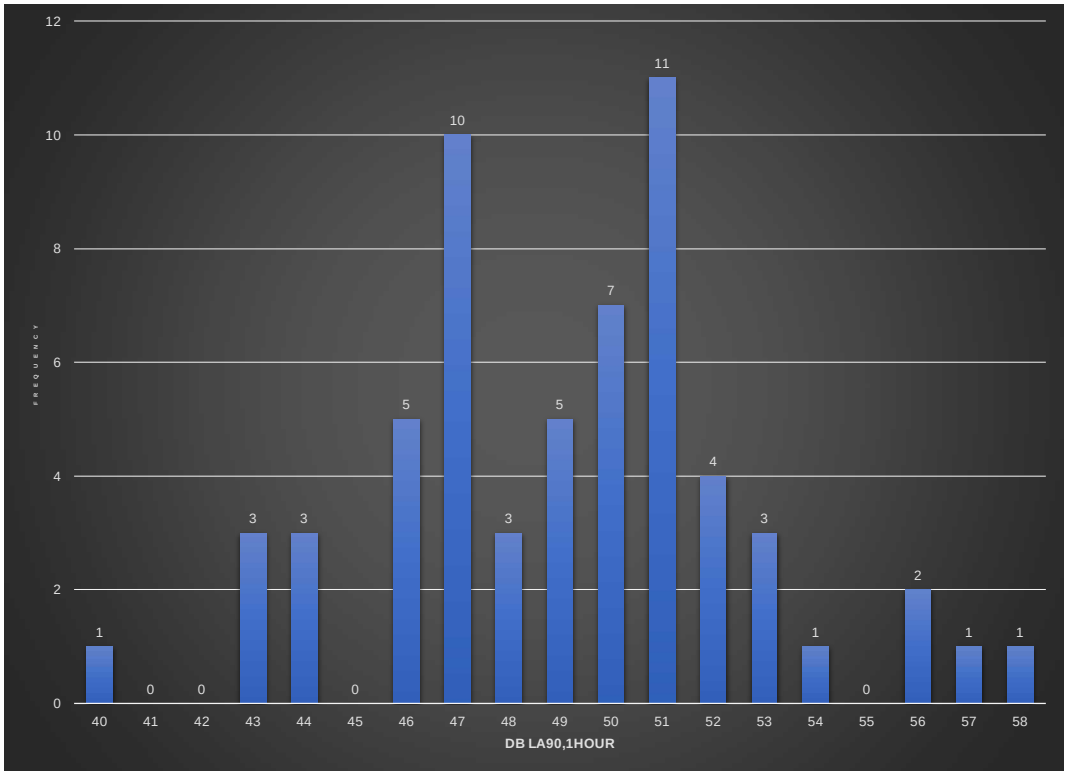

Figure 5: Histogram showing frequency distribution of $L_{A90,1hour}$ noise reading at ML1 during the daytime period (07:00 to 19:00 hours).

