SHARPS REDMORE

ACOUSTIC CONSULTANTS · Established 1990

Report

Noise assessment of a proposed drive thru at Lnd off A4421, Bicester, Oxfordshire, OX26 5AF

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Contents

1.0 Introduction

2.0 Assessment methodology and criteria

3.0 Environmental noise survey

4.0 Assessment of noise from fixed plant equipment

5.0 Noise from 'drive-thru' activity

6.0 Noise from car parking activity

7.0 Assessment conclusions

Appendices

A. Proposed site plan showing plant noise source positions

B. Noise survey results

C. 'Drive-thru' noise calculations

D. Acoustic terminology

1.0 Introduction

1.1 Sharps Redmore (SR) has been instructed to undertake a noise assessment of a proposed restaurant with drive-through facility, at land off A4421, Bicester.

1.2 The development is to comprise of a restaurant and drive thru with associated car parking. The closest noise sensitive property is Wyndham Hall care home to the north, with the closest dwellings at 1 to 4 Manor Farm Cottages due west of the site (a site location plan is reproduced at Appendix A).

1.3 The objective of the assessment is to determine how noise that may be generated as a result of the proposal would affect the amenity of the closest residential properties.

1.4 Section 2.0 of this report contains a discussion of the available methods of assessment and assessment criteria.

1.5 Section 3.0 of this report sets out the findings of an environmental noise survey, undertaken at a location representative of the noise climate at the closest noise sensitive property to the proposal site.

1.6 The different components of operational noise are considered in sections 4.0 to 6.0 of this report.

1.7 The assessment conclusions are contained in section 7.0 of this report.

1.8 A guide to the acoustic terminology used in this report is shown in Appendix D.

2.0 Assessment methodology and criteria

2.1 The National Planning Policy Framework (NPPF), February 2019, sets out the Government's planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 180 of the NPPF states the following:

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

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation".

2.2 Guidance on the interpretation of the policy aims contained within the NPPF is contained within National Planning Policy Guidance (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in the table below:

TABLE 1: Noise Exposure Hierarchy

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate ad reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.3 The NPPF and NPPG reinforce the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

2.4 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

2.5 Taking an overview of national policy aims and guidance it is clear that when considering the impact of noise that the fact can be heard and causes impact, is not reason to refusal an application as consideration should also be given to the significance of the impact and the mitigation measures available.

2.6 It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

i) The effect may be determined by reference to guideline noise values, such as those contained in the World Health Organisation (WHO) "*Guidelines for Community Noise"*.

ii) Alternatively, the impact may be determined by considering the change in noise level that would result from the proposal, in an appropriate noise index for the characteristic of the noise in question. There are various criteria linking change in noise level to effect. This is the method that is suited to, for example, the assessment of noise from road traffic because it is capable of displaying impact to all properties adjacent to a road link irrespective of their distance from the road.

iii) Another method is described within BS 4142:2014 to determine the significance of sound impact from sources of industrial and/or commercial nature. The sources that the newly revised standard is intended to assess are sound from industrial and manufacturing processes, sound from fixed plant installations, sound from loading and unloading of goods at industrial and/or commercial premises and the sound from mobile plant and vehicles, such as forklift, train or ship movements.

Guidelines for Community Noise

2.7 The WHO "Community Noise Guidelines" (CNG) values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological or physiological effect. They are, as defined by NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), but do not define the level above which effects are significant (the SOAEL). Compliance with the LOAEL should, therefore, be seen as a robust aim.

2.8 In 2018 the WHO published the "Environmental Noise Guidelines for the European Region" (ENGER). The new WHO Environmental Noise Guidelines (page 28) explain that *"The current environmental noise guidelines for the European Region supersede the CNG from 1999. Nevertheless, the GDG* (Guideline Development Group) *recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid"*. Hence the CNG remain relevant to this assessment.

2.9 The WHO ENGER brings together the latest research on the effects of specific types of noise on health in relation to transportation noise sources (road, rail and aircraft noise exposure), wind turbines and leisure noise. Hence in direct relation to the specific proposal that this noise assessment considers, the new WHO ENGER are not of material consideration.

