noise.co.uk Ltd
T+44(0)2476 545 397
F+44(0)2476 545 010
The Haybarn
Newnham Grounds
Kings Newnham Lane
Bretford
Warwickshire
CV23 0JU

Environmental Noise Survey & Assessment

Prepared: 16th April 2019

Report No	19968-1
Client	Greggs Plc
Site	245 Barnsley Road Wombwell

noise.co.uk

1. Quality Management

Report Number:	19968
Issue:	1
Prepared:	16th April 2019
Prepared By:	Bill Whitfield PhD, MSc, MIOA
Authorised By:	Dave Riley TechIOA

2. Limitations

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3. Executive Summary

3.1.1. An environmental noise assessment has been carried out to assess the noise impact of proposed new fixed plant at a new Greggs bakery at 245 Barnsley Road, Wombwell. The impact has been assessed using the guidance and procedures contained in BS4142:2014 (BS4142).[1]

3.2. Measurement, Assessment and Evaluation

3.2.1. The survey was conducted to BS7445-1:2003[2] and BS7445-1:1991[3] which is covered under our UKAS Accreditation.

3.2.2. The interpretation of the data and the specification of suitable mitigation or treatment is outside the scope of our UKAS accreditation but is covered in our 17025 Quality Management System and reporting procedure.

3.3. Scope

3.3.1. This report covers all aspects of the measurement, evaluation and assessment procedure, including the:

- measurement of the existing sound pressure levels at the site of the proposed development;
- evaluation of the background sound level;
- creation of a 3D noise model;
- assessment of the fixed plant using the assessment procedure from BS4142; and,

3.4. Assessment Outcome

3.4.1. Based on the numerical assessment from BS4142:2014, it has been demonstrated that the proposed new fixed plant is not likely to have an adverse impact on nearby residential receivers. Taking into account the context, that there is an existing fuel filling station on the site, the numerical assessment is likely to be robust.

[1] BS4142:2014 “Methods for rating and assessing industrial and commercial sound”
[2] BS7445-1:2003 “Description and measurement of environmental noise – Part 1: “Description of quantities and procedures”
[3] BS7445-1:1991 “Guide to the acquisition of data pertinent to land use”

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5. Introduction

5.1. Proposed Development

5.1.1. New fixed plant is proposed at a new Greggs bakery at 245 Barnsley Road, Wombwell. The plant is to be located externally at the rear of an existing building.

5.2. Nearby Residential Receivers

5.2.1. The local planning authority has raised concerns about noise affecting nearby residential dwellings. The nearest residential receivers are the houses accessed via Bamwell Crescent. An aerial view of the site and the nearest residential receivers is given in Figure 1.



Figure 1 - Aerial view showing the location of the proposed development (red) and the nearest residential receivers (blue)

5.3. Noise Climate

5.3.1. The general noise climate was described by the survey technician at the time of the survey as follows:

"At the time of the survey the general noise climate was dominated by continuous Road Traffic noise on Barnsley Road. Construction works had already started on site and were clearly audible at the boundary of the nearest residential receiver."

5.4. New Specific Sound Sources

5.4.1. New fixed plant is proposed at the rear of the bakery. The commercial items of plant and their locations are illustrated on an elevation drawing in Figure 2 and described in Table 1.

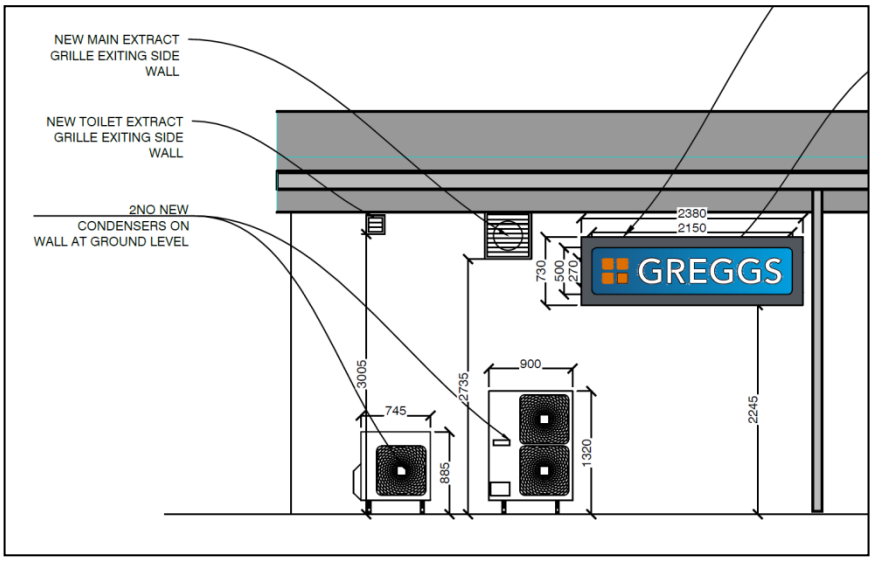


Figure 2 – Elevation showing the location of proposed new fixed plant on the flat roof at the rear of the bakery

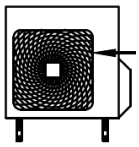
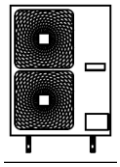
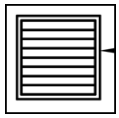
Plant Item	Illustration	Description
Condenser Unit Mitsubishi PUHZ - RP71VHA4		Air conditioner/heating condenser unit. Manufacturer's data supplied. Assumed to operate 100% of the reference period. Assumed to operate in its loudest mode L_p = 48dB(A) re 20µPa @1m
Mitsubishi PUHZ – ZRP125/140VKA		Air conditioner/heating condenser unit. Manufacturer's data supplied. Assumed to operate 100% of the reference period. Assumed to operate in its loudest mode L_p = 52dB(A) re 20µPa @1m
Extract Fan Ruck EL 315 E2 01		Assumed to operate for 100% of the reference period. Specific product sound power level data provided with octave band spectrum. L_w = 81dB(A) re 1pW
Toilet Extract Fan Vent-Axia S12/WL		Assumed to operate for 100% of the reference period. Specific product sound power level data provided with octave band spectrum. L_p = 46dB(A) re 20µPa @3m

Table 1 - Summary of proposed new fixed plant equipment

6. Assessment Criteria

6.1. BS4142:2014

6.1.1. BS4142 provides methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from industrial and manufacturing processes, fixed services plant, sound generated by the loading/unloading of goods and sound from mobile plant/vehicles associated with industrial/commercial premises (e.g. fork-lift trucks).