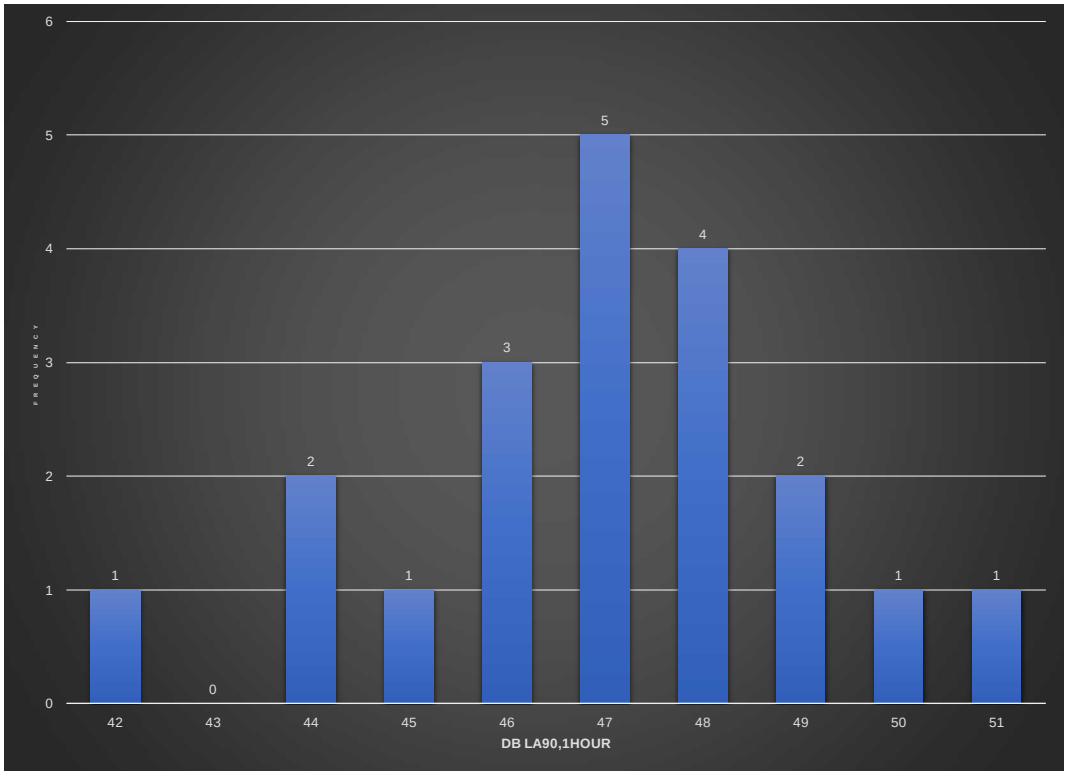

Figure 6: Histogram showing frequency distribution of $L_{A90,1hour}$ noise reading at ML1 during the evening period (19:00 to 23:00 hours).

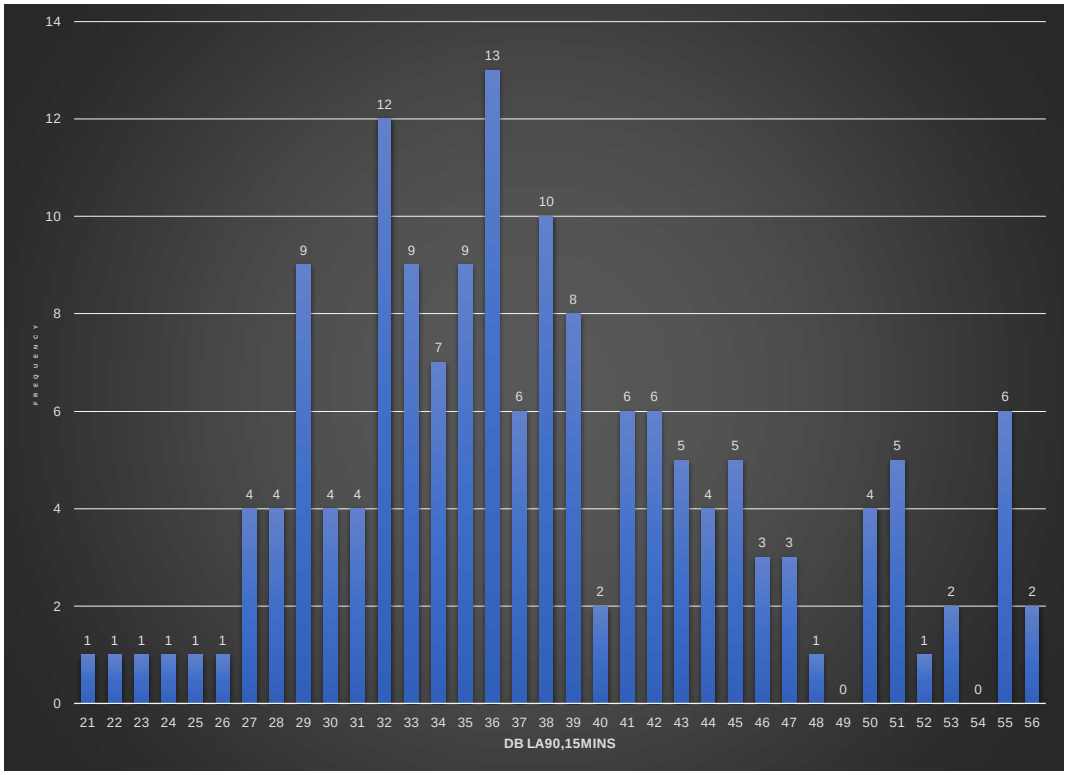

Figure 7: Histogram showing frequency distribution of $L_{A90,15mins}$ noise reading at ML1 during the night-time period (23:00 to 07:00 hours.

3.2.4 Typical $L_{A90,T}$ sound levels of 46 dB(A), 44 dB(A) and 29 dB(A) have been adopted for the subsequent BS 4142:2014 assessment for the daytime, evening and night-time, respectively.

3.2.5 The aforementioned selected values are considered appropriate typical values given the data set obtained and observed distribution of the dataset.