2.10 The relevant World Health Organisation (CNG) noise values are summarised in the following table:

TABLE 2: WHO CNG values

Document	Level	Guidance
World Health Organisation "Community Noise 2000"	L_{AeqT} = 55 dB	Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	L_{AeqT} = 50 dB	Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	L_{AeqT} = 35 dB	Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	L_{AeqT} = 30 dB	Sleep disturbance, night-time (indoors)
	L_{Amax} = 60 dB	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
	L_{Amax} = 45 dB	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)

2.11 For L_{AeqT} criteria the time base (T) given in the documents is 16 hours for daytime limits and 8 hours for night time limits. When assessing impact, this has the tendency to smooth out the hourly variations in noise level. As such, our calculations are carried out to a 1 hour time base, which is a more stringent assessment than is given in WHO Guidelines for Community Noise.

2.12 The internal CNG values can be converted to an external value by the addition of the attenuation provided by a partially open window of 15 dB.

Changes in noise level

2.13 Changes in noise levels of less than 3 dBA are not perceptible under normal conditions and changes of 10 dBA are equivalent to a doubling of loudness. This guidance has been accepted by inspectors, at inquiry, to encompass changes in noise levels in the index L_{AeqT}.

2.14 Table 3 below shows the response to changes in noise (known as a semantic scale); this table has been developed from general consensus opinion of acousticians.

TABLE 3: Change in noise level

Change in noise level L_{AeqT} dB	Response	Impact
<3	Imperceptible	None
3 – 5	Perceptible	Slight/moderate
6 – 10	Up to a doubling	Moderate/significant
11 – 15	More than a doubling	Substantial
>15	-	Severe

2.15 Where the existing ambient noise level is already above the criteria developed from the various guidance documents, it may be considered unreasonable to adopt such criteria. It would be reasonable, however, given the above statement, to consider criteria which do not exceed the existing noise climate, thus giving rise to an overall 3 dB increase i.e. the minimum perceptible. If it is less than the minimum perceptible it cannot be described as disturbing or to affect the amenity of residents.

Assessment using BS 4142:2014

2.16 As outlined, this British Standard enables the significance of sound impact to be determined in relation to industrial and commercial sources. The significance of sound impact is to be determined according to the following summary process:

i) Determine the background sound levels, in terms of the index L_{A90}, at the receptor locations of interest.

ii) Determine the specific sound level of the source being assessed, in terms of its L_{AeqT} level (T = 1 hour for day or 15 minutes for night), at the receptor location of interest.

iii) Apply a rating level acoustic feature correction if the source sound has tonal, impulsive, intermittent, or other characteristics which attract attention.

iv) Compare the rating sound level with the background sound level; the greater the difference between the two, the higher the likelihood of adverse impact.

v) A difference (rating – background) of around +10 dB is an indication of significant adverse impact, depending on the context; a difference of +5 dB is an indication of an adverse impact, depending on the context. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon context.

vi) The intent of the planning system is to ensure that a development does not result in "significant adverse impacts on health and quality of life." BS 4142:2014 considers that the threshold of significant adverse impact is "a difference around +10 dB or more … depending upon the context". However the NPPF and NPPG state that where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant

observed adverse effect, then according to the explanatory notes in the statement *"…all reasonable steps should be taken to mitigate and minimise adverse effects in health and quality of life while together taking into account the guiding principles of sustainable development. This does not mean that adverse effects cannot occur but that effort should be focused on minimising such effects"*.

2.17 BS 4142:2014 introduces the concept of '*context'* to the process of identifying noise impact. Section 11 of BS 4142:2014 explains "*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs* (our emphasis). A*n 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"* (our emphasis).

2.18 There are many *context* points to consider when undertaking an assessment of sound impact including:

- The absolute level of sound;
- The character and level of the specific sound in the context of the existing noise climate; for example is the sound to occur in a location already characterised by similar activities as those proposed?
- The sensitivity of the receptors;
- The time and duration that the specific sound is to occur;
- The conclusions of assessments undertaken using alternative assessment methods, for example WHO guidelines noise values or change in noise level;

2.19 It is therefore entirely possible that whilst the numerical outcome of a BS 4142:2014 assessment is indicative of adverse or significant adverse impact, when the proposal is considered in *context* the significance of the impact is reduced to an acceptable level.

3.0 Environmental noise survey details

3.1 A noise survey was undertaken between the Tuesday 25th and Wednesday 26th May 2021. The noise measurements were taken at a single location representative of the noise climate in the vicinity of the closest noise sensitive property to the north of the proposal site at Wyndham Hall care home.