6.1.2. The standard utilises various descriptors to assess complaints, the impact of sound associated with proposed industrial/commercial activities on existing noise-sensitive receivers, or the impact and likely suitability of siting new noise-sensitive receivers in the vicinity of existing industrial/commercial noise sources.

6.1.3. The standard is specifically precluded from being used to determine likely internal sound levels arising from external noise, or from the assessment of various sound sources for which other (more relevant) guidance exists, including music/entertainment noise, person noise and construction noise.

6.1.4. The magnitude of impact is assessed by subtracting the measured background sound level at a location representative of the nearest noise-sensitive receiver, from the 'rating level' (the specific sound source to be introduced into the locality, corrected for acoustically distinguishing characteristics which may make it more subjectively prominent).

6.1.5. Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context-specific.

6.1.6. As a guideline, BS4142 states that:

- A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context
- A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context
- The lower the rating level relative to the background level, the less likely it is that the specific sound will have an adverse impact
- Where the rating level does not exceed the background level, this is an indication that the specific sound will have a low impact, depending on context

6.1.7. It should be noted that BS 4142:2014 draws a clear distinction between the detailed and flexible assessment methods contained within, and the more limited versions contained in the previous (1997) edition.

Definitions

6.1.8. BS 4142 uses several specific terms to define the various levels used in assessments, as follows:

- Specific sound – the commercial/industrial noise source under consideration
- Residual sound – the sound level at the noise-sensitive receivers in the absence of the specific sound
- Ambient sound – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e. ambient = residual + specific)
- Background level - the sound pressure level which is exceeded by the residual sound for 90% of the measurement period
- Rating level – the specific sound, corrected for acoustically distinguishing characteristics

Background Sound Level

6.1.9. BS4142 emphasises that the background level ($L_{A90,T}$) is in fact a range of levels, not one absolute value. Whilst stating that the measurements of background sound should be normally not less than 15 minutes, the focus is on obtaining a level for use in assessment that is representative of typical conditions at the noise-sensitive receivers.

6. 1. 10. An example methodology by which this typical value may be obtained is given in the document. In this example, monitoring of $L_{A90,15mins}$ is undertaken during periods which represent when the specific noise will be operational. After obtaining a sequence of representative contiguous or disaggregated results, it is then proposed that the modal value is representative of the 'typical' background level.

Specific Sound

6.1.11. BS 4142 requires that the specific sound ($L_{Aeq,Tr}$) is obtained over a reference period of 1 hour (daytime) and 15 mins (at night). Ideally, measurements would be taken of the ambient sound and residual sound at the assessment location, with these measurements used to accurately calculate the specific sound (ambient – residual = specific).

6. 1. 12. Where the source (specific sound) is not yet operational, it is permissible to measure the specific sound elsewhere (or to use known manufacturers' or library data) and then model the impact of this against the known background level.

Rating Level

6.1.13. Once the specific sound level has been determined, this must be corrected in terms of the need to consider the subjective prominence of the impact of the sound at noise-sensitive receivers, and the extent to which acoustically distinctive characteristics will attract attention.

6.1.14. BS4142 states that this is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:

- Tonality: +2dB for a 'just perceptible' tone, +4dB for 'clearly perceptible', and rising to +6dB for 'highly perceptible' tones.
- Impulsivity (rapidity of change and overall chance in level): +3 dB for 'just perceptible' impulsivity, +6dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity.
- Intermittency: if the on/off-time of the specific sound is readily distinctive at the noise- sensitive receivers, +3dB.

6.1.15. It should be noted that where one feature is clearly perceived as dominant, it may be applicable to correct for that feature only. Where multiple features are likely to affect perception and response, each should be added arithmetically.

7. Survey

7.1. Measurement Instrumentation

7.1.1. The measurement instrumentation used during the survey is detailed in the appendix.

7.1.2. The acoustic equipment was calibrated to comply with Section 4.2 of BS7445-1:2003 before and after the surveys. The calibration details can also be found in the appendix.

7.2. Monitoring Locations

In order to avoid the measurements being adversely affected by the noise from construction works, a monitoring location on Bamwell Crescent was adopted. This location was the same distance from the A633 Barnsley Road as the nearest residential receivers and the noise climate is considered to be conservatively representative of that at the nearest residential receiver in the absence of the construction noise. The monitoring equipment was located 1.5m from the ground and at least 3m from the next nearest reflecting surfaces. The location of the monitoring equipment is illustrated in Figure 3.



Figure 3 – Plan showing the location of the monitoring equipment

7.3. Measurement and Timescale

7.3.1. Unattended noise monitoring took place over a typical weekday period between Monday 15th April 2019 and Tuesday 16th April 2019. The following quantities were measured:

$L_{A90,15\text{-}min}$

7.3.2. The acoustic measurements and their interpretation have been in accordance with BS 7445: Parts 1, and 2. All sound pressure levels are in dB (re 20μPa).

7.4. Meteorology

7.4.1. During the survey the weather information was noted. This is shown in Table 2.

	Monday 15th April 2019	Tuesday 16th April 2019
Roads(Wet/Dry)	Dry	Dry
Wind Speed (ms^{-1}) / Direction	7 E	5 NE

Table 2 - Meteorological data noted during the survey

7.5. Background Sound Pressure Level

7.5.1. The opening hours of Greggs bakeries are typically 07:00 – 18:00 Monday – Friday, with reduced trading hours at the weekend. Based on previous experience of assessing Greggs bakeries, baking activities tend to start at least one hour prior to formal opening. Therefore, the typical background sound level has been considered between the hours of 06:00-19:00.