4 3D SOUND MODEL

4.1 Introduction

4.1.1 A 3D sound model has been constructed in SoundPLAN™ to calculate the predicted sound pressure levels at selected potential receptor locations. The model uses the calculation method from ISO 9613-2:1996[7] to account for the distance between the source and receiver and any screening or reflections provided by the surrounding buildings. The model is based on the proposals forwarded to NoiseAir at the time of writing.

4.2 Noise Sources

4.2.1 The 3D noise model specifically includes the following noise sources outlined below.

4.2.2 The 3D model includes a 3 m barrier along the southern boundary.

4.2.3 For line sources associated with vehicle movements the sound power level has been adopted from the SoundPLAN™ library[8].

4.2.4 Car park noise sources are based on the SoundPLAN™ car park noise source tool.

Drive through point of order location noise – point source set to a sound power level of 75 dB(A) for the daytime and evening condition. The drive-thru point of order locations are operational during the daytime and evening time.
Bus maintenance depot – Industrial noise source building, based on a bus noise source inside set to an L_w of 95 dB(A). The industrial building has been modelled with opening to the north and south facades. The bus maintenance depot is operational during the daytime only.

4.2.5 A 3D visualisation of the constructed 3D model is shown in **Figure 8**.

[7] ISO9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"
[8] Sound power level is based on information advised in the SoundPLAN™ library of 47 dB(A) per m^2.

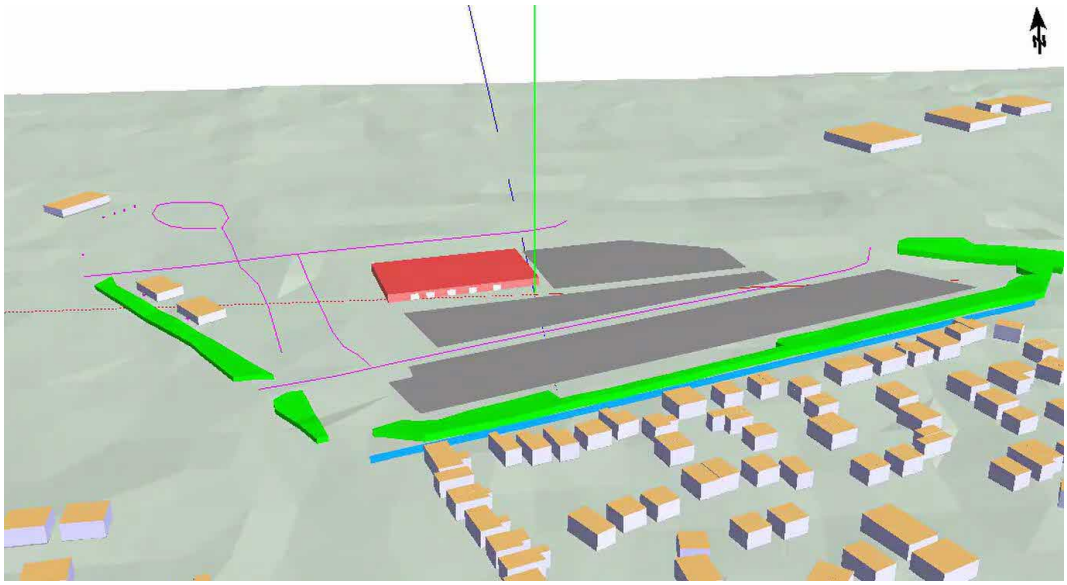

Figure 8: 3D view of the sound model including the 3 m acoustic barrier.

4.2.6 A noise contour plot illustrating the propagation of sound from source to receptor during the daytime, evening and night-time ($L_{Aeq,T}$), is presented in **Figure 9, Figure 10** and **Figure 11,** respectively.

