Noise Impact Assessment

Proposed McDonald's Restaurant, Ashgrove Road West, Aberdeen, AB16 5EH

12th April 2022

ENVIRONMENTAL AND SUSTAINABILITY CONSULTANTS

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Executive Summary

A sound survey was undertaken to inform the assessment of the likelihood of adverse impact from the proposed McDonald's restaurant with associated car park and drive-through facility on Ashgrove Road West, Aberdeen, AB16 5EH. The sound survey was carried out in compliance with BS 4142 as detailed in this report. The sound survey considers the impacts at residential dwellings to the south and the west of the site.

Sound measurements were taken at two locations, one representing the most exposed property to the west of the site, and the other to represent the most exposed property to the south. Noise measurements were taken from other sites to represent noise sources that will be associated with the proposed site, such as car park vehicle movements and deliveries. Sound levels associated with noise sources such as mechanical plant and refuse collections have been established from British Standards and Manufacturer datasheets.

When considering the closest noise sensitive receptor to the west and to the south of the site during the worst-case 1-hour daytime period, adverse impact is not likely to occur. The rating level is significantly below the prevailing background sound level that there is very little uncertainty that adverse impact will not occur.

When considering that closest noise sensitive receptor to the west of the site during the worst-case 15-minute night-time period, adverse impact is not likely to occur. The assessment of the worst-case 15-minute period at the closest receptor to the south indicates that adverse effect in not likely. Contextual factors, particularly the nature of the source within the residual environment and the absolute sound level suggests that the impact is likely to be considerably lower than predicted by the BS 4142 assessment.

1 Introduction

1.1 Overview

Encon Associates Ltd have been commissioned to prepare an environmental noise impact assessment for a proposed McDonald's Restaurant with associated car park and drive-through facility on the corner of Ashgrove Road West and North Anderson Drive, Aberdeen, AB16 5EH.

The following report has been produced to accompany a planning application that is to be submitted to Aberdeen City Council.

This report details existing background sound levels at the noise sensitive receptors considered as the worst affected, as well as noise emissions associated with the operations that are to take place.

Due to the necessary technical nature of the report, a glossary of terms can be found in Appendix A to assist the reader.

1.2 Scope & Objectives

The scope of the noise assessment can be summarised as follows:

- Baseline sound monitoring to evaluate the prevailing acoustic environment at the worst affected noise sensitive receptors in relation to the site;
- A detailed assessment of the sound emissions from the site, in accordance with relevant standards in respect of sound emissions from the site;
- Distance calculations in accordance with ISO9613 – 1 prediction methodology to predict sound levels at the worst affected noise sensitive receptors;
- Recommendation of mitigation measures, where necessary, to comply with the requirements of BS4142: 2014, and other relevant standards.

2 Site Description & Background Information

2.1 Site & Surrounding Area

The site is located on a corner with Ashgrove Road West to the south and North Anderson Drive to the west. The immediate surrounding area comprises a mixture of residential dwellings and commercial units. Immediately to the west of the site lies SSE Enterprise, which operates between the hours of 09:00 and 17:00 Monday to Friday. Residential dwellings are situated to the south of the site on the opposite side of Ashgrove Road West. On the opposite side of North Anderson Drive are multiple residential dwellings.

Figure 1.0 – Site and Surrounding Area

2.2 Background

It is proposed that the existing building on the land on the corner of Ashgrove Road West and North Anderson Drive be demolished with a McDonald's Restaurant with associated car park and drive-through facility with side-by-side customer order displays (CODs) be erected. McDonald's are seeking permission to trade 24/7 from this new facility. Consequently, a noise impact assessment was required to determine the likelihood of adverse impact upon nearby residents.

The existing acoustic environment is dominated by road traffic along Ashgrove Road West and North Anderson Drive. Birdsong and occasional noise from passing pedestrians also contributed to the acoustic climate.

3 Legislation, Policy and Guidance

This report is based on the following policy, guidance and legislation.

3.1 BS4142: 2014 'Methods for rating and assessing industrial and commercial sound

British Standard 4142: 2014 describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as the from fork-lift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

The standard presents methods to measure and determine ambient, background and residual sound levels, and the rating levels of industrial/commercial sound. BS4142:2014 requires consideration of the level of uncertainty in the data and associated calculations.

The determination of noise amounting to a nuisance is beyond the scope of BS4142. The standard stipulates that it not intended to be applied to the rating and assessment of sound from the passage of vehicles of vehicles on public roads and railway systems, recreational activities, music and entertainment, shooting grounds, construction and demolition, domestic animals, public address systems and other sources not specified within the document.

The Reference Time Interval, T, is defined in the standard as the "specified interval over which the specific sound level is determined", which is 1 hour during the daytime (07:00 to 23:00 hours) and 15 minutes during the night (23:00 to 07:00 hours).

Ambient sound is defined as "totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far". It comprises the residual sound and the specific sound when present.

Residual sound is defined as "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".

The background sound level is the $L_{A90,\,T}$ of the residual sound level, and is the underlying level of sound. Measurements of background sound level should be undertaken at the assessment location where possible or at a comparable location.

The measurement time interval should be sufficient to obtain a representative value (normally not less than 15 minutes) and the monitoring duration should reflect the range of background sound levels across the assessment period. The background sound level used for the assessment should be representative of the period being assessed.

The specific sound level is the $L_{Aeq,T}$ of the sound source being assessed over the reference time interval, Tr. BS 4142: 2014 advises that Tr should be 1 hour during the day and 15 minutes at night.

The rating level is the specific sound level plus any adjustment for the characteristics that are present with the sound including tonality, impulsivity, intermittency or other acoustic characteristics. The standard describes subjective and objective methods to establish the appropriate adjustment. The characteristics and coinciding adjustments are defined as:

- Tonality: A rating penalty of + 2dB is applicable for a tone which I "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

- Impulsivity: A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

- Intermittency: When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on-time if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3dB can be applied."

- Other Sound Characteristics: Where the specific sound features that are neither tonal nor impulsive but are otherwise readily distinctive against the residual acoustic environment, a 3 dB penalty can be applied.

The level of impact is assessed by comparing the rating level with the background sound level. Typically the greater the difference between the rating level and background sound level the greater the magnitude of impact, depending on context. A difference of +5 dB is likely to indicate an adverse impact and a difference of +10 dB is likely is likely to indicate a significant adverse impact, depending on context.

4 Environmental Noise Survey

To characterise the acoustic environment of the area, a long-term noise survey was carried out from the 23rd – 24th March 2022.

4.1 Measurement Methodology

Long-term monitoring was carried out at two measurement positions (MP1). The sound level meter (MP1) was positioned on the north-west of the development site. The microphone was mounted onto a tripod 1.5m above the ground in free-field conditions (more than 3.5m from any reflective surfaces apart from the ground). The other sound level meter (MP2) was positioned on the south-east of the development. The microphone was mounted onto a tripod 1.5m above the ground in free-field conditions. These measurement positions were chosen to obtain representative sound levels over a 24-hour period to represent properties to the south and to the west of the site during proposed operational hours.

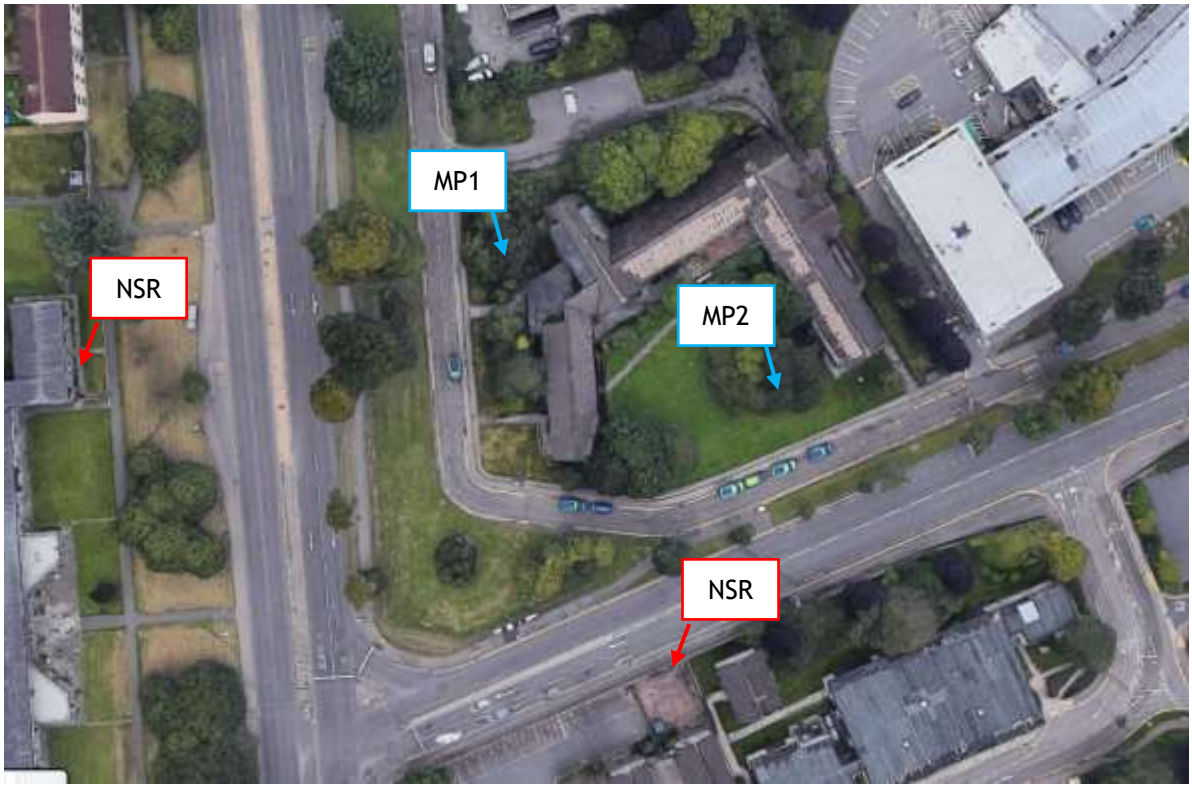

Figure 2.0 – Measurement Positions

4.2 Instrumentation

Equipment	Serial No.	Laboratory Calibration
Svantek SV 307 Class 1 Sound Level Meter	87841	11/12/2021
Svantek SV 307 Class 1 Sound Level Meter	87849	15/02/2022

Table 1.0 – Instrumentation

All sound level meters were field calibrated immediately before and after the measurement period and no significant drift (≤0.5 dB) occurred. Laboratory calibration by a third-party is carried out on all sound level meters every twenty-four months with all calibrators being calibrated every twelve months. All microphones were fitted with a protective windshield. Calibration certificates can be seen in Appendix E.