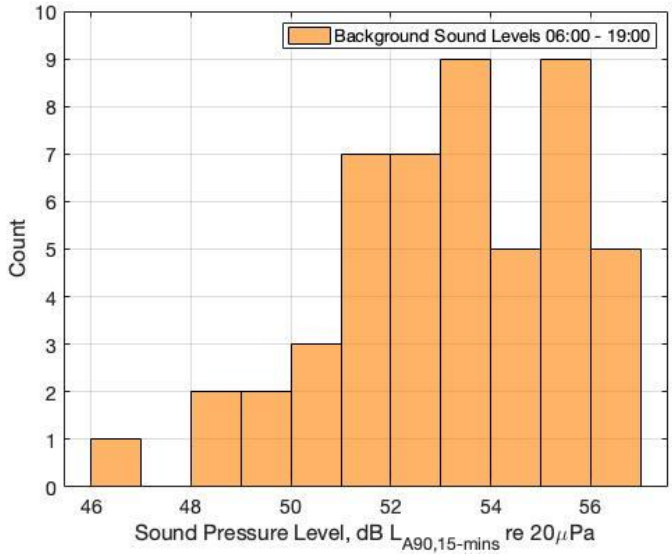


Figure 4 – Histogram showing the distribution of the background sound level between 06:00 and 19:00

7.5.2. Figure 4 shows that the background sound level ranged between 47dB $L_{A90,15\text{-min}}$ and 57dB $L_{A90,15\text{-min}}$ between 06:00 and 19:00 on the 15th and 16th of April 2019. The two peaks in the distribution are the most common values on each of the days of the survey; where the 15th April 2019 experienced higher windspeeds than the 16th April 2019. Therefore, the lower of the two peaks has been taken to be the typical background sound level, this is 54dB $L_{A90,15\text{-min}}$.

8. 3D Noise Model

8.1.1. A 3D noise model has been constructed in SoundPLAN™ to calculate the specific sound level 1m from the facades of the nearby residential receivers. The model uses the calculation method from ISO9613-1:1996[4] to account for the distance between the source and receiver and any screening or reflections provided by the surrounding buildings.

8.1.2. The spectral content for the sources has been provided by the manufacturer and has been reproduced in the appendix. In each case the new fixed plant items have been assumed to be point sources. A noise contour plot illustrating the propagation of the specific sound from source to receiver is give in Figure 5.

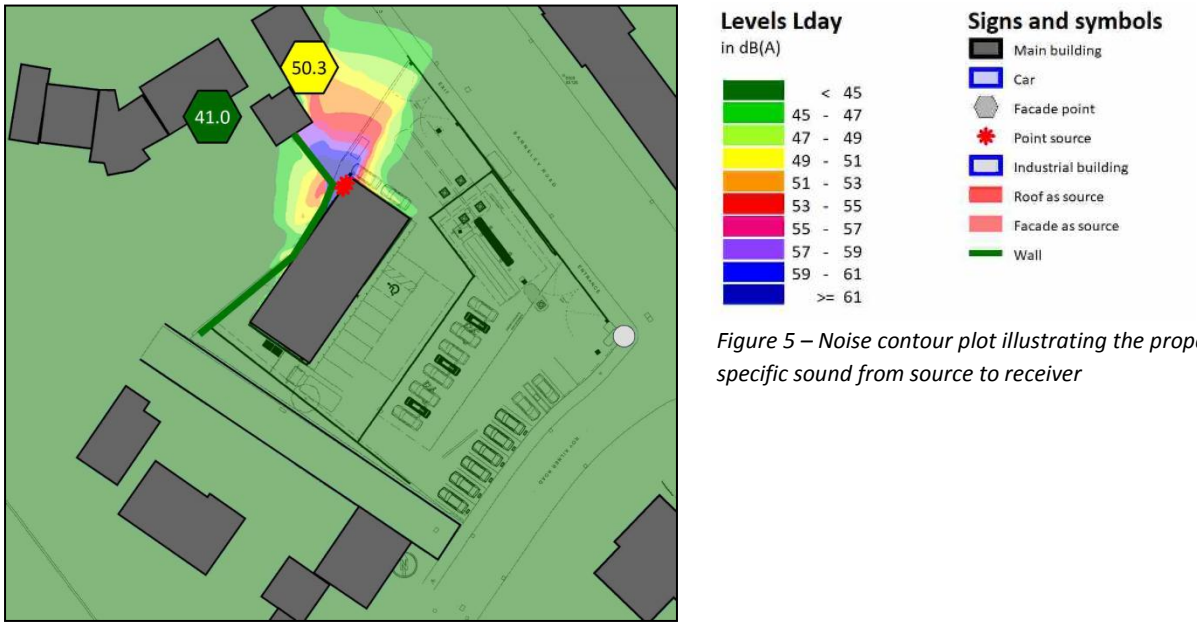


Figure 5 – Noise contour plot illustrating the propagation of specific sound from source to receiver

8.1.3. The worst case façade level from the 3D noise model was 50.3dB(A). The latest revision of the standard makes the assessment using a free-field sound pressure level; therefore 47dB(A) has been taken to be the specific sound level for the assessment, rounded to the nearest whole decibel.

[4] ISO9613-1:1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"

9. BS4142 Assessment

9.1. Rating Level

9.1.1. The items of fixed plant have been specified but not installed; it is, therefore, not possible to make a subjective judgment of the character of the specific sound. Character corrections have been applied based on experience of similar items of plant.

Tonality

9.1.2. Most items of heating, ventilation and air conditioning plant have rotating components that would be likely to produce modest tones. It is possible that these tones could be just perceivable. Therefore a +2dB character correction has been made for tonality.