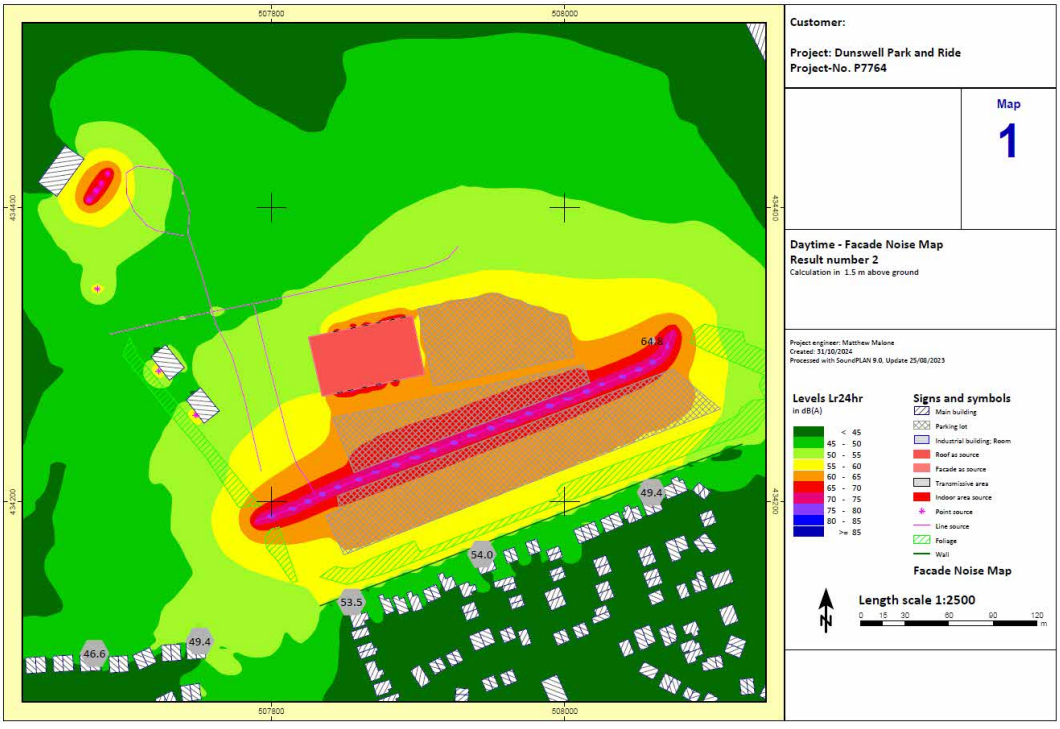

Figure 9: Noise contour plot illustration of the predicted propagation of sound from the proposed development during the daytime – $L_{Aeq,1hour}$.

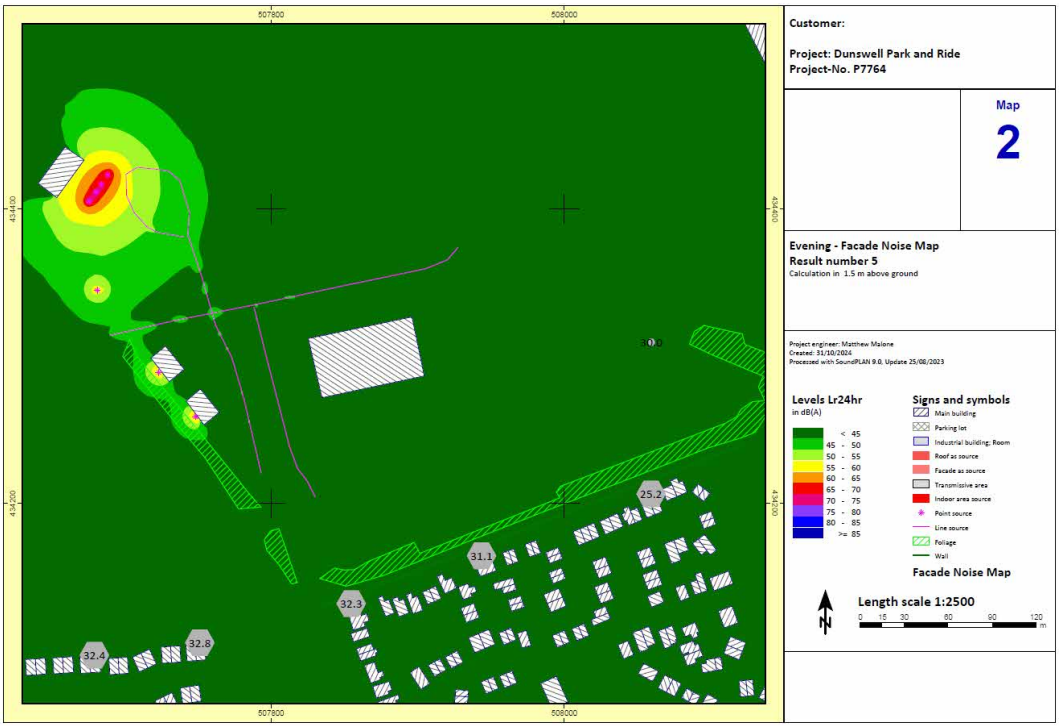

Figure 10: Noise contour plot illustration of the predicted propagation of sound from the proposed development during the evening – $L_{Aeq,1hour}$.