4.3 Weather Conditions

Localised meteorological conditions were recorded throughout the survey period during the measurement of the background sound levels from 23rd – 24th March 2022. The conditions were considered suitable i.e. in accordance with those laid out in BS 7445-2:1991 and provided no significant uncertainty to the measured data. A summary of the meteorological conditions can be found in Appendix C.

4.4 Survey Results

Time History Graphs showing the results of the automated survey can be found in Appendix B. These graphs display the 15-minute L_{A90}, L_{A10} L_{Aeq}, and L_{AFmax} sound levels at each monitoring location throughout the survey period

4.4.1 Background Measurement Results

The table below shows the L_{A90} measurements at MP1 throughout the day-time operational hours.

Measurement Position 1			
Daytime (07:00 - 23:00)	**Typical $L_{A90, 15\ min}$ (mode)**	**Min. $L_{A90, 15\ min}$**	**Max. $L_{A90, 15\ min}$**
Wednesday – Thursday 23-24/03/22	56	48	74

Table 2.0 – Daytime Background Measurements - MP1

Measurement Position 1			
Night-time (23:00 - 07:00)	**Typical $L_{A90, 15\ min}$ (mode)**	**Min. $L_{A90, 15\ min}$**	**Max. $L_{A90, 15\ min}$**
Wednesday – Thursday 23-24/03/22	34	33	56

Table 3.0 – Night-time Background Measurements – MP1

Measurement Position 2			
Daytime (07:00 - 23:00)	**Typical $L_{A90, 15\ min}$ (mode)**	**Min. $L_{A90, 15\ min}$**	**Max. $L_{A90, 15\ min}$**
Wednesday – Thursday 23-24/03/22	52	48	69

Table 3.0 – Daytime Background Measurements – MP2

Measurement Position 2			
Night-time (23:00 - 07:00)	**Typical $L_{A90, 15\ min}$ (mode)**	**Min. $L_{A90, 15\ min}$**	**Max. $L_{A90, 15\ min}$**
Wednesday – Thursday 23-24/03/22	34	31	51

Table 4.0 – Night-time Background Measurements – MP2

Tables 2 - 4 demonstrate the range of background sound levels at the noise sensitive receptors. Considering that the background sound levels have not been influenced by on-site activity, the $L_{A90, 15min}$ sound levels measured at the noise sensitive receptors during the same periods that activities were taking place are to be used for the assessment.

5 Specific Sound Sources

5.1 Customer Vehicle Noise

To assess whether noise from the car park will have an impact on nearby residents, secondary data has been used from a survey carried out at an existing McDonald's site. The following table shows sound levels associated with car park and drive-through vehicle movements.

Source	Measurement Distance (m)	Time (s)	Sound Level dB $L_{Aeq, T}$	Sound Exposure Level (L_{AE})
Drive Thru – drive off street and stop at COD	5	10	65	75
Engine Idling – Making Order	1	63	75	93
Drive to Pay Point	5	6	67	75
Engine Idling – Pay Point	5	20	63	76
Drive to Collection Point	5	8	67	76
Engine Idling - Collection Point	5	20	63	76
Car Driving off and pulling out of drive-thru	5	9	71	81
Car Pulling into Car Park	7	6	67	75
Car Reversing	7	10	56	66
Car Pulling off Parking Space	4	6	63	70
Car Engine Starting	5	6	60	68
Car Passage	3	6	65	73
Car Door Slam	1	6	81	90

Table 5.0 – Individual Noise Sources from Vehicle Movements

Using this data, it is possible to predict the noise levels from the car park during the busiest period. The following table predicts the noise levels from the car park over the busiest one-hour daytime period at the noise sensitive receptors to the west based on a table of comings and goings provided by ADL traffic and highways engineering. The transport assessment predicts that the busiest one-hour period consists of 136 vehicles coming onto the site. Of the inbound vehicles, 82 vehicles will use the drive-through, whilst the other 54 vehicles will use the customer carpark. The ADL table does not provide the number of outgoings from the carpark. Therefore, the assumption has been made that all 82 vehicles using the drive-through and half those leaving the carpark will leave within the same hour. Considering that a 1.4m fence is to be installed around the site, there should be no line of sight between vehicle movements and the western properties. Subsequently, a screening correction of -10dB has been applied (BS5228: 2009). Equations and calculations can be found in Appendix D. Calculations of the distances between the sources and receptors are available upon request.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Drive Thru - drive off street and stop at COD	5	90	-10	40	82	23
Engine Idling - Making Order	1	73	-10	46	82	29
Drive to Pay Point	5	77	-10	41	82	25
Engine Idling - Pay Point	5	90	-10	41	82	24
Drive to Collection Point	5	90	-10	41	82	24
Engine Idling - Collection Point	5	99	-10	40	82	24
Car Driving off and pulling out of drive-thru	5	107	-10	44	82	28
Car Pulling into Car Park	7	139	-10	39	136	25
Car Driving off and pulling onto the street	5	140	-10	42	109	27
Car Reversing	7	116	-10	32	27	10
Car Reversing	7	114	-10	32	27	11
Car Pulling off Parking Space	4	116	-10	31	27	10
Car Pulling off Parking Space	4	114	-10	31	27	10
Car Engine Starting	5	116	-10	31	27	9
Car Engine Starting	5	114	-10	31	27	10
Car Passage	3	61	-10	37	136	23
Car Passage	3	114	-10	31	54	13
Car Passage	3	136	-10	30	109	15
Car Door Slam	1	116	-10	39	54	20
Car Door Slam	1	114	-10	39	54	21
Total dBLAeq, 1hour						**36**

Table 6.0 – Proposed Carpark Noise Emissions at Western Properties – Daytime

The following table predicts the noise levels from the carpark over the busiest 15-minute night-time period at the noise sensitive receptors to the west. The transport assessment predicts that the busiest one-hour night-time period consists of 49 vehicles coming onto the site. Of the inbound vehicles, it is predicted that 27 vehicles will use the drive-through, whilst the other 22 vehicles will use the customer carpark. These values have been divided by four to represent a 15-minute period. The assumption has been made that all 7 vehicles using the drive-through and half those leaving the carpark will leave within the same 15-minute period.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Drive Thru – drive off street and stop at COD	5	90	-10	40	7	13
Engine Idling – Making Order	1	73	-10	46	7	19
Drive to Pay Point	5	77	-10	41	7	14
Engine Idling – Pay Point	5	90	-10	41	7	14
Drive to Collection Point	5	90	-10	41	7	14
Engine Idling - Collection Point	5	99	-10	40	7	13
Car Driving off and pulling out of drive-thru	5	107	-10	44	7	17
Car Pulling into Car Park	7	139	-10	39	13	25
Car Driving off and pulling onto the street	5	140	-10	42	7	25
Car Reversing	7	116	-10	32	3	1
Car Reversing	7	114	-10	32	3	1
Car Pulling off Parking Space	4	116	-10	31	3	0
Car Pulling off Parking Space	4	114	-10	31	3	0
Car Engine Starting	5	116	-10	31	3	0
Car Engine Starting	5	114	-10	31	3	0
Car Passage	3	61	-10	37	13	12
Car Passage	3	114	-10	31	6	4
Car Passage	3	136	-10	30	9	2
Car Door Slam	1	116	-10	39	3	8
Car Door Slam	1	114	-10	39	3	8
Total dBLAeq, 1hour						**25**

Table 7.0 – Proposed Carpark Noise Emissions at Western Properties - Night-time

The following table predicts the noise levels from the car park over the busiest one-hour daytime period at the noise sensitive receptors to the south. The closest property will have line of site to vehicles entering and leaving the carpark, therefore, a screening correction has not been applied to these movements.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Drive Thru – drive off street and stop at COD	5	57	-10	44	82	37
Engine Idling – Making Order	1	80	-10	45	82	39
Drive to Pay Point	5	97	-10	39	82	33
Engine Idling – Pay Point	5	98	-10	40	82	34
Drive to Collection Point	5	99	-10	40	82	34
Engine Idling - Collection Point	5	99	-10	40	82	34
Car Driving off and pulling out of drive-thru	5	107	-10	44	82	38
Car Pulling into Car Park	7	46	0	59	136	44
Car Driving off and pulling onto the street	5	64	0	58	109	44
Car Reversing	7	51	-10	39	27	18
Car Reversing	7	68	-10	36	27	15
Car Pulling off Parking Space	4	51	-10	42	27	17
Car Pulling off Parking Space	4	68	-10	37	27	14
Car Engine Starting	5	51	-10	38	27	17
Car Engine Starting	5	68	-10	37	27	14
Car Passage	3	51	-10	38	136	23
Car Passage	3	68	-10	36	54	18
Car Passage	3	70	-10	36	109	20
Car Door Slam	1	51	-10	46	54	28
Car Door Slam	1	68	-10	43	54	25
Total dBLAeq, 1hour						**47**

Table 8.0 – Proposed Carpark Noise Emissions at Southern Properties – Daytime

The following table predicts the noise levels from the car park over the busiest 15-minute night-time period at the noise sensitive receptors to the south.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Drive Thru – drive off street and stop at COD	5	57	-10	44	7	27
Engine Idling – Making Order	1	80	-10	45	7	28
Drive to Pay Point	5	97	-10	39	7	22
Engine Idling – Pay Point	5	98	-10	40	7	23
Drive to Collection Point	5	99	-10	40	7	23
Engine Idling - Collection Point	5	99	-10	40	7	23
Car Driving off and pulling out of drive-thru	5	107	-10	44	7	27
Car Pulling into Car Park	7	46	0	59	13	34
Car Driving off and pulling onto the street	5	64	0	58	7	32
Car Reversing	7	51	-10	39	3	18
Car Reversing	7	68	-10	36	3	15
Car Pulling off Parking Space	4	51	-10	42	3	17
Car Pulling off Parking Space	4	68	-10	37	3	15
Car Engine Starting	5	51	-10	38	3	17
Car Engine Starting	5	68	-10	37	3	15
Car Passage	3	51	-10	38	13	22
Car Passage	3	68	-10	36	6	18
Car Passage	3	70	-10	36	9	20
Car Door Slam	1	51	-10	46	3	25
Car Door Slam	1	68	-10	43	3	23
Total dBLAeq, 1hour						**36**

Table 9.0 – Proposed Carpark Noise Emissions at Southern Properties - Night-time

5.2 Customer Order Display

There are two customer order display units in the drive-through facility where customers place their orders. Sound measurements were taken of the member of staff conversing with a customer which was emitted from the speaker of the customer order display at a McDonald's in Arnold, Nottingham. The table below shows the associated sound levels.