FIGURE 1: Noise measurement location

3.2 The measurements were carried using a Norsonic 118 sound level fitted with an environmental microphone kit. The sound level meter was calibrated at the start and end of the measurements and no variation in level noted.

3.3 The sound level meter microphone at location A was positioned approximately 1.5 metres above the ground in free field conditions.

3.4 Weather conditions during the survey were dry and partly cloudy with temperatures of 3 to 15°C; winds were light and mainly from the south west.

3.5 The results of the noise survey are presented in full in Appendix B, and summarised in Table 4 and Figure 2.

3.6 The noise levels throughout the survey were dominated by local road traffic sources.

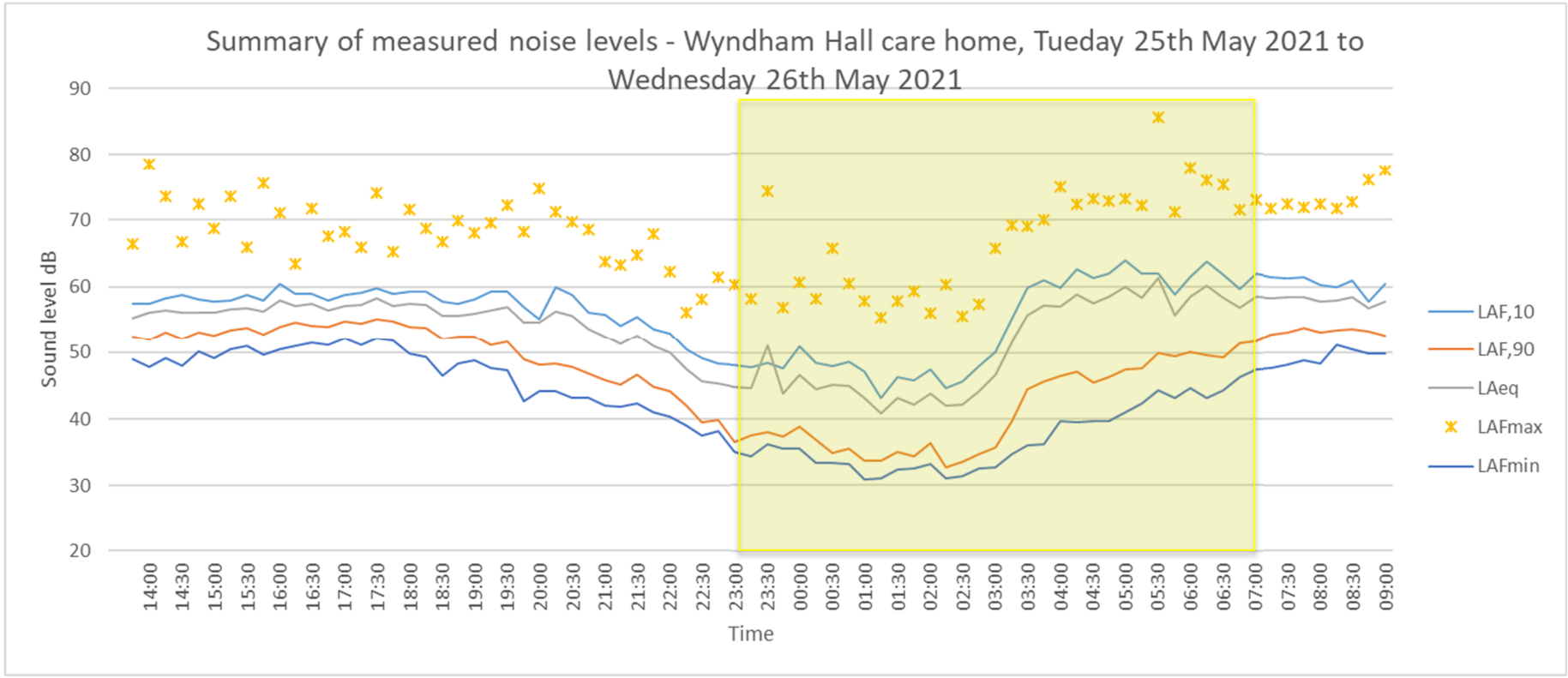
3.7 Table 4 below summaries the hourly/15 minute noise levels during the survey.