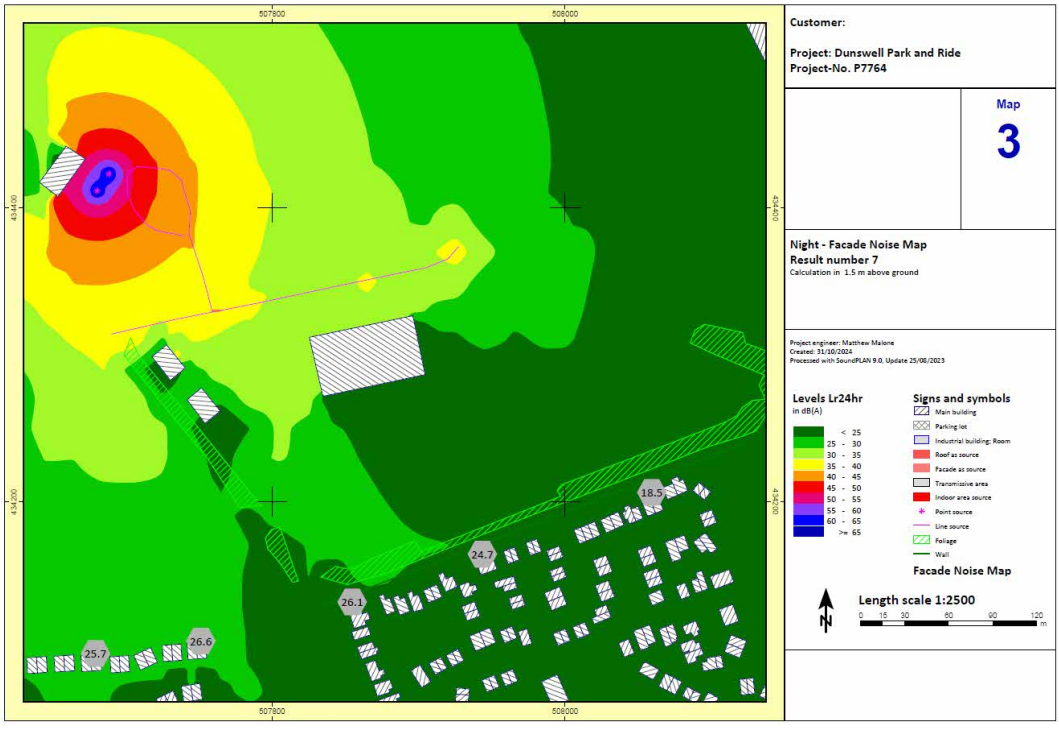

Figure 11: Noise contour plot illustration of the predicted propagation of sound from the proposed development during the night-time – $L_{Aeq,15mins}$.

3D Sound Model Calculated Results

4.2.7 **Table 7** below details the predicted worst case noise levels.

Table 7: Calculated NSR Noise Levels		
dB $L_{Aeq,1hour}$ Daytime	dB $L_{Aeq,1hour}$ Evening	dB $L_{Aeq,15mins}$ Night-time
54.0	32.8	26.6

5 BS 4142:2014+A1:2019 ASSESSMENT

5.1 Introduction

5.1.1 Based on the calculated sound levels presented in Section 4.2 a BS4142:2014 assessment has been undertaken with respect to the proposed development.

5.2 Background Sound Level

5.2.1 The background sound levels have been measured and presented within Section 3.2 of this report.

5.2.2 46 dB(A), 44 dB(A) and 29 dB(A) have been adopted for the BS 4142:2014 assessment for the daytime, evening and night-time, respectively.

5.3 Character Corrections

5.3.1 NoiseAir have experience of assessment of noise breakout from 'drive thru' and commercial sites, based on our historic observations character corrections have been selected as below:

Tonality – while it is considered that some operations may emit noise with tonal characteristics, the sound insulation of the proposed maintenance unit structure, inherent screening of the buildings and the distance from source to receptor is likely to reduce such characteristics to imperceptible levels. Therefore, no character correction for tonality has been applied.
Impulsivity – the activities are not likely to exhibit impulsive characteristics therefore no character correction has been applied for impulsivity; and,
Intermittency – the operations at the development site are likely to be intermittent and therefore a character correction of +3 dB has been applied as a conservative measure.

5.4 BS 4142:2014 Initial Assessment

5.4.1 The daytime BS 4142:2014 initial assessment based on the calculated noise breakout levels for all proposed noise sources is presented in **Table 8**.

Table 8: BS 4142:2014 Assessment to Determine the Likelihood of Adverse Impacts on at the Existing Houses.