Source	Measurement Distance (m)	Time (s)	Sound Level dB $L_{Aeq, T}$	Sound Exposure Level (L_{AE})
Customer Order Display	0.5	7	79	87

Table 10.0 – Individual Noise Source – Customer Order Display

Using this data, the noise emissions from the customer order display can be predicted considering the worst-case 1-hour daytime period, as shown in the table below.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Customer Order Display	0.5	80	-10	33	82	17
Total dBLAeq, 1hour						**17**

Table 11.0 – Customer Order Display Noise Emissions at Western Properties - Daytime

Considering that the drive-through facility is scheduled to operate through the night, noise emissions from the customer order displays have been calculated according to the worst-case 15-minute night-time period.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Customer Order Display	0.5	80	-10	33	7	12
Total dBLAeq, 1hour						**12**

Table 12.0 – Customer Order Display Noise Emissions at Western Properties – Night-time

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Customer Order Display	0.5	73	-10	34	82	18
Total dBLAeq, 1hour						**18**

Table 13.0 – Customer Order Display Noise Emissions at Southern Properties - Daytime

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Customer Order Display	0.5	73	-10	44	7	13
Total dBLAeq, 1hour						**13**

Table 14.0 – Customer Order Display Noise Emissions at Southern Properties – Night-time

5.3 Fixed Plant Installations

Items of mechanical plant are scheduled to be installed on the roof of the main building. Sound level data has been obtained from manufacturer datasheets quoted as either A-weighted sound pressure level at 1m or as a sound power level. The following tables detail the sound levels associated with all items of mechanical plant associated with the development and predicts cumulative A-weighted sound pressure level at the closest noise sensitive receptors with all plant running simultaneously. The predicted cumulative A-weighted sound pressure level stated in the table below is based on there being clear line-of-site between each item of plant and the noise sensitive receptors. It is understood however that the items of plant will be shielded by a parapet, meaning that there should be no line of site between the plant and the receptors. This is accounted for later in the report when calculating the specific sound level from the proposed development.

Plan Reference	Plant Item	dBA @1m	dB LWA	Distance to NSR (m)	Propagation	Screening Correction	A-weighted SPL @ NSR
S2/C1	Mitsubishi ZRP200 (Heating)	62	-	110	-	-10	11
S2/C2	Mitsubishi ZRP200 (Heating)	62	-	110	-	-10	11
S1/C1	Mitsubishi ZRP250 (Heating)	62	-	100	-	-10	12
S1/C2	Mitsubishi ZRP250 (Heating)	62	-	100	-	-10	12
S1/C3	Mitsubishi ZRP250 (Heating)	62	-	100	-	-10	12
EF/01	BW10 (Breakout @1m)	67	-	100	-	-10	17
AC/02	Mitsubishi M50FA	-	51	95	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	0
AC/03	Mitsubishi PUZ-ZM71VHA	-	67	95	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	9
EF/02	EF/02	-	67	95	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	8
EF/03	EF/03	-	67	90	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	0
HWS	fRY013pI	-	59	90	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	2
S1	S1 (Supply Fan Outlet in Duct)	-	86	110	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	27
S2	S2 (Supply Fan Outlet in Duct)	-	79	110	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	20
A-weighted total (dB) (All plant running simultaneously)							29

Table 15.0 – Noise Emissions from Proposed Mechanical Plant Installations – Western Properties

Plan Reference	Plant Item	dBA @1m	dB LWA	Distance to NSR (m)	Propagation	Screening Correction	A-weighted SPL @ NSR
S2/C1	Mitsubishi ZRP200 (Heating)	62	-	97	-	-10	12
S2/C2	Mitsubishi ZRP200 (Heating)	62	-	97	-	-10	12
S1/C1	Mitsubishi ZRP250 (Heating)	62	-	94	-	-10	13
S1/C2	Mitsubishi ZRP250 (Heating)	62	-	94	-	-10	13
S1/C3	Mitsubishi ZRP250 (Heating)	62	-	94	-	-10	13
EF/01	BW10 (Breakout @1m)	67	-	97	-	-10	18
AC/02	Mitsubishi M50FA	-	51	84	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	0
AC/03	Mitsubishi PUZ-ZM71VHA	-	67	84	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	11
EF/02	EF/02	-	67	86	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	9
EF/03	EF/03	-	67	85	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	10
HWS	fRY013pI	-	59	90	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	2
S1	S1 (Supply Fan Outlet in Duct)	-	86	96	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	28
S2	S2 (Supply Fan Outlet in Duct)	-	79	97	On a reflective surface: Q-factor of 2 (+ 3dB)	-10	21
A-weighted total (dB) (All plant running simultaneously)							30

Table 16.0 – Noise Emissions from Proposed Mechanical Plant Installations – Southern Properties

5.4 Delivery Noise

It is understood that the restaurant will require four deliveries per week, which will be made on a tail lift HGV. The deliveries shall take place within the hours of 07:00 – 19:00. The delivery vehicle will enter the site and either pull forward or reverse into the space between the drive-through and the corral. The goods will be transported manually on trolleys into the Corral. Once the delivery has been completed, the HGV will either reverse and drive around the carpark to the exit or it will pull forward and drive around towards the exit.

Sound Measurements were taken of a HGV delivery being made at a McDonald's restaurant in Arnold, Nottingham. The table below shows sound levels associated with the loading and unloading of goods from the HGV.

Source	Measurement Distance (m)	Time (mm:ss)	Sound Level dB $L_{Aeq, T}$	Sound Exposure Level (L_{AE})
Goods Loading and Unloading	6	13:10	71	100
HGV Engine Starting and Idling	5	00:20	76	89
HGV Reversing	5	00:21	78	91
HGV Pulling Off	7	00:13	76	88
HGV Passage	5	00:11	73	83

Table 17.0 – Individual Noise Sources - Delivery

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Goods Loading and Unloading	6	80	-10	68	1	32
HGV Engine Starting and Idling	5	80	-10	55	1	19
HGV Reversing	5	90	-10	59	1	20
HGV Pulling Off	7	90	-10	59	1	20
HGV Pulling Off	7	140	-10	59	1	16
HGV Passage	5	114	-10	46	1	10
HGV Passage	5	116	-10	49	1	10
Total dBLAeq, 1hour						**33**

Table 18.0 – Delivery Noise Emissions - Western Properties

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	L_{AE} @ Receptor	Number of Events	dB $L_{Aeq, 1hour}$
Goods Loading and Unloading	6	80	-10	68	1	32
HGV Engine Starting and Idling	5	80	-10	55	1	19
HGV Reversing	5	65	-10	59	1	23
HGV Pulling Off	7	65	-10	59	1	23
HGV Pulling Off	7	46	0	72	1	36
HGV Passage	5	114	-10	46	1	10
HGV Passage	5	80	-10	49	1	13
Total dBLAeq, 1hour						**38**

Table 19.0 – Delivery Noise Emissions - Southern Properties

5.5 Waste Collection

It is understood that waste from McDonald's restaurants is stored in bins provided by a private contractor employed by the franchisee. Subsequently, the company making the waste collections is currently unknown, meaning that sound level data which relates specifically to waste collections at this particular McDonald's site cannot be obtained due to the potential difference in vehicles, bins and the method of collection. It is understood that waste collections will take place on four occasions per week during daytime hours. BS 5228:2009 provides sound level data for a refuse wagon quoted at 10m, as shown in the table below.

Source	Octave Band Sound Pressure Levels @10m (Hz)								A-weighted sound pressure level $L_{Aeq, T}$ @10m
	63	125	250	500	1k	2k	4k	8k	
Refuse Wagon	88	81	79	76	72	70	64	60	78

Table 20.0 – Refuse Wagon Sound Levels

It is assumed that each waste collection will take place over a 5-minute period. Therefore, the activity on-time correction has been applied based on a 1-hour reference period. It is assumed that the refuse wagon will pull into the same space as the delivery vehicle 80m away from the closest noise sensitive receptors both to the west and the south. The following table shows the sound levels associated with the refuse wagon at the closest noise sensitive receptor after the on-time correction has been applied.

Source	dB $L_{Aeq, T}$ @10m	On-time (m)	On-time Correction (dB)	dB $L_{Aeq, 1\text{-}hour}$ @10m	Screening Correction	dB $L_{Aeq, 1\text{-}hour}$ @Receptor
Refuse Wagon	78	5	-10.8	67	-10	39

Table 21.0 – Waste Collection Noise Emission – Western and Southern Properties

5.6 External Cleaning/Maintenance

It is understood that external cleaning operations involving mobile plant such as road sweepers will not be employed at this McDonald's restaurant. Noise from general cleaning operations such as window cleaning and floor sweeping have been considered negligible.

Sound Measurements were taken of a bag being thrown into a Biffa Wheelie Bin, as well as the lid being closed. It was observed that a bag was thrown into the bin on only three occasions during the day. The associated sound levels are shown below.