TABLE 4: Summary of existing noise levels

Date	Time	Noise level dB		
		$L_{A90\ 1\ hour}$	$L_{A90\ 15\ mins}$	$L_{Aeq\ 1\ hour}$
25.5.21	14:00	52.6		56.2
	15:00	53.2		56.4
	16:00	54.2		57.3
	17:00	54.8		57.5
	18:00	53.1		56.6
	19:00	51.1		56.1
	20:00	47.8		55.2
	21:00	45.6		51.9
	22:00	41.4		47.5
	23:00		36.5	47.3
26.5.21	00:00		34.9	45.4
	01:00		33.7	42.4
	02:00		32.7	43.2
	03:00		35.7	54.3
	04:00		45.5	58.0
	05:00		47.4	59.2
	06:00		49.3	58.6
	07:00	52.9		58.4
	08:00	53.4		57.7

3.8 The graph at Figure 2 below also summarises the noise survey measurements. It has been used to determine typical period noise levels in order to establish appropriate typical background noise levels against which to set noise criteria for the assessment of fixed plant equipment. The typical daytime background noise level is determined to be 50 dB L_{A90}; during the evening period (1900 to 2300 hours) the background noise level is typically 45 dB L_{A90} and during the night time period the background noise level is typically 35 dB L_{A90}.

FIGURE 2: Summary of measured noise levels.



4.0 Assessment of noise from fixed plant equipment

4.1 The objective assessment of plant sound sources in commercial premises should be undertaken in accordance with British Standard 4142:2014. This Standard enables the resultant sound levels from new plant equipment to be compared against the existing typical background sound level (L_{A90}) of an area to establish the significance of the sound impact.

4.2 In determining suitable plant sound criteria SR have considered measured background sound levels taken during the noise survey. Figure 2 indicates typical evening background noise level of around 45 dB and typical night time background noise levels of around 35 dB.

4.3 To ensure that the amenity of local residents would not be affected, this assessment considers the robust approach that predicted plant rating noise levels should not exceed the typical measured background sound levels. The advice in BS 4142:2014 is that *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source of having a low impact, depending on the context*" (clause 11, note 'd').

4.4 It is proposed to adopt the following overall plant sound limits at the nearest noise sensitive premises:

TABLE 5: Proposed plant rating sound limits

Rating level limits (dB)	
Daytime	Night time
45 dB	35 dB

4.5 The following planning condition is recommended to secure the above criteria:

"*No fixed plant and/or machinery shall come into operation until details of the fixed plant and machinery serving the development hereby permitted, and any mitigation measures to achieve this condition, are submitted to and approved in writing by the local planning authority. The rating level of the sound emitted from the site shall not exceed 45 dBA between 0700 and 2300 hours and 35 dBA at all other times. The sound levels shall be determined by measurement or calculation at the nearest residential premises. The measurements and assessment shall be made according to BS 4142:2014.*"

5.0 Noise from 'drive-thru' activity

5.1 SR have previously undertaken measurements of customer activity and associated noise levels from drive-thru facilities at similar sites.

5.2 There are principally four events associated with a customer visit to the drive thru facility. These are arrival of a customer vehicle, the ordering of the food, followed by payment and collection and the movement along the access road to depart the site. These activities do not involve occupants leaving the vehicle, with the associated door slams, so peak noise levels are generated by the acceleration of the vehicle away from the order/collection windows.

5.3 The layout of the site would be such that the vehicles cannot travel at speed around the drive through loop. As such, noise levels generated by drive-thru facilities are not particularly high.

5.4 Measurements of these four activities, taken at a reference distance of 10 metres from the centre of activity gave the following typical noise levels:

TABLE 6: Drive-thru activity source noise levels

Activity	SEL	L_{AMAX}
Arrival of vehicle	72 dBA	63 dB
Ordering	70 dBA	61 dB
Collection, Payment and departure	72 dBA	62 dB
Slow movement (20km/h) on access road	72 dBA	63 dB

5.5 The SEL (single event or sound exposure level) is a parameter used to denote the sound energy of an event into a standard 1-second time period. This can then be used to convert a number of events of unknown or varying duration into a $L_{Aeq\,T}$ ambient noise level.

5.6 The nearest noise sensitive receptor to the proposed drive-thru facility is Wyndham Hall care home to the north, and 1 to 4 Manor Farm Cottages to the west.

5.7 Sharps Redmore has been supplied with forecasted peak hour customer arrival data for the proposed 'drive-thru' facility by ADL Traffic and Highways Engineering Limited. The calculations presented in this assessment are based on the calculated weekday and Saturday peak hour drive thru flows.