Quantity	Sound level dB(A)		
	Daytime	Evening	Night
Typical Background Sound Level, dB L_{A90}	46	44	29
Specific sound level calculated by SoundPlan™	54	33	27
Acoustic feature correction for tonality.	+3	+3	+3
Rating Level	57	36	30
Excess of Rating Level over Background Sound Level	**+11**	**-8**	**+1**
Initial Impact Rating	**Significant Adverse (Context Depending)**	**Low Impact (Context Depending)**	**Low Impact (Context Depending)**

5.5 BS4142:2014 Assessment and Context

5.5.1 The BS 4142 assessment indicates a significant adverse impact during the daytime and low impacts for both the evening and night-time scenarios.

5.5.2 In the daytime scenario the threshold of the significant adverse impact is exceeded by 1 dB and is therefore marginal. It should be noted however that the character of the noise from the local road network is likely to be very similar in nature to that of the proposed park and ride when operational and therefore it is considered that there is likely to be significant acoustic masking characteristics, especially given that the residual noise levels are typically around the 50-55 dB(A) level. It is therefore considered that the perceived impact is likely to be lessened somewhat and present at approximately the threshold of **low impact to adverse impact**.

5.5.3 In the case of the evening and night-time scenarios, both situations indicate a **low impact** based on the initial assessment, with the night-time being 1 dB above the background sound level, this assessment is considered to be representative given the context of the locality and noise source types.

Uncertainty

5.5.4 Uncertainty of measurements can have a significant effect on the outcome and findings of an assessment and therefore such constraints are documented and discussed below.

5.5.5 The SLM used was a Norsonic Class 1 SLM's, it is generally recognised that Class 1 SLM's offer an uncertainty of ±1.0 dB. The instrumentation used for the survey has been calibrated by UKAS approved laboratories

5.5.6 The sound levels measured (which include busier and quieter periods) are considered typical for the area investigated.

5.5.7 Wind speeds during the survey visits were typically less than 5 ms^{-1} and the effect of wind generated noise is not considered to have a significant impact on this assessment.

5.5.8 The specific noise level and therefore rated noise levels have been calculated using a 3D sound model and site specific data, however a conservative assessment of breakout noise levels has been undertaken.

5.5.9 It is therefore considered that in this instance the uncertainty of the calculations may have minimal influence on the outcome of the assessment.

6 RECOMMENDATIONS

6.1 Introduction

6.1.1 A BS 4142:2014 assessment has been undertaken with respect to the likely noise impact as a result of the operational phase of the proposed development.

6.1.2 It is recommended that a conservative approach to mitigation is adopted at the development site to ensure a reduced likelihood of adverse impact as a result of the proposed development.

6.1.3 A series of recommendations have therefore been outlined below for consideration.

6.2 Recommendation 1- Proposed Maintenance Unit and Drive-Thru Unit Acoustic Specification

6.2.1 The proposed maintenance unit and drive thru-units should be designed to achieve an overall sound reduction index of 20 dB(A) to all facades. This could be achieved by constructing the facades and roof adopting a Kingspan specialised system such as outlined in **Figure 12** below.

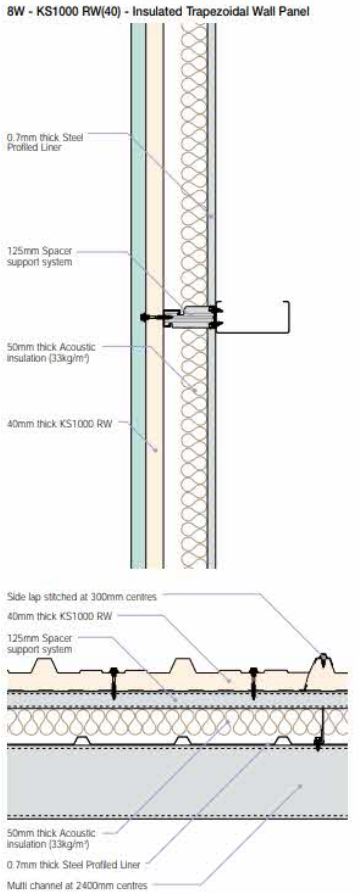

Figure 12: Kingspan 8W KS1000 (RW40) Typical Construction Detail – 38 dB R_w.

6.2.2 All openings to the proposed maintenance unit, such as pedestrian doors and roller shutter doors should be selected to achieve not less than R_w 20 dB(A) and be designed with appropriate seals to all sides.

6.2.3 With respect to the proposed drive-thru units it is considered that typical construction details for such units are constructed from modular construction. Such constructions typically achieve R_w values in excess of 20 dB, and therefore is considered appropriate construction with respect to moderate internal ambient noise levels and associated noise breakout.