Impulsivity

9.1.3. The items of plant would be expected to emit continuous sound. No correction has been made for impulsivity.

Intermittency

9.1.4. It is possible that the fixed plant will not operate 100% of the time. However, in any 1-hour daytime reference period the plant would not be expected to switch on and off more than once. Therefore, no correction for intermittency has been made.

9.2. BS4142 Assessment

9.2.1. The BS4142 assessment is detailed in Table 3.

	Level
Background sound level, dB $L_{A90,15min}$	54
Specific sound level, dB(A)	47
Character corrections Tonality Impulsivity Intermittency	 +2 0 0
Rating level Specific sound level + corrections	49
Assessment Level Rating level – Background sound level	-5
"The lower the rating level relative to the background level, the less likely it is that the specific sound will have an adverse impact" *"Where the rating level does not exceed the background level, this is an indication that the specific sound will have a low impact, depending on context"*	

Table 3 - The assessment procedure from BS4142

9.3. Context

9.3.1. In this situation the site is currently occupied by a fuel filling station and the presence of sound from mechanical and electrical plant will not be new. Therefore, the likely "low impact" assessment outcome is expected to be robust.

10. Uncertainty

10.1.1. BS4142 requires that uncertainty is reported and minimised wherever possible. The document acknowledges that all calculation-based modelling practices are ultimately an approximation. However, rather than ignore this fact or consider the results absolute, it is considered good practice to honestly report factors which can affect the robustness of any assessment.

10.2. Source Sound Complexity and Variability

10.2.1. The data for the specific sound sources has been provided by the manufacturer. This data is unlikely to have been affected by other, residual, sound. The specific sound is dominated by broadband noise from fans but the maximum character correction for tonality ensures that the worst case has been assessed.

10.3. Background Sound Complexity and Variability

10.3.1. The ambient noise climate at the assessment site is reasonably simple and the background sounds levels measured (which include busier and quieter periods) are considered typical for an urban area. Wind speeds during the survey visits were typically under 5ms^{-1} and, where this was exceeded, data has been excluded from the analysis.

10.3.2. There will inevitably be times when the background level at nearby residential receivers is higher or lower than that used in assessment; however, using the typical level (see Section 7.5) is considered to represent the most pragmatic and reasonable solution.

10.4. 3D Noise Model

10.4.1. The attenuation of sound propagating outdoors between fixed source and receivers fluctuates due to variations in the meteorological conditions along the propagation path. ISO9613:1996 restricts the prediction to moderately downwind conditions of propagation. There is an expected uncertainty of ±3dB in the predicted sound pressure levels.

10.4.2. Ultimately, algorithms used to calculate distance attenuation are approximations. However, within all calculations, ground absorption and diffusion (which can be helpful in terms of attenuating sound with distance) have been set to pessimistic levels. In this way, a worst-case scenario can be modelled, increasing the robustness of the assessment.

10.5. Instrumentation

10.5.1. The instrumentation used in noise.co.uk's surveys has been calibrated by UKAS-approved laboratories. It is, however, noted that the degree of measurement tolerance of most Type 1 sound level analysers is approximately 1-2 dB, meaning that two independently-verified meters could measure the same sound level and report marginally differing values.

11. Conclusions

11.1.1. An environmental noise assessment has been carried out to assess the noise impact of new fixed plant at a new Greggs bakery at 245 Barnsley Road, Wombwell.

11.1.2. A BS4142 assessment shows that the new fixed plant is unlikely to result in adverse impact to local residents. Taking into account the context, that the existing site is already occupied by a fuel filling station, the likely "low impact" assessment outcome is expected to be robust.

11.1.3. We strongly recommend that this report be passed to the local authority for approval before any works are carried out.

12. Appendix

12.1. APPENDIX A: Summary Information

Required ISO Test Report Information (cross referenced where required)			
		Measurements carried out to:	Analysed to:
A	Standards	BS 7445-1: 2003 BS 7445-1: 1991	BS4142:2014
B	Organisation performed the measurements	noise.co.uk Ltd, The Haybarn, Newnham Grounds, Kings Newnham Lane, Bretford, Coventry, CV23 0JU.	
C	Name of Client	Greggs Plc	
D	Full site address	245 Barnsley Road, Wombwell	
E	Date of surveys	Unattended survey date: 15th April 2019 to 16th April 2019	
F	Description & identification of proposed development	Two new air conditioning units and a new kitchen extract are proposed at at the rear of a new commercial premises.	
G	Brief Description of details of Procedure & equipment	See Section 5 of this report.	

12.2. APPENDIX B: Technical Appendix

12.2.1. Measurements were made using the following equipment:

Monitoring Position	Sound Level Meter	Calibrator
Position 1	Norsonic 140 (1404965)	Norsonic 1251 (31817)

12.2.2. The equipment has traceable calibration. The sound level meter was calibrated immediately prior to and immediately after the measurements were carried out.