5.8 Using the forecasted customer vehicle movements the following overall noise levels are predicted (arrival, ordering, collection and departure) at Wyndham Hall care home and 1 to 4 Manor Farm Cottages from the use of the drive-thru. The full calculations are presented at Appendix C.

TABLE 7: Predicted 'drive-thru' activity noise levels

Receptor location	Noise level dB		
	Weekday	Saturday	Peak noise levels dB L_{Amax}
	Peak $L_{Aeq, 1\ hour}$	Peak $L_{Aeq, 1\ hour}$	
Wyndham Hall care home	46	46	49
1 to 4 Manor Farm Cottages	40	40	43

5.9 The noise levels predicted to arise from 'drive thru' activity at the proposed restaurant fall within the WHO guideline values for daytime noise and are well below the existing noise climate.

5.10 Noise associated with off peak hour drive thru movements during the early morning period would comply with the WHO night time guideline noise values; indeed associated peak noise levels from drive thru activity are well below the WHO peak noise criterion associated with the onset of sleep disturbance.

5.11 With regard to predicted drive thru noise levels it is concluded that the proposed unit could trade on an unrestricted basis without associated noise giving rise to significant adverse impact, which is the test under the NPPF.

6.0 Noise from car parking

6.1 This assessment considers customer car parking activity noise in the context of guideline noise values and the existing ambient noise climate.

6.2 SR has previously undertaken extensive noise monitoring of car parks; at 10 metres from the boundary of a busy car park measured noise levels are 48 dB $L_{Aeq,1hr}$ (free field) have been found. During off peak trading periods, car park source noise levels can be approximately 5 dB lower.

6.3 The closest property to the proposed car park is the Wyndham Hall care home, which would be approximately 30 metres from the closest parking spaces.

6.4 The resultant predicted car park activity noise level (during peak trading conditions) at Wyndham Hall care home would be 38 dB $L_{Aeq\ 1\ hour}$ (allowing for distance attenuation of 10 dB) during peak trading hours, and 33 dB $L_{Aeq\ 1\ hour}$ during off peak times. The predicted car park noise levels are significantly below both the existing ambient noise climate and the WHO guideline noise values.

6.5 Peak noise levels in car parks have been attributed to car door slam events. SR have measured noise from a considerable number of car door slam events and peak noise levels can be up to 66 dB L_{Amax} (free field) at 10 metres from the vehicle.

6.6 Resultant peak noise levels from car parking activity would therefore be in the region of 56 dB L_{Amax} (66 – 20log [10/30]).

6.7 Predicted customer car parking activity noise levels would comply with the WHO daytime and night guideline values. On this basis the proposed restaurant could trade during the night time period, without associated car parking noise giving rise to significant adverse impact.

7.0 Assessment conclusions

7.1 Having undertaken this assessment against objective criteria it is concluded that noise from the operation of the proposed restaurant and 'drive-thru' at land off A4421, Bicester would not adversely affect the amenity of the existing residents.

7.2 The rating noise level of fixed plant will be designed and controlled so as to not exceed the existing background noise climate; 45 dB during the daytime/evening and 35 dB at night. These limits can be secured by the imposition of the following planning condition.

"*No fixed plant and/or machinery shall come into operation until details of the fixed plant and machinery serving the development hereby permitted, and any mitigation measures to achieve this condition, are submitted to and approved in writing by the local planning authority. The rating level of the sound emitted from the site shall not exceed 45 dBA between 0700 and 2300 hours and 35 dBA at all other times. The sound levels shall be determined by measurement or calculation at the nearest residential premises. The measurements and assessment shall be made according to BS 4142:2014.*"

7.3 Noise from 'drive-thru' and car parking activity would comply with both the daytime and night time WHO guideline values and be well below the existing daytime ambient noise climate.

7.4 It is concluded, therefore, that the proposed restaurant and 'drive-thru' facility could trade on an unrestricted basis without associated noise causing significant adverse impact.