Source	Measurement Distance (m)	Time (s)	Sound Level dB $L_{Aeq, T}$	Sound Exposure Level (L_{AE})
Biffa Bin Lid Closing	1.5	6	84	92
Bag being thrown into Biffa Bin	1.5	7	71	79

Table 22.0 – Biffa Bin Measured Levels

The impact of bags being loaded into the bins as well as the lids closing has been considered at the closest noise sensitive receptor, as shown in the table below.

Source	Measurement Distance (m)	Receptor Distance (m)	Screening Correction	SEL @ Closest NSR
Biffa Bin Lid Closing	1.5	80	-10	48
Bag Being Thrown into Biffa Bin	1.5	80	-10	35

Table 23.0 – Biffa Bin Sound Levels – Western and Southern Receptors

It is understood that these bins will be used only occasionally during the day. Subsequently, bags being taken to the bin will not be included within the BS 4142 assessment.

5.7 Determining the Specific Sound Level

In order to carry out the BS 4142 assessments the specific sound level must be determined. Considering that the site will be operating during both daytime and night-time hours, the specific sound level must be determined for both daytime and night-time assessments based on the activities that are likely to take place. BS 4142 stipulates a 1-hour daytime reference period. Vehicle movements associated with the customer carpark and drive-through facility are the greatest source of noise impact from the proposed development. As such, the worst-case daytime 1-hour period considers the hour where the carpark and drive-through are predicted to be at their busiest. It is understood that deliveries and waste collections will take place during daytime hours and to ensure a worst-case scenario, they have been considered in the assessment of the worst-case 1-hour daytime period. The table below shows the specific sound level for the worst-case 1-hour daytime period.

Source	dB $L_{Aeq,\ 1hour}$
Car Park and Drive-Thru vehicle Movements	36
Customer Order Display	17
Fixed Plant Installations	29
Delivery Noise	33
Waste Collection	39
Specific Sound Level dB$_{LAeq,1hour}$	**42**

Table 24.0 – Specific Sound Level Western Properties – Daytime

Considering that deliveries and waste collections shall not take place between the hours of 23:00 and 07:00, these noise sources are not included in the specific sound level for the night-time assessment with a reference time interval of 15-minutes. The worst-case night-time period considers the worst-case scenario in terms of vehicle comings and goings. The table below shows the calculated specific sound level for the night-time period when the worst-case is considered at the western properties.

Source	dB $L_{Aeq,\ 15\ minute}$
Car Park and Drive-Thru vehicle Movements	25
Customer Order Display	12
Fixed Plant Installations	29
Specific Sound Level dB$_{LAeq,1hour}$	**31**

Table 25.0 – Specific Sound Level Western Properties – Night-time

The following table shows the calculated specific sound level for the daytime period at the closest noise sensitive receptor to the south when the worst-case is considered.

Source	dB $L_{Aeq, 1hour}$
Car Park and Drive-Thru vehicle Movements	47
Customer Order Display	18
Fixed Plant Installations	30
Delivery Noise	38
Waste Collection	39
Specific Sound Level $dB_{LAeq,1hour}$	**48**

Table 26.0 – Specific Sound Level Southern Properties – Daytime

The following table shows the calculated specific sound level for the night-time period at the closest noise sensitive receptor to the south when the worst-case is considered.

Source	dB $L_{Aeq, 15 minute}$
Car Park and Drive-Thru vehicle Movements	36
Customer Order Display	13
Fixed Plant Installations	30
Specific Sound Level $dB_{LAeq,1hour}$	**37**

Table 27.0 – Specific Sound Level Southern Properties – Night-time

6 BS 4142:2014 Assessments

6.1 BS 4142 Assessment Tables

Daytime Assessment – Western Properties			
Assessment		**Relevant Clause**	**Commentary**
Specific Sound Level @ Western Properties	42 $dB_{LAeq,1hour}$		Calculated based on predicted vehicle movements from the associated car park and drive-through as well as noise emissions from deliveries, waste collections and fixed plant installations. Table 24.0 for determination of specific sound level. Appendix D for calculations. Appendix E for distances.
Background Sound Level	56 $dBL_{A90,15min}$	8.1.1 8.1.2 8.1.3 8.1.4 8.2 8.6	
Barrier Attenuation	0 dB_A		Barrier Attenuation already applied in tables for each source
Acoustic Character Correction: Impulsivity = +0 dB	+0 dB	9.2	No perceptible tones or impulsivity.
Rating Level at Receiver	42 dB_A	9.1	
Excess of rating level over background level	(42 – 56) = -14 dB_A	11	
Impact	The Assessment indicates that significant adverse impact is not likely, depending on context	11	The excess of rating level over background sound level is -14dBA, which is 19 dBA below the level of difference that indicates likelihood of adverse impact, depending on context

Table 28.0 - BS 4142: 2014 Assessment – Daytime Assessment – Western Properties

Night-time Assessment - Western Properties			
Assessment		**Relevant Clause**	**Commentary**
Specific Sound Level @ Western Properties	31 $dB_{LAeq,15min}$		Calculated based on predicted vehicle movements from the associated car park and drive-through as well as noise emissions from and fixed plant installations. Table 25.0 for determination of specific sound level. Appendix D for calculations. Appendix E for distances.
Background Sound Level	34 $dBL_{A90,15min}$	8.1.1 8.1.2 8.1.3 8.1.4 8.2 8.6	
Barrier Attenuation	0 dB_A		Barrier Attenuation already applied in tables for each source
Acoustic Character Correction: Impulsivity = +3 dB	0 dB_A	9.2	No perceptible tones or impulsivity.
Rating Level at Receiver	31 dB_A	9.1	
Excess of rating level over background level	(31 – 34) = -3 dB_A	11	
Impact	The Assessment indicates that significant adverse impact is not likely, depending on context	11	The excess of rating level over background sound level is -3dBA, which is 8 dBA below the level of difference that indicates likelihood of adverse impact, depending on context

Table 29.0 - BS 4142: 2014 Assessment – Night-time Assessment – Western Properties

Daytime Assessment – Southern Properties			
Assessment		**Relevant Clause**	**Commentary**
Specific Sound Level @ Southern Properties	48 $dB_{LAeq,1hour}$		Calculated based on predicted vehicle movements from the associated car park and drive-through as well as noise emissions from deliveries, waste collections and fixed plant installations. Table 26.0 for determination of specific sound level. Appendix D for calculations. Appendix E for distances.
Background Sound Level	52 $dBL_{A90,15min}$	8.1.1 8.1.2 8.1.3 8.1.4 8.2 8.6	
Barrier Attenuation	0 dB_A		Barrier Attenuation already applied in tables for each source
Acoustic Character Correction: Impulsivity = +0 dB	+0 dB	9.2	No perceptible tones or impulsivity.
Rating Level at Receiver	48 dB_A	9.1	
Excess of rating level over background level	(48 – 52) = -4 dB_A	11	
Impact	The Assessment indicates that significant adverse impact is not likely, depending on context	11	The excess of rating level over background sound level is -4dBA, which is 10 dBA below the level of difference that indicates likelihood of adverse impact, depending on context

Table 30.0 - BS 4142: 2014 Assessment – Daytime Assessment – Southern Properties

Night-time Assessment – Southern Properties			
Assessment		**Relevant Clause**	**Commentary**
Specific Sound Level @ Southern Properties	37 $dB_{LAeq,15min}$		Calculated based on predicted vehicle movements from the associated car park and drive-through as well as noise emissions from and fixed plant installations. Table 25.0 for determination of specific sound level. Appendix D for calculations. Appendix E for distances.
Background Sound Level	34 $dBL_{A90,15min}$	8.1.1 8.1.2 8.1.3 8.1.4 8.2 8.6	
Barrier Attenuation	0 dB_A		Barrier Attenuation already applied in tables for each source
Acoustic Character Correction: Impulsivity = +3 dB	0 dB_A	9.2	No perceptible tones or impulsivity.
Rating Level at Receiver	37 dB_A	9.1	
Excess of rating level over background level	(37 – 34) = +3 dB_A	11	
Impact	The Assessment indicates that significant adverse impact is not likely, depending on context	11	The excess of rating level over background sound level is +3dBA, which is 2 dBA below the level of difference that indicates likelihood of adverse impact, depending on context

Table 31.0 - BS 4142: 2014 Assessment – Night-time Assessment – Southern Properties

6.2 Discussion

6.2.1 Overview

The assessment of adverse impact at the noise sensitive receptors considered to be the worst affected has been employed by the measured sound levels from the environmental noise survey. The measurement and subsequent assessment have been carried out in accordance with methodology outlined in BS 4142:2014. BS 4142 requires that human response to activity sound is rated via numerical values as well as careful consideration for the context in which the sound exists.

The assessments at the closest properties to the west and to the south of the proposed site indicate that adverse impact during the worst-case 1-hour daytime period is not likely, depending on context. The properties benefit from the protection provided by the 1.2m fence, as well as the physical distance between the activities and the receptors.

The night-time assessments at the closest properties to the west and the south of the proposed development indicate that adverse impact during the worst-case 15-minute period is not likely, subject to context.

6.2.2 Context

It is stated in section 11 of BS 4142: 2014 that "where the initial estimate of the impact needs to be modified due to context, take all pertinent factors into consideration, including the following."

1) Where background sound levels and rating levels are low, absolute levels might be as, or more relevant than the margin by which the rating level exceeds the background. This is especially true at night. Seeing as the rating level exceeds the background sound level at night due to comparably low background levels, the level of impact may be less than predicted by the initial assessment. The typical lowest background sound level that has been used for the night-time assessment occurred between 01:00 and 04:15, during this time-period LAeq is 47 dB. When combining the specific sound level of 37dB with the LAeq for the most sensitive night-time period, there is no increase to the absolute sound level. Although BS 4142 does not facilitate the prediction of internal noise levels, the determined specific sound level demonstrates that they should be below ProPG guidance levels of 30 dB at night accounting for 15dB of attenuation provided by an open window stipulated in BS 8233:2014 (42 – 15 = 27dB).