Sound Level Meter	Before	After
Norsonic 140 (1404965)	113.9 dB	113.9 dB

12.2.3. There was no adverse deviation.

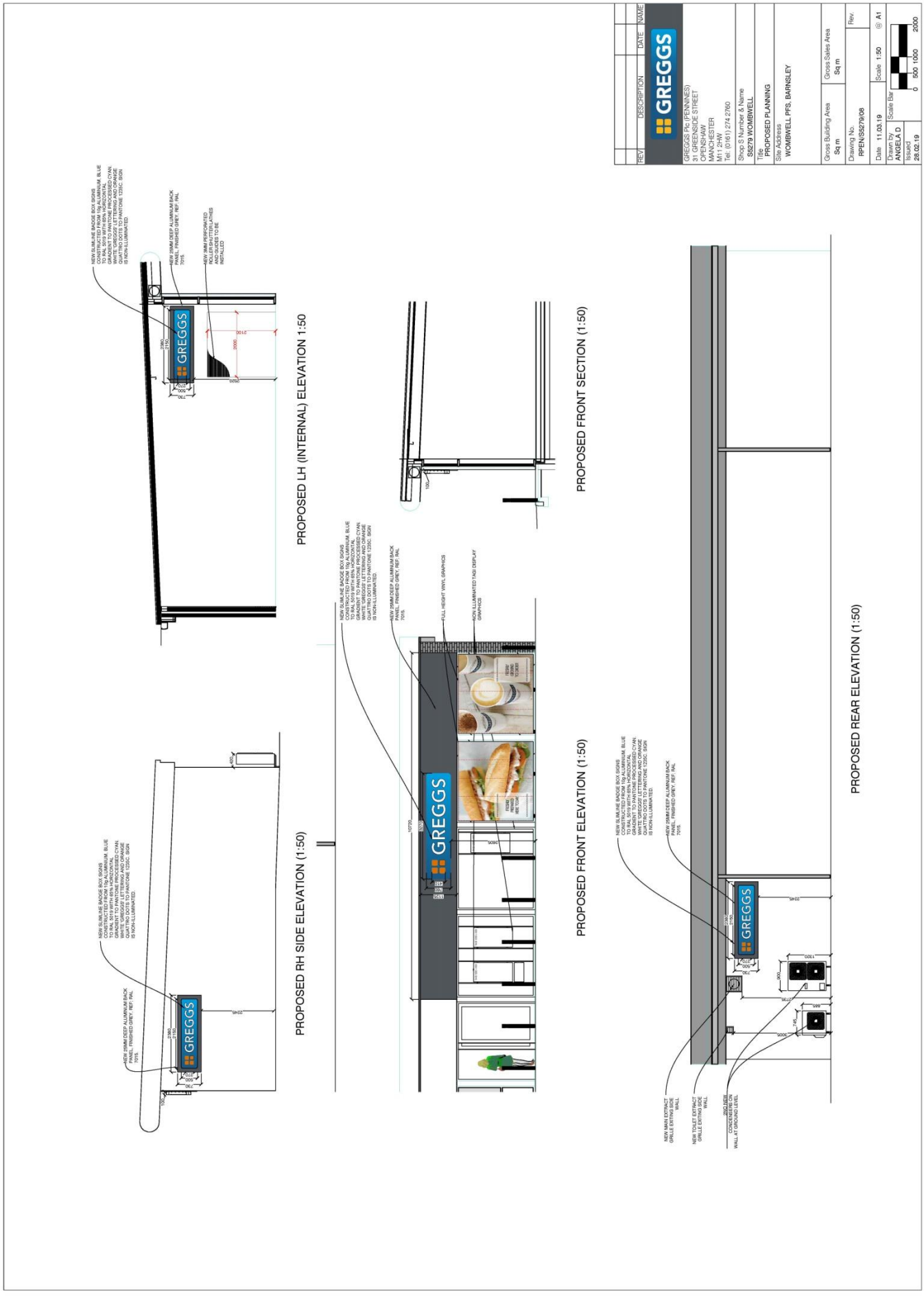
12.3. APPENDIX C: Background Sound Level Data

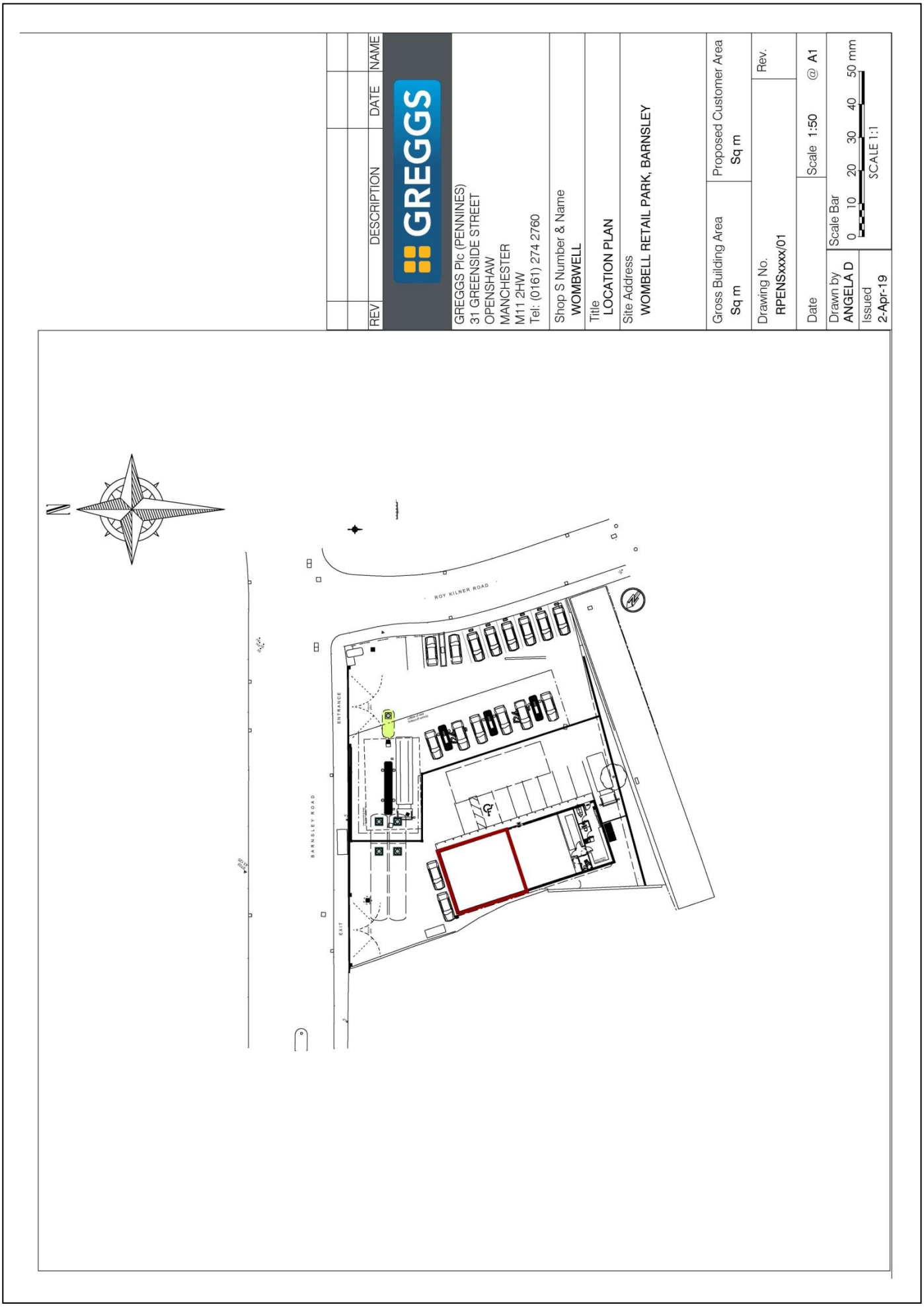
Date	Time	dB $L_{A90,15\text{-}min}$
15/04/2019	13:15:00	54.5
15/04/2019	13:30:00	55.0
15/04/2019	13:45:00	57.5
15/04/2019	14:00:00	57.5
15/04/2019	14:15:00	54.0
15/04/2019	14:30:00	55.5
15/04/2019	14:45:00	55.0
15/04/2019	15:00:00	56.5
15/04/2019	15:15:00	54.5
15/04/2019	15:30:00	55.0
15/04/2019	15:45:00	55.5
15/04/2019	16:00:00	56.5
15/04/2019	16:15:00	57.0
15/04/2019	16:30:00	55.5
15/04/2019	16:45:00	55.5
15/04/2019	17:00:00	57.0
15/04/2019	17:15:00	56.0
15/04/2019	17:30:00	55.5
15/04/2019	17:45:00	54.5
15/04/2019	18:00:00	55.5
15/04/2019	18:15:00	53.5
15/04/2019	18:30:00	54.0
15/04/2019	18:45:00	51.0
15/04/2019	19:00:00	51.0
15/04/2019	19:15:00	51.5
15/04/2019	19:30:00	50.0
15/04/2019	19:45:00	50.0
15/04/2019	20:00:00	47.5
15/04/2019	20:15:00	48.5
15/04/2019	20:30:00	49.0
15/04/2019	20:45:00	45.0
15/04/2019	21:00:00	47.5
15/04/2019	21:15:00	44.0
15/04/2019	21:30:00	44.5
15/04/2019	21:45:00	43.5
15/04/2019	22:00:00	44.5
15/04/2019	22:15:00	40.5
15/04/2019	22:30:00	39.0
15/04/2019	22:45:00	37.0
15/04/2019	23:00:00	37.5