APPENDIX A

PROPOSED SITE PLAN

Appendix A: Proposed site plan

APPENDIX B

NOISE SURVEY RESULTS

Appendix B1	Title: Noise survey results

Measurement location A opposite Wyndham Hall care home, Bicester

Date	Sample start time	Noise Parameter - dB				
		L_{A10}	L_{A90}	L_{Aeq}	L_{AFmax}	L_{AFmin}
25.5.21	13:45:00	57.4	52.4	55.3	66.5	48.9
	14:00:00	57.4	51.9	56.1	78.5	47.8
	14:15:00	58.2	53.1	56.4	73.6	49.2
	14:30:00	58.8	52.1	56.2	66.8	47.9
	14:45:00	58.1	53.1	56.2	72.4	50.1
	15:00:00	57.8	52.7	56.1	68.7	49.1
	15:15:00	58.0	53.5	56.6	73.5	50.4
	15:30:00	58.8	53.8	56.7	65.9	50.9
	15:45:00	58.0	52.8	56.3	75.6	49.7
	16:00:00	60.4	53.9	58.0	71.1	50.5
	16:15:00	58.9	54.7	57.1	63.5	51.0
	16:30:00	59.0	54.2	57.5	71.7	51.4
	16:45:00	58.0	54.0	56.4	67.6	51.1
	17:00:00	58.7	54.8	57.1	68.2	52.1
	17:15:00	59.1	54.5	57.2	66.0	51.2
	17:30:00	59.8	55.2	58.3	74.1	52.2
	17:45:00	58.9	54.8	57.1	65.2	51.8
	18:00:00	59.3	53.9	57.4	71.5	49.8
	18:15:00	59.2	53.8	57.2	68.8	49.3
	18:30:00	57.7	52.1	55.6	66.8	46.5
	18:45:00	57.5	52.4	55.7	69.9	48.3
	19:00:00	58.1	52.4	56.0	68.0	48.8
	19:15:00	59.2	51.2	56.4	69.6	47.7
	19:30:00	59.3	51.7	56.9	72.3	47.3
	19:45:00	56.9	48.9	54.6	68.3	42.6
	20:00:00	55.2	48.1	54.6	74.7	44.2
	20:15:00	59.9	48.3	56.3	71.3	44.1
	20:30:00	58.8	47.8	55.7	69.7	43.1
	20:45:00	56.2	46.8	53.6	68.6	43.1
	21:00:00	55.8	45.8	52.4	63.7	42.0
	21:15:00	54.2	45.2	51.3	63.2	41.8
	21:30:00	55.4	46.6	52.6	64.8	42.4
	21:45:00	53.6	44.9	51.0	67.9	41.0
	22:00:00	52.9	44.2	49.9	62.2	40.3
	22:15:00	50.5	42.0	47.5	56.1	39.0
	22:30:00	49.1	39.5	45.7	58.1	37.5
	22:45:00	48.3	39.9	45.3	61.5	38.2
	23:00:00	48.1	36.5	44.9	60.3	35.1
	23:15:00	47.8	37.5	44.7	58.1	34.3
	23:30:00	48.4	38.0	51.1	74.4	36.1
	23:45:00	47.6	37.3	43.9	56.7	35.5
26.5.21	00:00:00	50.9	38.8	46.6	60.6	35.6
	00:15:00	48.4	36.9	44.5	58.1	33.3
	00:30:00	48.0	34.9	45.1	65.8	33.3
	00:45:00	48.7	35.6	45.0	60.4	33.2
	01:00:00	47.2	33.7	43.2	57.7	30.9
	01:15:00	43.2	33.7	40.8	55.3	31.1
	01:30:00	46.3	35.1	43.1	57.8	32.4
	01:45:00	45.8	34.3	42.2	59.2	32.5
	02:00:00	47.5	36.3	43.8	55.9	33.2