2) The character and level of the residual sound compared to the character and level of the specific sound. Considering that the specific sound will exist within proximity of busy road networks, it is reasonable to expect that the nearby residents would expect an acoustic climate which includes noise vehicle movements. The sound of vehicle movements is likely to be masked by road traffic noise and is not distinguishable from the residual sound environment. Noise associated with fixed plant installations is unlikely to contain impulsive elements and is not likely to be readily distinguished considering the steady residual environment which is dominated by road traffic noise.

6.2.3 Rating Level Assessment

BS 4142 requires the assessment of acoustic features. Considering that the specific sound is currently not present, feature corrections have been applied based on observations which were made when taking sound measurements which would be used for the specific sound, as well as information gathered from an existing McDonald's restaurant. The sound of car engines from vehicles using the associated carpark and drive-through facility is likely to be masked by road traffic from the surrounding road networks. Engine noise generally does not contain tonal elements and is not impulsive in nature. Subsequently, no rating penalty has been applied for the vehicle movements.

The sound of vehicle doors slamming can be considered impulsive, however, due to the substantial physical distance to the receptors as well as the presence of the fence, the impact of impulsivity from car doors closing is not considered perceptible against the background.

6.2.4 On-time Impact

BS 4142:2014+A1:2019 uses a reference period of 1-hour during the daytime and 15-minutes assess the likelihood of adverse impact. The activities within these periods are required to be typical of the operation under investigation both in terms of level and duration. This identifies whether the sounds associated with the activity have the likelihood of adverse impact, depending on context. The proportion of time the activity takes place within extended periods of time greater than the one-hour reference period provides part of the acoustic context that the BS 4142:2014 assessment is subject to.

Although it is proposed that the McDonald's restaurant will operate 24/7, there will be periods where the site will be busier, as predicted by the transport assessment of vehicle arrivals. The assessment has been based on the likely worst-case 1-hour daytime period, as well as the worst-case 15-minute night-time period. It is therefore considered that the assessment accurately represents the impact of site activity during the busiest 1-hour period and the worst-case 15-minute night-time period, therefore the noise environment will be improved during all other time periods.

6.2.5 Uncertainty

Reasonable steps have been undertaken to reduce uncertainty in both measurement and assessment in line with section 10 of BS 4142:2014. These steps include the use of class 1 instrumentation, measurements being taken in suitable weather conditions, the measurement locations chosen to obtain background sound levels being representative of the assessment locations and the number of measurements taken. Considering that the assessment has been carried out for a proposed site, uncertainty has been reduced by taking measurements of a comparable car park with the same road surface, as well as observations made of a similar existing veterinary surgery to understand the typical scenarios that are likely to take place. Uncertainty has been reduced by the inclusion of considered and supported contextual issues, as they provide a greater understanding of the residual acoustic environment and the level of variability in sound emission from the source.

7 Assessment of Impacts

The significance of sound of a 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. An initial estimate of the impact of the specific sound is made by subtracting the background level.

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

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

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

d) 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 having a low impact, depending on the context.

Based on the above, the assessment indicates that adverse impact is not likely to occur at the closest noise sensitive receptors to the south of the site during the worst-case daytime period. The rating level being so markedly below the prevailing background sound level reduces the influence of contextual considerations and therefore the assessment outcome is not altered.

The assessment of the worst-case night-time period at the western receptors indicates that adverse effect is not likely. The rating level is significantly below the prevailing background sound level that the influence of contextual consideration is reduced, and therefore the assessment outcome is not altered.

The assessment of the night-time period at the southern receptors indicates that adverse effect is not likely. The rating level is only 2dB below the level which indicates adverse impact, therefore, the influence of context is greater. The contextual observation of the comparably low background levels suggests that the absolute sound level may be a more accurate representation of the level of impact than the margin which the rating level exceeds the background. When considering the residual sound level, the absolute sound level would be no greater when the specific sound is introduced. The night-time internal ambient noise level criteria stipulated in ProPG: Guidance and Noise, BS8233:2014 and WHO:1999 should also be achieved when accounting for the absolute sound level. When considering the characteristics of the specific sound, engine noise and vehicle rolling noise is similar to the residual environment, which is dominated by road traffic movements. Noise from the plant that is to be installed at the McDonald’s restaurant will not contain perceivable tonality or impulsivity and as is not highly distinguishable from a steady background. Considering the context in which the specific sound would occur, it is deemed that the overall assessment outcome suggests that the level of impact is substantially lower than the initial assessment predicts.

8 Conclusions

A sound survey was undertaken to inform the assessment of the likelihood of adverse impact from the proposed McDonald's restaurant with associated car park and drive-through facility on the corner of Ashgrove Road West and North Anderson Drive, Aberdeen. The sound survey was carried out in compliance with BS 4142 as detailed in this report. The sound survey considers the impacts at residential dwellings to the west and to the south of the site.

Sound measurements were taken at two locations, one representing the most exposed property to the west of the site, and the other to represent the most exposed property to the south. Noise measurements were taken from other sites to represent noise sources that will be associated with the proposed site, such as car park vehicle movements and deliveries. Sound levels associated with noise sources such as mechanical plant and refuse collections have been established from British Standards and Manufacturer datasheets.

The initial assessment of the worst-case daytime period indicates that adverse impact is not likely at properties to the west of the site. The rating level is so far below the prevailing background sound level that there is very little uncertainty that adverse impact will not occur.

The initial assessment of the worst-case daytime period indicates that adverse impact is not likely at properties to the south of the site. The rating level is so far below the prevailing background sound level that there is very little uncertainty that adverse impact will not occur.

The initial assessment of the worst-case night-time period indicates that adverse impact is not likely at properties to the west of the site. The rating level is so far below the prevailing background sound level that there is very little uncertainty that adverse impact will not occur.

The initial assessment of the worst-case night-time period indicates that adverse impact is not likely at properties to the south of the site. period indicates the likelihood of significant adverse impact at the closest property to the south. The contextual considerations required by BS 4142, particularly the nature of the source within the residual environment and the absolute sound level suggests that the impact is likely to be considerably lower than predicted by the BS 4142 assessment.

This Report concludes that from the established sound levels and subsequent BS 4142 assessment, that the proposed McDonald's Restaurant should not provide adverse impact to nearby residents.

This Report has been prepared by:

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Date: 12th April 2022

Appendix A – Acoustic Terminology & Definitions

Sound Pressure	The fluctuations in air pressure, from the steady atmospheric pressure, created by sound, measured in pascals (Pa).
Sound Pressure Level (SPL)	The sound pressure measured on a decibel scale relative to a standard reference pressure of 20μPa (20x10-6 Pascals).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
Frequency (Hz)	The pitch of the sound, measured in Herts (Hz)
Integrating Sound Level Meter	An instrument used for measuring sound levels with the capacity to perform calculations to derive other parameters.
Calibration	A check of the function of a sound level meter by comparing the meter reading with a known sound pressure level. This is performed in the field before and after measurement and by a laboratory every year calibrators and every two years for Sound Level Meters.
A-Weighting, dB(A)	A frequency waiting devised to attempt to take the fact that human response to sound is not equally sensitive at all frequencies into account.
Z-Weighting	A zero frequency weighting (often referred to as unweighted).
Attenuation	Noise reduction, measured in decibels.
Ambient Sound Level $L_{Aeq.T}$	The total encompassing sound in a given situation, at a given time. Usually composed of sounds from many sources, near and far.
Residual Sound Level $L_{Aeq.T}$	The ambient sound remaining when the specific sound source is suppressed to a degree it does not contribute to the ambient sound.
Specific Sound Level $L_{Aeq.T}$	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.
Rating Level $L_{Ar, tr}$	The specific sound level plus any adjustment for the characteristic features of the sound.
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.
Sound Exposure Level , SEL (L_{AE})	A measure of A-weighted sound energy used to describe noise events such as the passing of trains; it is the A-weighted sound pressure level which, is occurring over a period of one second, would contain the same amount of A-weighted sound energy as the event.
Frequency Analysis	Analysis of a sound into its frequency components. Commonly 1/1 or 1/3 octave bands
Frequency Spectrum	A graph resulting from frequency analysis and showing different levels of the signal in the various frequency bands.
Octave-bands	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
Noise Index	A method of evaluating or rating a noise, usually by assigning a single number to it, based on some combination of its physical parameters (sound pressure level, frequency, duration) and other factors such as time of day, tonal characteristics and impulsive characteristics.
Leq, T	Otherwise referred to as the 'continuous equivalent noise level' of a period of time (T). This is the steady noise level which contains the same amount of energy as the time varying sound level that was recorded.
Lmax,T	The maximum RMS sound pressure level that occurs within a specified time period. It is used often to describe occasional loud noise events that may have little influence on the Leq but will have an effect on the overall acoustic environment. The time weighting (Fast or Slow) is usually specified.