Date	Time	dB $L_{A90,15\text{-}min}$
15/04/2019	23:15:00	37.0
15/04/2019	23:30:00	35.0
15/04/2019	23:45:00	33.5
16/04/2019	00:00:00	34.0
16/04/2019	00:15:00	33.0
16/04/2019	00:30:00	32.5
16/04/2019	00:45:00	32.0
16/04/2019	01:00:00	32.0
16/04/2019	01:15:00	32.0
16/04/2019	01:30:00	32.0
16/04/2019	01:45:00	31.5
16/04/2019	02:00:00	32.0
16/04/2019	02:15:00	31.5
16/04/2019	02:30:00	31.5
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16/04/2019	05:45:00	47.0
16/04/2019	06:00:00	48.0
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16/04/2019	06:30:00	48.5
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16/04/2019	07:00:00	49.0
16/04/2019	07:15:00	51.0
16/04/2019	07:30:00	52.0
16/04/2019	07:45:00	52.0
16/04/2019	08:00:00	53.0
16/04/2019	08:15:00	51.5
16/04/2019	08:30:00	51.5
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16/04/2019	09:00:00	51.5
16/04/2019	09:15:00	51.5

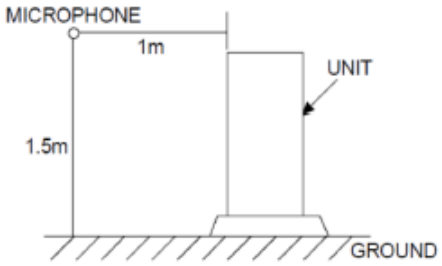
Date	Time	dB $L_{A90,15\text{-}min}$
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16/04/2019	09:45:00	50.5
16/04/2019	10:00:00	51.5
16/04/2019	10:15:00	53.5
16/04/2019	10:30:00	52.0
16/04/2019	10:45:00	52.0
16/04/2019	11:00:00	53.5
16/04/2019	11:15:00	53.0
16/04/2019	11:30:00	52.5
16/04/2019	11:45:00	52.5
16/04/2019	12:00:00	53.0
16/04/2019	12:15:00	53.0
16/04/2019	12:30:00	53.5
16/04/2019	12:45:00	52.5
16/04/2019	13:00:00	53.0

12.4. APPENDIX E: Client Drawings and Information


PROPOSED LH (INTERNAL) ELEVATION 1:50
PROPOSED RH SIDE ELEVATION (1:50)
PROPOSED FRONT SECTION (1:50)
PROPOSED FRONT ELEVATION (1:50)
PROPOSED REAR ELEVATION (1:50)
GREGGS
REV
DESCRIPTION
DATE
NAME
GREGGS Plc (PENNINES)
31 GREENSIDE STREET
OPENSHAW
MANCHESTER
M11 2HW
Tel. (0161) 274 2760
Shop S Number & Name
S5279 WOMBWELL
Title
PROPOSED PLANNING
Site Address
WOMBWELL PF8, BARNSLEY
Gross Building Area
Sq m
Gross Sales Area
Sq m
Drawing No.
RPEN/S5279/06
Rev.
Date 11.03.19
Scale 1:50 @ A1
Drawn by
ANGELA D
Scale Bar
Issued
28.02.19
0 500 1000 2000