6.2.4 Any ventilation openings to the building structure should be designed to ensure that the overall building acoustic properties are not compromised. Depending on the ventilation strategy adopted for the building this may require the inclusion of acoustic louvres or acoustic attenuators, specialist design should be sought.

6.3 Recommendation 2 – 3.0 m High Acoustic Barrier

6.3.1 Construction of a 3.0 m high acoustic barrier is recommended to the south boundary of the development. The approximate location of the acoustic barrier is shown in **Figure 8** (in blue).

6.3.2 The acoustic barrier should be imperforate with a surface density of not less than 10 kg/m^2.

6.3.3 A typical example of an acoustic barrier which may be appropriate is the Jacksons Jakoustic® reflective barrier, details can be found at web address: https://www.jacksons-security.co.uk/acoustic-security-barriers/reflective-acoustic-barrier.

6.4 Proposed Drive-Thru Units and Petrol Filling Station Shop Mechanical Plant

6.4.1 Mechanical plant associated with ventilation and other systems is likely to be required at the development site. At the time of writing details of such systems are not available.

6.4.2 It is likely that, given the locations of the drive-thru and PFS shop, these systems will not be in close proximity to existing residents however it is considered appropriate to determine plant noise limits at this stage.

6.4.3 We recommend therefore that the rated sound level of any mechanical plant does not exceed 35 dB(A) at 10 m. The mechanical plant should be assessed in accordance with BS 4142:2014+A1:2019.

6.4.4 General recommendations with respect to the design and installation of any mechanical ventilation plant at the development site include the following points for consideration:

Mechanical plant should be installed to sides of proposed buildings away from line of sight of existing residential receptors.
Mechanical plant extract termination outlets should be installed at ground level where possible, however it is noted that odour dispersion requirements may limit this possibility (expert advice should be sought);
In the event that mechanical plant extract termination points are located at high level appropriate attenuators should be designed and installed, the system design should ensure that air extract flow rates are maintained at low levels to minimise the potential for flow generated noise breakout.

7 CONCLUSIONS

7.1.1 NoiseAir has carried out a noise impact assessment to support a full planning application for a new park and ride, a bus depot, four new vehicular accesses, a petrol filling station with a shop, and three restaurant units to be located at land at Raich Carter Way, Hull.

7.1.2 An on site acoustic survey has been conducted to ascertain the typical background sound level at the noise sensitive receptors in the locality of the development site. A present the development site noise is dominated by traffic sources from the surrounding road network.

7.1.3 A BS 4142:2014 assessment has been undertaken to assess the likely impact as a result of the development proposals during the operational phase. Three time scenarios have been assessed: daytime, evening and night-time.

7.1.4 It is considered that the perceived impact during the daytime is likely to be lessened somewhat due to noise masking characteristics from the surrounding road network and present at approximately the threshold of **low impact** to **adverse impact.**

7.1.5 During the evening and night-time scenarios, both situations indicate a **low impact** based on the initial assessment, with the night-time being 1 dB above the background sound level, this assessment is considered to be representative given the context of the locality and noise source types.

7.1.6 A series of recommendations are set out within Section 6, a summary of the recommendations are outlined below:

The proposed maintenance building and drive-thru units should be designed to achieve an overall sound reduction index of R_w 20 dB(A);
Construction of a 3 m high acoustic barrier to the south; and,
Any proposed mechanical plant systems or similar should, as a minimum, be designed to achieve a rated noise level of 35 dB(A) at 10 m when assessed in accordance with BS 4142:2014.

APPENDIX A - REPORT LIMITATIONS

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APPENDIX B - GLOSSARY

A-weighted sound pressure, p_A	Value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network. *NOTE: The A-weighting network modifies the electrical response of a sound level meter with frequency in approximately the same way as the sensitivity of the human hearing system.*
A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure in decibels (dBA).
Acoustic environment	Sound from all sound sources as modified by the environment [BS ISO 12913-1:2013].
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. *NOTE: The ambient sound comprises the residual sound and the specific sound when present.*
Ambient sound level, $L_a = L_{Aeq,T}$ (BS4142:2014)	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 *NOTE: The ambient sound level is a measure of the residual sound and the specific sound when present.*
Background sound	Underlying level of sound over a period, *T*, which might in part be an indication of relative quietness at a given location.
Background sound level, $L_{A90,T}$ (BS4142:2014)	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.
Break-in	Noise transmission into a structure from outside.
Break-out	Noise transmission from inside a structure to the outside.
Cross-talk	Noise transmission between one room and another room or space via a duct or other path.
C_{tr}	Correction term applied against the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$) to provide a weighting against low frequency performance. *NOTE: The reference values used within the C_{tr} calculation are based on urban traffic noise.*
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time.
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ (BS4142:2014)	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.
Equivalent sound absorption area of a room, A	Hypothetical area of a totally absorbing surface without diffraction effects, expressed in square metres (m2), which, if it were the only absorbing element in the room, would give the same reverberation time as the room under consideration
Facade level	Sound pressure level 1 m in front of the façade. *NOTE: Facade level measurements of L_{pA} are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the facade.*
Free-field level	Sound pressure level away from reflecting surfaces. *NOTE: Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source). Estimates of noise from aircraft overhead usually include a correction of 2 dB to allow for reflections from the ground.*