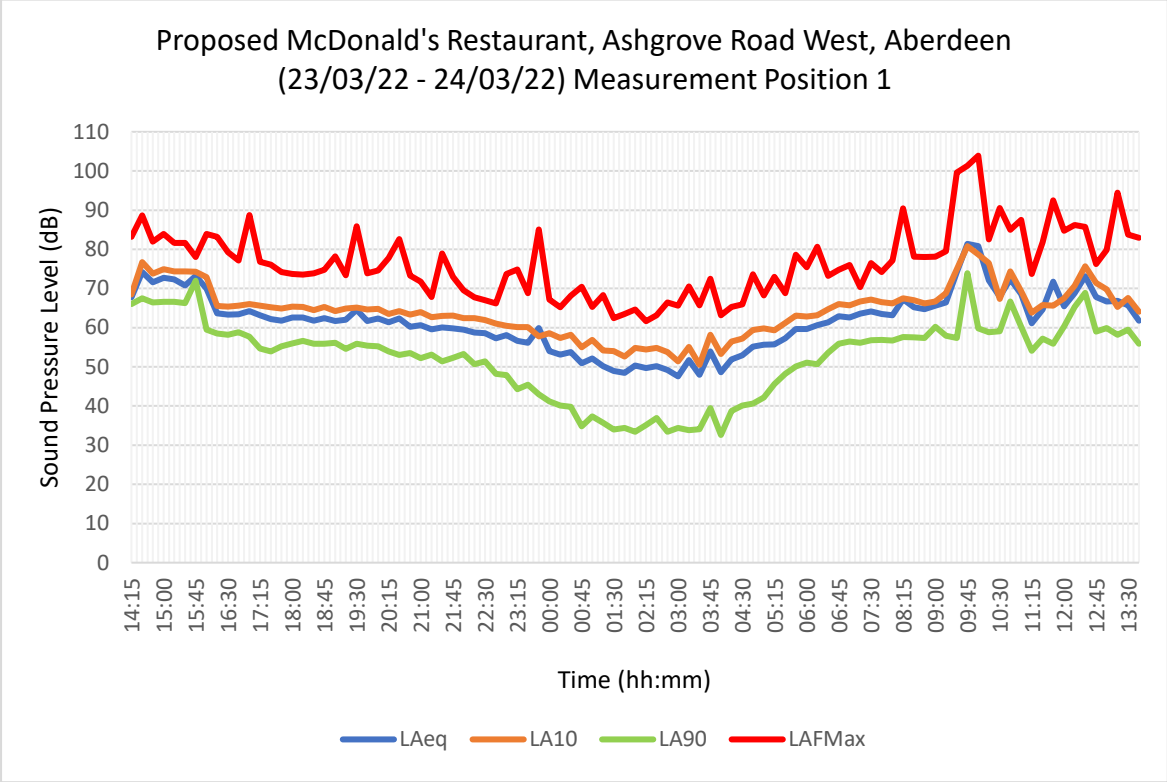
L90, T	The noise level exceeded for 90% of the specified time period (T). It is often used to characterise the background noise.
L10, T	The noise level exceeded for 10% of the specified time period (T). It is often used to characterise road traffic noise.
Free-Field	A situation where the radiation from a sound source is completely unaffected by the presence of reflective surfaces. In terms of environmental noise measurement, it is usually taken to mean at least 3.5m away from 3.5m away from reflective surfaces with the exception of the ground.
Façade Noise Level	A noise level measured within 3m of a building façade, which contains a contribution arising from reflection of sound at the façade. The difference between the façade level and free-field level is described as the façade correction factor.
Noise Sensitive Receptor	Premises that are used for purposes sensitive to noise and that require protection.
Line Source	A source of sound that as distance increases away from the source it still appears large in one dimension. Attenuation of this form of source occurs at a distance of (a/π) where a is the largest dimension of the source.
Point Source	A source of sound that as distance increases away from the source it appears as a point in space. Attenuation of this form of source occurs at a distance of (b/π) where b is the smallest dimension of the source.
Time Weighting	One of the standard averaging times (Fast, Slow or Impulsive) used for the measurement of RMS sound pressure level in sound level meters, specified in ISO 61671-1.
Rw	Single number quantity which characterises the airborne the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.
DnT,w + Ctr	A single value that characterises the airborne sound insulation performance using the Ctr: spectrum adaption terms described in BS EN ISO 717-1. The value is based on field measurements and the value represents total sound transmission including flanking sound, not just the partition.

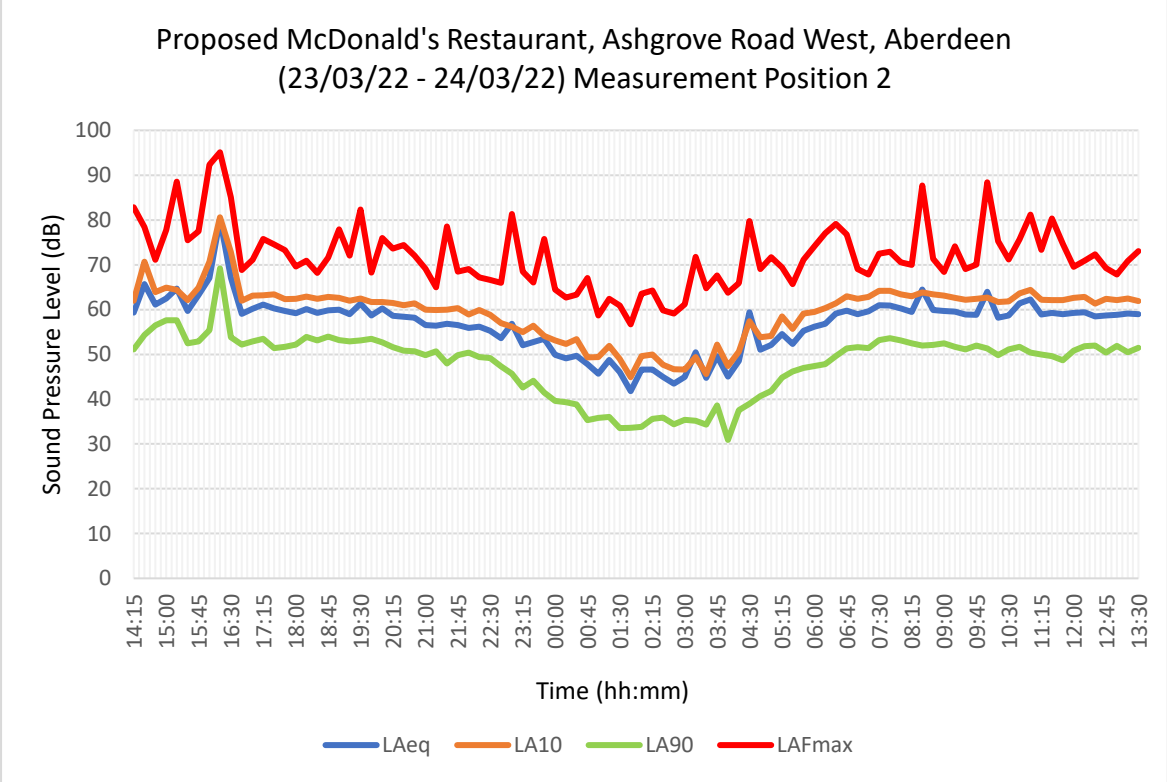
The table below presents an indication of sound levels associated with the environment starting from 0dB (the threshold of hearing) to 140dB (The threshold of pain).
cat

Sound Level	Location/Activity
0 dB(A)	Threshold of Hearing
20 – 30 dB(A)	Inside Quiet Bedroom at Night
30 – 40 dB(A)	Inside a Living Room During the Day
40 – 50 dB(A)	Inside Typical Office
50 – 60 dB(A)	Inside a Car
60 – 70 dB(A)	Typical High Street
70 – 90 dB(A)	Inside Factory
100 – 110 dB(A)	Burglar Alarm at 1m
110 – 130 dB(A)	Jet Aircraft on Take Off
140 dB(A)	Threshold of Pain

The ‘A’ denotes the A-weighting scale used to replicate the frequency response of the human ear.

Appendix B – Time History Graph





Appendix C - Weather Conditions

Upon installation of the noise monitoring equipment at MP1 and MP2 on 23/03/2022 the sky had approximately 50% cloud cover with bright sunshine. During 24/03/2022 the sky had approximately 40% cloud cover throughout the day. No rainfall occurred when sound levels were being measured 23/03/22 – 24/03/2022.

Weather Conditions (3.0 miles from Measurement Location)				
Time Period	**Air Temperature**	**Rainfall mm/h**	**Prevailing Wind Direction**	**Wind Speed (m/s)**
23/03/22 – 14:00 – 23:59	5 – 17	0.0	S	0.5 – 5.0
24/03/22 – 00:00 – 10:00	4 – 14	0.0	S	0.5 – 1.5

Appendix D – Calculations

In order to calculate the worst-case one-hour and 15-minute periods for the vehicle movements from the associated carpark and drive-thru, the measured LAeq, T sound levels were first converted to Sound Exposure Levels (L_{AE}). The equation used for this is shown below:

$L_{AE} = L_{Aeq,\,T} + 10\log(T)$

Where 'T' is time in seconds.

Using the Car Passage

L_{Aeq} = 65 dB
T = 6 seconds

$L_{AE} = 65 + 10\log(6) = 73\ dBL_{AE}$

The calculation above provides the sound exposure level based at the measured distance from the source. A distance attenuation calculation needs to be carried out to determine the sound levels at the receptor. All sources in this report have been considered as point sources. The equation below shows the distance attenuation for a point source.

$L2 = L1 - 20\log(r2/r1)$

Where:

L1 = known sound pressure level
L2 = sound pressure level at the receptor
R1 = distance from source to measurement location
R2 = distance from source to receptor

Using the example of the Car Passage:

$L2 = 73 - 20\log(114/3) = 41\ dBL_{AE}$

The purpose of the Sound Exposure Level is to be able to obtain an $L_{Aeq,1\ hour}$ based on the number of times the event takes place. To convert the sound exposure level to a 1-hour LAeq, the following equation is used:

$L_{Aeq,\,T} = L_{AE} + 10\log(N) - 10\log(T)$

Where:

N = Number of Identical Events
T = Time in seconds

Using the example of the Car Passage:

$L_{Aeq,\,1hour} = 41 + 10\log(54) - 10\log(3600) = 23\ dBL_{Aeq,\,1hour}$

Considering that the night-time reference period is 15-minutes instead of 1-hour, the 'T' values of 900 seconds was used instead of 3600 seconds.