REV
DESCRIPTION
DATE
NAME
GREGGS
GREGGS Plc (PENNINES)
31 GREENSIDE STREET
OPENSHAW
MANCHESTER
M11 2HW
Tel: (0161) 274 2760
Shop S Number & Name
WOMBWELL
Title
LOCATION PLAN
Site Address
WOMBELL RETAIL PARK, BARNSLEY
Gross Building Area
Sq m
Proposed Customer Area
Sq m
Drawing No.
RPENSxxxx/01
Rev.
Date
Scale 1:50 @ A1
Drawn by
ANGELA D
Scale Bar
0 10 20 30 40 50 mm
SCALE 1:1
Issued
2-Apr-19
N
ROY KILNER ROAD
BARNSLEY ROAD
ENTRANCE
EXIT

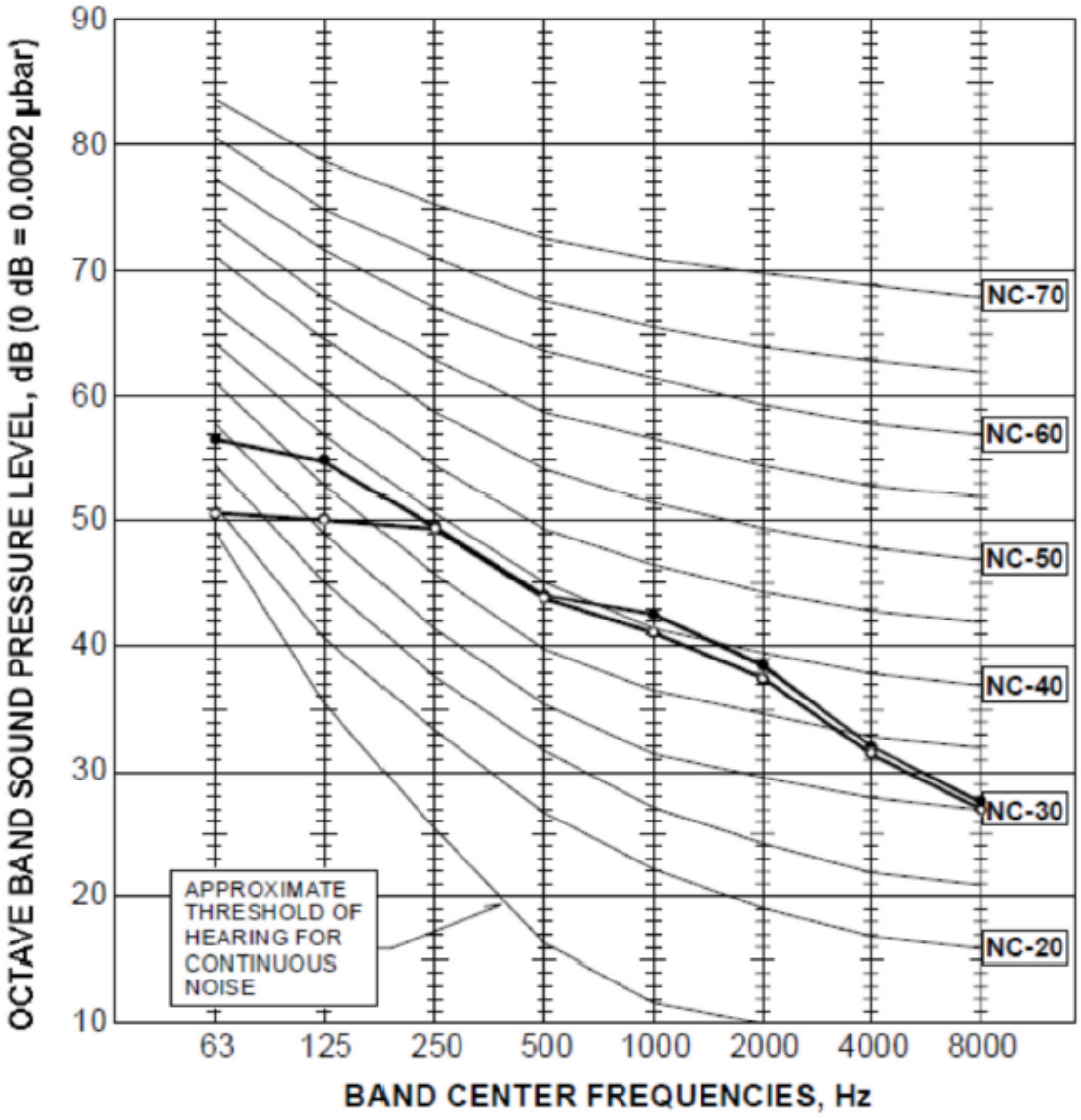
5-4. NOISE CRITERION CURVES



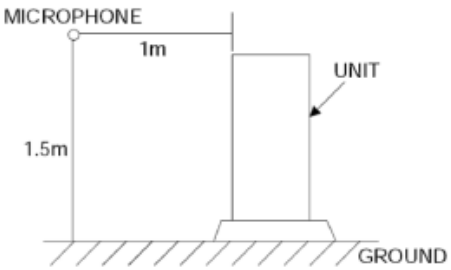
SINGLE AIR CONDITIONING CONDENSER UNIT

PUHZ-RP71VHA4

MODE	SPL(dB)	LINE
COOLING	47	
HEATING	48	



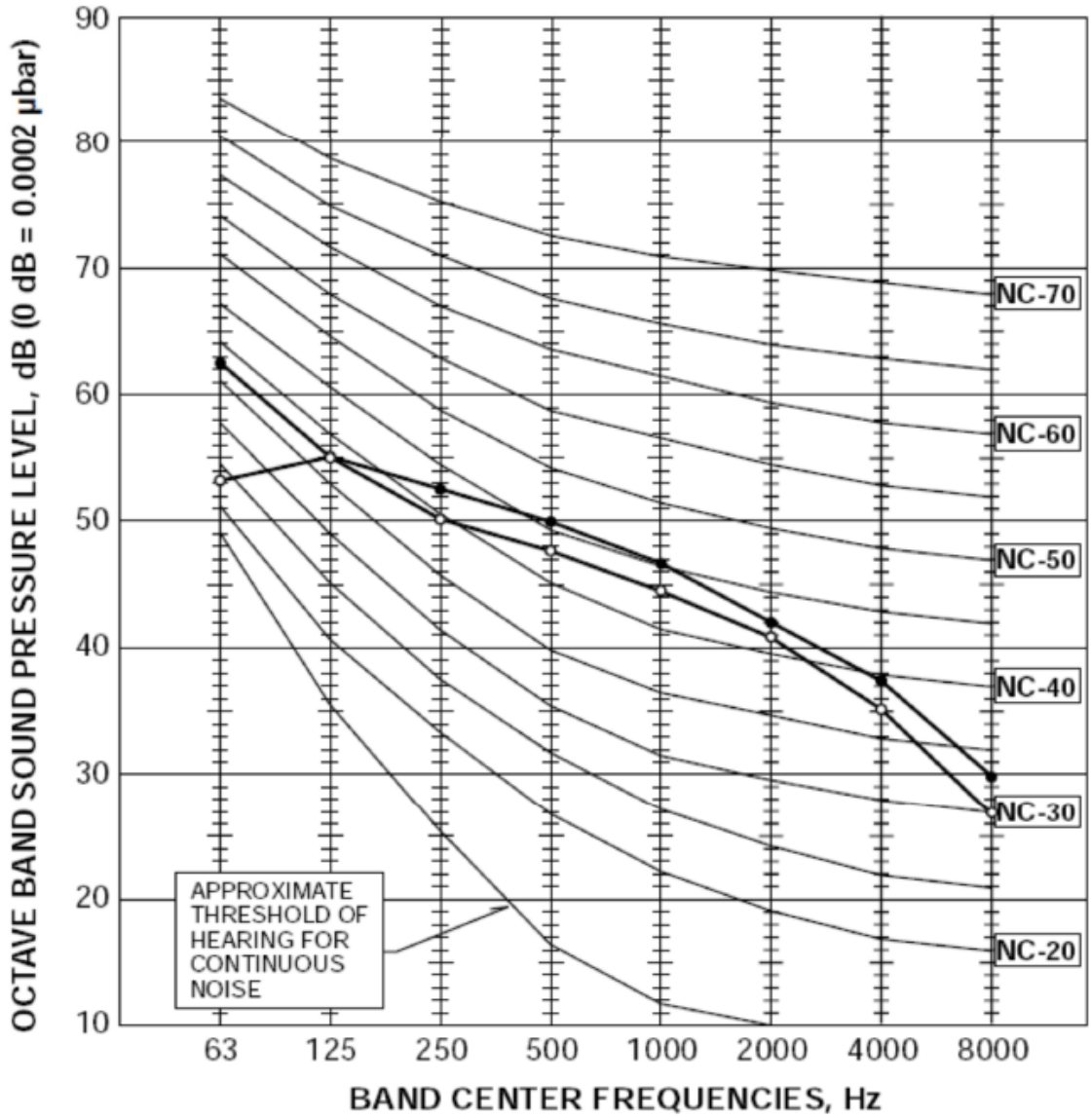
5-3. NOISE CRITERION CURVES



DOUBLE AIR CONDITIONING CONDENSER UNIT

PUHZ-ZRP125/140VKA

MODE	SPL(dB)	LINE
COOLING	50	
HEATING	52	



EL...E

ruck VENTILATOREN

DESCRIPTION | DIAGRAM | SPECIFICATIONS | DRAWINGS | DOCU | ACCESSORIES

Type EL 315 E2 01
ID 112202

Circuit Data Entire Unit		
Rated frequency	Hz	50
Nominal voltage	V	230
Rated power	W	530
Max. operating current	A	3.2
Phase		1~
Motor Type		1~
Type of motor control		V
Motor Protection		TMI
Capacitor µ	µF	10
Capacitor Voltage	V	400
Insulation Class Motor		F
Poles		2
IP Motor		IP54
IP Terminal Box		IP44