Impact sound pressure level, L_i	Average sound pressure level in a specific frequency band in a room below a floor when it is excited by a standard tapping machine or equivalent.
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants. *NOTE: The location(s) within the room at which the ambient indoor noise is to be measured or calculated ought to be considered.*
Measurement time interval, T_m (BS4142:2014)	Total time over which measurements are taken. *NOTE: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.*
Noise criteria	Numerical indices used to define design goals in a given space.
Noise rating, NR	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves.
Normalised impact sound pressure level, L_n	Impact sound pressure level normalized for a standard absorption area in the receiving room. *NOTE: Normalised impact sound pressure level is usually used to characterize the insulation of a floor in a laboratory against impact sound in a stated frequency band.*
Octave band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.
Percentile level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for *N*% of a specified time interval.
Reference time interval, T_r (BS4142:2014)	Specified interval over which the specific sound level is determined. *NOTE: 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 (BS4142:2014)	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, $L_r = L_{Aeq,T}$ (BS4142:2014)	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.
Rating level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise. *NOTE: This is used in BS 7445 and BS 4142 for rating industrial noise, where the noise is the specific noise from the source under investigation.*
Reverberation time, *T*	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped.
Sound exposure level, *L*AE	Level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.
Sound level difference, *D*	Difference between the sound pressure level in the source room and the sound pressure level in the receiving room.
Sound pressure, *p*	Root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound.
Sound pressure level, L_p	Quantity of sound pressure, in decibels (dB).
Sound reduction index, *R*	Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ (BS4142:2014)	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
Specific sound source (BS4142:2014)	Sound source being assessed.
Standardised impact sound pressure level, L'_{nT}	Impact sound pressure level normalized to a reverberation time in the receiving room of 0.5 s.
Standardised level difference, D_{nT}	Difference in sound level between a pair of rooms, in a stated frequency band, normalized to a reference reverberation time of 0.5 s for dwellings.
Groundborne noise	Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground. *NOTE Common sources of ground-borne noise include railways and heavy construction work on adjacent construction sites.*
Structure-borne noise	Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements. *NOTE Common sources of structure-borne noise include building services plant, manufacturing machinery and construction or demolition of the structure.*
Third octave band	Band of frequencies in which the upper limit of the band is 2% times the frequency of the lower limit.
Weighted level difference, D_w	Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions. *NOTE Weighted level difference is used to characterize the insulation between rooms in a building as they are. Values cannot normally be compared with measurements made under other conditions (see BS EN ISO 717-1).*
Weighted normalised impact sound pressure level, $L'_{n,w}$	Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or
Weighted standardised impact sound pressure level $L'_{nT,w}$	Single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Weighted standardised level difference, $D_{nT,w}$	Single-number quantity that characterizes the airborne sound insulation between rooms.

Symbols

D_w	Weighted level difference (dB)
D_{nT}	Standardized level difference (dB)
$D_{nT,w}$	Weighted standardized level difference (dB)
L_{Amax}	Maximum noise level (dB)
$L_{Ar,Tr}$	Rating level (dB)
L_n	Normalised impact sound pressure level (dB)
L'_{nT}	Standardised impact sound pressure level (dB)
$L'_{nT,w}$	Weighted standardised impact sound pressure level (dB)
$L'_{n,w}$	Weighted normalised impact sound pressure level (dB)
L_p	Sound pressure level (dB)
L_{pA}	A-weighted sound pressure level (dB)
$L_{AN,T}$	Percentile level (dB)
L_{AE}	Sound exposure level (dB)
$LAeq,T$	Equivalent continuous A-weighted sound pressure level (dB)
p	Sound pressure (Pa)
p_A	A-weighted sound pressure (dB)
$p_{A(t)}$	Instantaneous A-weighted sound pressure (Pa)

R	Sound reduction index (dB)
R_w	Weighted sound reduction index (dB)
T	Time interval (also used for reverberation time) (s)
t_0	Reference time interval (s)

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