Once the LAeq, 1 hour has been determined for all sources, the combine 1-hour LAeq can be calculated by logarithmically adding all the values. The equation below is used to logarithmically adding decibels:

$L_T = 10 \log (10^{L1/10} + 10^{L2/10} \ldots)$

where

L_T = *combined sound pressure level (dB)*

For the distance calculations for noise from fixed plant the following equation was used where the A-weighted sound pressure level is quoted at a given distance:

L2 = L1 – 20log (r2/r1)

Where:

L1 = known sound pressure level
L2 = sound pressure level at the receptor
R1 = distance from source to measurement location
R2 = distance from source to receptor

Where the item of plant is quoted as an A-weighted sound power, the following equation was used to calculate the sound pressure level at the receptor:

Lp = Lw - 20log(r) – 11 + D

Where:

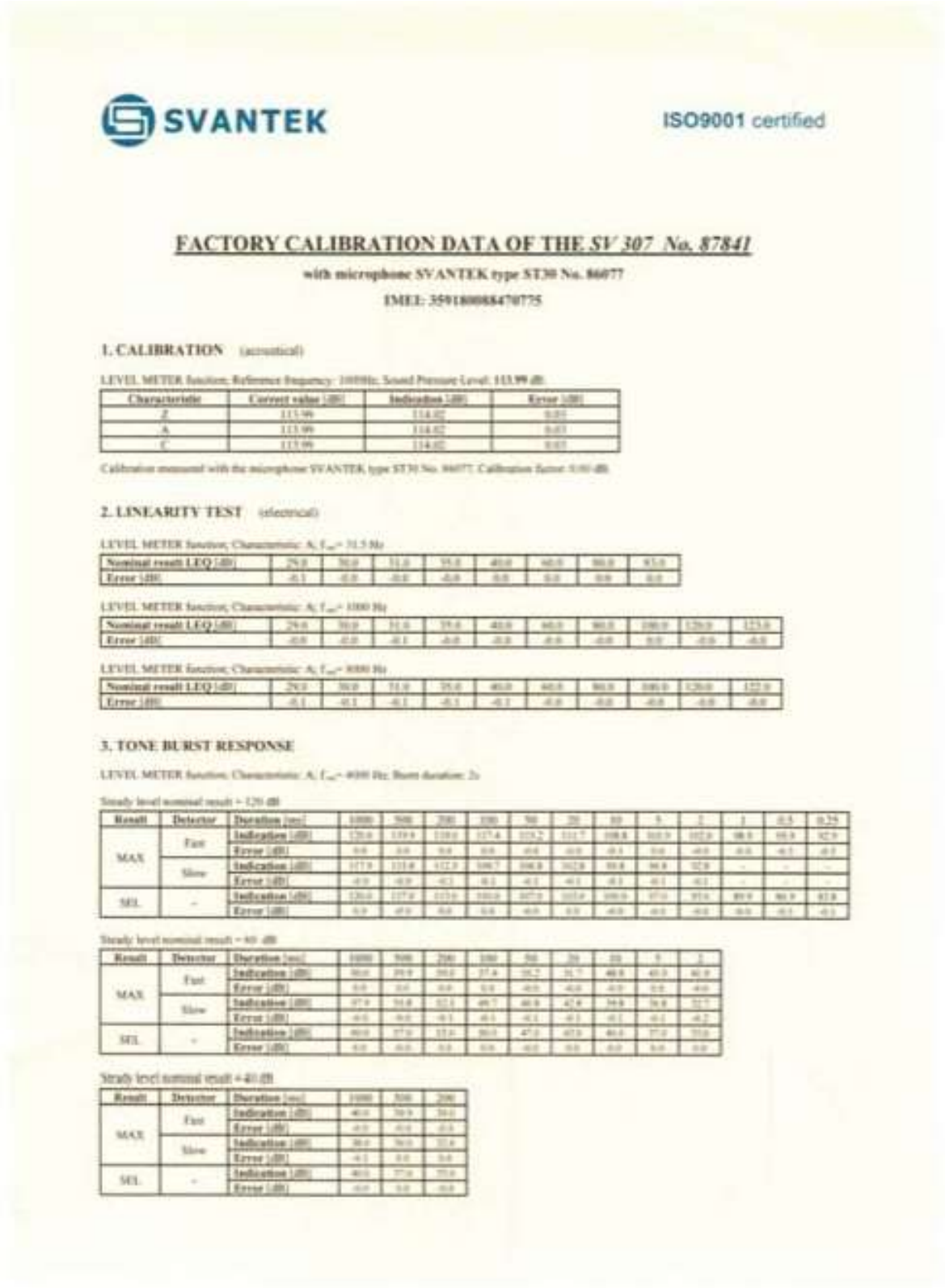
Lp = Sound Pressure Level
Lw = Sound Power Level
r = distance from source to receiver
D = directivity factor

Using the example of the Mitsubishi PUZ- ZM71VHA:

Lp = 67 – 20log(95) – 11 + 3 = 19 dB_A

The directivity factor of +3dB applied due to the presence of a reflective surface resulting in semi-hemispherical sound propagation.

Appendix E – Instrument Calibration Certificates



SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE *SV 307 No. 87841*

with microphone SVANTEK type ST30 No. 86077

IMEI: 359180088470775

1. CALIBRATION (acoustical)

LEVEL METER function; Reference frequency: 1000Hz; Sound Pressure Level: 113.99 dB

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.99	114.02	0.03
A	113.99	114.02	0.03
C	113.99	114.02	0.03

Calibration measured with the microphone SVANTEK type ST30 No. 86077. Calibration factor: 0.00 dB

2. LINEARITY TEST (electrical)

LEVEL METER function; Characteristic: A; f_{ref}= 31.5 Hz

Nominal result LEQ [dB]	29.0	30.0	31.0	35.0	40.0	45.0	50.0	85.0
Error [dB]	-0.1	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Characteristic: A; f_{ref}= 1000 Hz

Nominal result LEQ [dB]	29.0	30.0	31.0	35.0	40.0	45.0	50.0	100.0	125.0	127.0
Error [dB]	-0.0	-0.0	-0.1	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0

LEVEL METER function; Characteristic: A; f_{ref}= 8000 Hz

Nominal result LEQ [dB]	29.0	30.0	31.0	35.0	40.0	45.0	50.0	100.0	120.0	122.0
Error [dB]	-0.1	-0.1	-0.1	-0.1	-0.1	-0.0	-0.0	-0.0	-0.0	-0.0

3. TONE BURST RESPONSE

LEVEL METER function; Characteristic: A; f_{ref}= 4000 Hz; Burst duration: 2s

Steady level nominal result = 120 dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	120.0	119.9	119.0	117.4	113.2	111.7	108.8	103.9	102.0	98.8	95.9	92.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.3	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	117.9	113.8	112.9	109.7	106.8	102.8	99.8	96.8	92.8	-	-	-
		Error [dB]	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-	-	-
SEL	-	Indication [dB]	120.0	117.0	113.0	110.0	107.0	103.0	100.0	97.0	93.0	89.9	86.9	83.8
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Steady level nominal result = 80 dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2
MAX	Fast	Indication [dB]	80.0	79.9	79.0	77.4	73.2	71.7	68.8	63.9	62.0
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.3	-0.1	0.0	-0.0
	Slow	Indication [dB]	77.9	73.8	72.9	69.7	66.8	62.8	59.8	56.8	52.8
		Error [dB]	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2
SEL	-	Indication [dB]	80.0	77.0	73.0	70.0	67.0	63.0	60.0	57.0	53.0
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.0	0.0	0.0

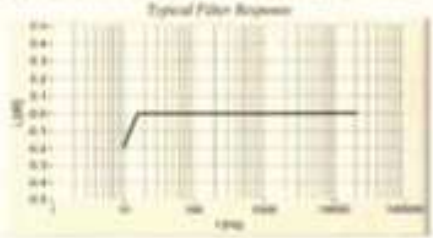
Steady level nominal result = 40 dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	40.0	39.9	39.0
		Error [dB]	-0.0	-0.0	-0.0
	Slow	Indication [dB]	36.9	36.0	32.9
		Error [dB]	-0.1	0.0	0.0
SEL	-	Indication [dB]	40.0	37.0	33.0
		Error [dB]	-0.0	0.0	-0.0

4. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: Z; Input signal +120 dB;

Typical Filter Response



Measured Filter Response
(Frequency: Z-Area)

F [Hz]	L [dB]	F [Hz]	L [dB]	F [Hz]	L [dB]
10	-0.1	63	-0.0	4000	-0.0
12.5	-0.0	125	-0.0	8000	-0.0
16	0.0	250	-0.0	16000	-0.0
20	0.0	500	-0.0	20000	-0.0
25	0.0	1000	-0.0		
31.5	-0.0	2000	-0.0		

All frequencies are nominal centre values for the 1/3 octave bands

5. FREQUENCY RESPONSE (acoustical)

LEVEL METER function; Characteristic: Z; Input: 94 dB;

Frequency [Hz]	20	31.5	63	125	250	500	1000	2000	4000
Pressure Response [dB]	-0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.3
Free Field Response [dB]	-0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.4

Frequency [Hz]	8000	10000	12500	14000	16000	18000	20000	22400	25000
Pressure Response [dB]	-0.8	-1.3	-2.6	-3.7	-5.9	-8.1	-10.6	-13.5	-16.9
Free Field Response [dB]	-0.6	-0.2	-0.1	-0.0	-0.2	-0.5	-1.0	-1.9	-3.9

6. INTERNAL NOISE LEVEL (electrical - compensated)

LEVEL METER function; Calibration factor 0dB

Characteristic	Z	A	C
Level [dB]	≤23	≤19	≤19

7. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A;

Indication [dB]	≤20

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 71421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
24 °C	34%	1003 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1	SVANTEK	SVAN 401	126	Signal generator
2	SVANTEK	SVAN 912A	17984	Sound & Vibration Analyzer
3	RIGOL	DM3068	DM3O15510[illegible]	Digital multimeter
4	SVANTEK	SV33	64172	Acoustic calibrator
5	G.R.A.S.	51AB	106364	Sound Intensity Calibrator
6	G.R.A.S.	40BP	413396	½" Pressure Microphone
7	G.R.A.S.	40AN	71421	½" Free Field Microphone
8	SVANTEK	SE 307	-	Microphone equivalent electrical impedance (15pF)

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively outputs them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2202773.
3. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
4. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Jurii Jurva

Test date: 2021-11-12

AcSoft
Noise, Vibration & Air Quality

SVANTEK UK

CALIBRATION CERTIFICATE

Date of issue: 15-02-2022 **Certificate No:** 1501752-1 **Page:** 1/6

OBJECT OF CALIBRATION	Manufacturer:	**SVANTEK**	
	Model:	**SV307**	
	Serial No.:	87849	
	Description:	Sound Level Meter	
SENSOR	Manufacturer:	**Svantek**	
	Model:	**ST30**	
	Serial No.:	82676	
	Description:	Microphone	
APPLICANT	Dragonfly Consulting		
	4 Bramley's Barn, The Menagerie, Escrick, York YO19 6ET		
ENVIRONMENTAL CONDITIONS	Temperature:	23.6 – 23.7	°C
	Humidity:	39 – 39	%
	Pressure:	99.2 – 99.2	kPa
DATE OF CALIBRATION	15-02-2022		
APPROVED BY	B. Hunt		

AcSoft
Noise, Vibration & Air Quality

AcSoft Calibration | Bedford Technology Park
Thurleigh | Bedford | MK44 2YA
+44 (0) 1234 639550
www.acsoft.co.uk

AcSoft SVANTEK UK

CALIBRATION CERTIFICATE

Issued by AcSoft Calibration

Date of issue: 15-02-2022 **Certificate No:** 1501752-1 **Page:** 2/6

CALIBRATION METHOD

Method described in instruction IN-02 "Calibration of the sound level meter", issue number 11 date 27.01.2016, written on the basis of international standard EN IEC 61672-3:2013 Electroacoustics. Part 3: Periodic tests.