IP Complete Unit		IPX4
Min. Operating Temperature	°C	-25

Rated Current	A	2.4
Rated Speed	1/min	2770
Max. Static Efficiency	%	52.5
Max. Total Efficiency	%	56.7
Max. allowed Frequency (3~ motors)	Hz	-
Max. allowed RPM (with EC-motors)	1/min	-
Max. Power Consumption	W	530
Max. Current Consumption	A	3.2
Max. RPM	1/min	2860
Max. air volume	m³/h	3510
Min. Pressure	Pa	-
Max. Pressure	Pa	760
Max. allowed Ambient Temperature at Rated Current	°C	80
Max. allowed Medium Temperature at Rated Current	°C	80
Max. allowed Ambient Temperature	°C	70
Max. allowed medium temperature	°C	70
Blocked current	A	8.5
Min. allowed Voltage	V	80
Weight	kg	15,0

Sound Measurement (Octave)				Σ	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
SPL inlet	L_{WA5}	dB(A)	1	84	-	66	75	78	79	77	75	68
			2	80	-	61	70	75	74	73	70	62
			3	76	-	48	64	69	70	70	69	66
			4	78	-	46	66	70	71	71	71	70
			5	81	-	48	71	73	74	74	75	74
SPL outlet	L_{WA6}	dB(A)	1	88	-	69	77	82	84	81	77	70
			2	84	-	66	73	78	80	78	72	64
			3	81	-	50	70	75	77	75	71	65
			4	83	-	50	73	77	79	77	72	68
			5	85	-	50	73	78	80	78	75	70
SPL casing break out	L_{WA2}	dB(A)	1	68	-	61	61	59	62	61	58	50
			2	66	-	58	58	57	60	57	54	45
			3	61	-	46	50	52	57	54	53	46
			4	61	-	43	49	52	56	54	53	48
			5	63	-	46	51	56	58	55	55	51