CALIBRATION RESULTS

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2013 (BS EN 61672-3:2013), for the environmental conditions under which the tests were performed.

The results are presented on pages 3 to 6 of this certificate (including measurement uncertainty).

CONFORMITY WITH REQUIREMENTS

On the basis of the calibration results, it has been found that, the sound level meter meets metrological requirements specified in the standard IEC 61672-1:2013 Electroacoustics – Sound level meters. Part 1: Specifications, for class 1.

UNCERTAINTY OF MEASUREMENTS

Uncertainty of measurement has been evaluated in compliance with EA-4/02:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor $k = 2$.

NOTES

1. *The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.*
2. *The measurements in this document are traceable to GUM (Central Office of Measures), Poland*
3. *This calibration certificate shall not be reproduced except in full, without written permission from AcSoft Ltd.*

REFERENCE EQUIPMENT

Description	Manufacturer	Model	Serial Number	Last Calibrated
Signal Generator	Svantek	SV401	124	27.08.2021
Sound & Vibration Analyser	Svantek	SV912AE	15909	22.09.2021
Thermo-Barometer	LAB-EL	LB-706B	912	27.08.2021
Acoustical Calibrator	Svantek	SV30A	83782	17.09.2021
Reference Microphone	GRAS	40AG	235709	31.08.2021
Sound Intensity Calibrator	GRAS	51AB	203319	01.09.2021

This calibration was performed by AcSoft Calibration.
AcSoft Calibration is a trading name of AcSoft Ltd, Bedford Technology Park, Thurleigh, Bedford, MK44 2YA.

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CALIBRATION CERTIFICATE

Issued by AcSoft Calibration

Date of issue: 15-02-2022 **Certificate No:** 1501752-1 **Page:** 3/6

CALIBRATION RESULTS Calibration results are as follows:

1. **Indication at the calibration check frequency**

The sound level meter was calibrated in compliance with the instruction manual. During this process, the indication of this SLM was adjusted to the sound pressure level of the sound level calibrator type SV 30A, No 44775, from SVANTEK. The sound pressure level was corrected by the free-field factor.

Deviation of the acoustic pressure measurement of the A-weighted sound level using the sound calibrator type SV 30A, No 44775, from SVANTEK, was made according to the standard reference conditions: for static pressure 1003 hPa, for temperature 24 °C and for relative humidity 60 %, results:

0.0 ± 0.2 dB

The deviation was determined as a difference between the measured sound level and the sound level corrected by the free-field factor appropriate to mentioned sound calibrator.

2. **Self-generated noise with microphone installed**

Frequency weighting	A
The highest level of self-generated noise stated in the instruction manual [dB]	n/a
Indication [dB]	n/a

3. **Self-generated noise with microphone replaced by the electrical input signal device**

Frequency weighting	A	C	Z
The highest expected level of self-generated noise stated in the instruction manual [dB]	15.0	15.0	23.0
Level of self-generated noise [dB]	14.0	14.0	19.0

4. **Acoustical signal tests of a frequency weighting C**

Frequency	Relative frequency-weighted free-field response	Design-goal frequency weighting	The deviation of frequency weighting	Expanded uncertainty	Acceptable limits
Hz	dB	dB	dB	dB	dB
125.0	94.0	-0.2	0.2	0.3	±1.5
1000.0	94.0	0.0	0.0	0.3	±1.1
4000.0	93.2	-0.8	0.0	0.4	±1.6
8000.0	91.6	-3.0	0.6	0.4	-3.1; +2.5

This calibration was performed by AcSoft Calibration.
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CALIBRATION CERTIFICATE

Issued by AcSoft Calibration

Date of issue: 15-02-2022 **Certificate No:** 1501752-1 **Page:** 4/6

5. Electrical signal tests of frequency weightings

Frequency	Design-goal frequency weighting			The deviation of frequency weighting			Expanded uncertainty	Acceptable limits
	A	C	Z	A	C	Z		
Hz	dB	dB	dB	dB	dB	dB	dB	dB
63	-26,2	-0,8	0,0	0.0	0.0	0.0	0,3	±1,5
125	-16,1	-0,2	0,0	0.0	0.1	0.0	0,3	±1,5
250	-8,6	0,0	0,0	0.0	0.0	0.0	0,3	±1,4
500	-3,2	0,0	0,0	0.0	0.1	0.0	0,3	±1,4
1000	0,0	0,0	0,0	0.0	0.0	0.0	0,3	±1,1
2000	1,2	-0,2	0,0	0.0	0.1	0.0	0,3	±1,6
4000	1,0	-0,8	0,0	0.1	0.1	0.0	0,3	±1,6
8000	-1,1	-3,0	0,0	0.2	0.1	0.0	0,4	-3,1; +2,1
16000	-6,6	-8,5	0,0	-0.1	-0.2	0.0	0,6	-17,0; +3,5

6. Frequency and time weightings at 1 kHz

	Sound level				Time-averaged sound level
Frequency weighting	A	A	C	Z	A
Time weighting	Fast	Slow	Fast	Fast	-
Indication [dB]	114.0	114.0	114.0	114.0	114.0
The deviation of indication from the indication of A-weighted sound level with Fast time weighting [dB]		0.0	0.0	0.0	0.0
Expanded uncertainty [dB]		0.1			
Acceptable limits[dB]		±0.3	±0.4	±0.4	±0.3

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Date of issue: 15-02-2022 **Certificate No:** 1501752-1 **Page:** 5/6

7. Level linearity

Reference level range: HIGH

Expected sound level	Indication	Level linearity error	Expanded uncertainty	Acceptable limits
dB	dB	dB	dB	dB
119.0	118.9	-0.1		
118.0	117.9	-0.1		
117.0	116.9	-0.1		
116.0	115.9	-0.1		
115.0	115.0	0.0		
114.0	114.0	0.0		
109.0	109.0	0.0		
104.0	104.0	0.0		
99.0	99.0	0.0		
94.0	94.0	0.0		
89.0	89.0	0.0		
84.0	84.0	0.0		
79.0	79.0	0.0		
74.0	74.0	0.0		
69.0	68.9	-0.1	0.2	±1.1
64.0	63.9	-0.1		
59.0	58.9	-0.1		
54.0	53.9	-0.1		
49.0	48.9	-0.1		
44.0	43.9	-0.1		
39.0	38.9	-0.1		
38.0	37.9	-0.1		
37.0	36.9	-0.1		
36.0	35.9	-0.1		
35.0	34.9	-0.1		
34.0	33.9	-0.1		
33.0	32.9	-0.1		
32.0	31.9	-0.1		
31.0	30.8	-0.2		

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Date of issue: 15-02-2022 **Certificate No:** 1501752-1 **Page:** 6/6

8. Toneburst response

Measurement quantity	Time weighting	Toneburst duration	The indications in response to toneburst relative to steady sound level	Reference toneburst response relative to steady sound level	Deviation of measured toneburst response from reference toneburst	Expanded uncertainty	Acceptable limits
		ms	dB	dB	dB	dB	dB
Time-weighted sound level	Fast	200	-1.0	-1.0	0.0	0.2	±0.8
		2	-18.0	-18.0	0.0		-1.8; +1.3
		0.25	-27.1	-27.0	-0.1		-3.3; +1.3
Time-weighted sound level	Slow	200	-7.5	-7.4	-0.1		±0.8
		2	-27.1	-27.0	-0.1		-1.8; +1.3
Sound exposure level	-	200	-7.0	-7.0	0.0		±0.8
		2	-27.0	-27.0	0.0		-1.8; +1.3
		0.25	-36.2	-36.0	-0.2		-3.3; +1.3

9. Peak C sound level

Numbers of cycles in test signal	Frequency of test signal	The deviation of indication	Expanded uncertainty	Acceptable limits
	Hz	dB	dB	dB
One	8000	-0.5	0.2	±2.4
Positive half-cycle	500	-0.1		±1.4
Negative half-cycle	500	-0.1		

10. Overload indication

Frequency weighting A

The difference between the levels of the positive and negative one-half-cycles input signals that first cause the displays of overload indication	Expanded uncertainty	Maximum value of the difference
dB	dB	dB
0.2	0.3	1.8

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AcSoft
Noise, Vibration & Air Quality

YOUR PURCHASE ORDER: agreed free Calibration from Aidan
OUR REFERENCE: 1501752
DATE: 17/02/2022

Delivery Note

WE WILL DELIVER TO:
Dragonfly Consulting
4 Bramley's Barn, The Menagerie, Escrick,
York
YO19 6ET

CONTACT: Sam Garside-Cole
TELEPHONE: 01904 898368
EMAIL: sam@dragonfly-consulting.com

Part no. and Description	Serial No.	Quantity
CAL_200 Traceable calibration of Sound Level Meter		1.00

Notes:
SERIAL NUMBERS AND ADDITIONAL INFORMATION:
1 X SV307 #87849
1 X WIND SHIELD
1 X MIC PROTECTOR
1 X BIRD SPIKE
1 X CABLE

CONTACT: Owen Hubbard TELEPHONE: 01234 639550 EMAIL: office@acsoft.co.uk
ADDRESS: AcSoft Ltd, Building 115, Bedford Technology Park, Thurleigh, Bedford, MK44 2YA

Appendix F – Proposed Site Plan