Appendix B2	Title: Noise survey results

Measurement location A opposite Wyndham Hall care home, Bicester

Date	Sample start time	Noise Parameter - dB				
		L_{A10}	L_{A90}	L_{Aeq}	L_{AFmax}	L_{AFmin}
26.5.21	02:15:00	44.7	32.7	42.0	60.2	31.0
	02:30:00	45.7	33.5	42.2	55.4	31.3
	02:45:00	48.0	34.7	44.2	57.2	32.5
	03:00:00	50.1	35.7	46.6	65.7	32.7
	03:15:00	55.1	39.7	51.6	69.2	34.7
	03:30:00	59.7	44.5	55.7	69.0	36.0
	03:45:00	61.0	45.6	57.1	70.1	36.2
	04:00:00	59.7	46.4	57.0	75.1	39.6
	04:15:00	62.6	47.2	58.8	72.4	39.5
	04:30:00	61.2	45.5	57.5	73.3	39.7
	04:45:00	62.0	46.3	58.4	72.9	39.6
	05:00:00	63.9	47.4	59.9	73.3	41.0
	05:15:00	62.0	47.6	58.3	72.3	42.3
	05:30:00	61.9	49.9	61.2	85.6	44.4
	05:45:00	58.7	49.5	55.6	71.2	43.2
	06:00:00	61.5	50.2	58.4	77.9	44.6
	06:15:00	63.7	49.7	60.1	76.1	43.1
	06:30:00	61.7	49.3	58.3	75.4	44.3
	06:45:00	59.6	51.5	56.8	71.5	46.3
	07:00:00	62.0	51.8	58.5	73.1	47.4
	07:15:00	61.5	52.8	58.3	71.7	47.6
	07:30:00	61.3	53.2	58.4	72.4	48.2
	07:45:00	61.4	53.8	58.4	71.9	48.8
	08:00:00	60.2	53.1	57.7	72.4	48.3
	08:15:00	60.0	53.5	57.9	71.7	51.2
	08:30:00	61.0	53.7	58.4	72.8	50.5
	08:45:00	57.8	53.3	56.8	76.0	49.8
	09:00:00	60.5	52.7	57.7	77.6	49.8
	22:30:00	49.1	39.5	45.7	58.1	37.5
	22:45:00	48.3	39.9	45.3	61.5	38.2
	23:00:00	48.1	36.5	44.9	60.3	35.1
	23:15:00	47.8	37.5	44.7	58.1	34.3
	23:30:00	48.4	38.0	51.1	74.4	36.1
	23:45:00	47.6	37.3	43.9	56.7	35.5
	00:00:00	50.9	38.8	46.6	60.6	35.6
	00:15:00	48.4	36.9	44.5	58.1	33.3

APPENDIX C

'DRIVE THRU' NOISE CALCULATIONS

APPENDIX C1

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: weekday AM peak hour at Wyndham Hall care home

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	86	56 dB	48 m	-14 dB	0 dB	42 dB
Ordering	70 dB	86	54 dB	38 m	-12 dB	0 dB	42 dB
Collection of order	72 dB	86	56 dB	55 m	-15 dB	-10 dB	31 dB
Departure of vehicle	72 dB	86	56 dB	63 m	-16 dB	0 dB	40 dB
						Overall dB $L_{Aeq\ 1\ hour}$	46 dB

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: weekday PM peak hour at Wyndham Hall care home

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	72	55 dB	48 m	-14 dB	0 dB	41 dB
Ordering	70 dB	72	53 dB	38 m	-12 dB	0 dB	41 dB
Collection of order	72 dB	72	55 dB	55 m	-15 dB	-10 dB	30 dB
Departure of vehicle	72 dB	72	55 dB	63 m	-16 dB	0 dB	39 dB
						Overall dB $L_{Aeq\ 1\ hour}$	46 dB

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: Saturday AM peak hour at Wyndham Hall care home

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	85	56 dB	48 m	-14 dB	0 dB	42 dB
Ordering	70 dB	85	54 dB	38 m	-12 dB	0 dB	42 dB
Collection of order	72 dB	85	56 dB	55 m	-15 dB	-10 dB	31 dB
Departure of vehicle	72 dB	85	56 dB	63 m	-16 dB	0 dB	40 dB
						Overall dB $L_{Aeq\ 1\ hour}$	46 dB

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: Saturday PM peak hour at Wyndham Hall care home

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	81	56 dB	48 m	-14 dB	0 dB	42 dB
Ordering	70 dB	81	54 dB	38 m	-12 dB	0 dB	42 dB
Collection of order	72 dB	81	56 dB	55 m	-15 dB	-10 dB	31 dB
Departure of vehicle	72 dB	81	56 dB	63 m	-16 dB	0 dB	40 dB
						Overall dB $L_{Aeq\ 1\ hour}$	46 dB

Drive thru peak noise (L_{Amax}) level predictions

Activity	L_{Amax} at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	L_{Amax} at receptor
Arrival of vehicle	63 dB	48 m	-14 dB	0 dB	49 dB
Ordering	61 dB	38 m	-12 dB	0 dB	49 dB
Collection of order	62 dB	55 m	-15 dB	-10 dB	37 dB
Departure of vehicle	63 dB	63 m	-16 dB	0 dB	47 dB
				Highest dB L_{amax}	49 dB

APPENDIX C2

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: weekday AM peak hour at 1 to 4 Manor Farm Cottages

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	86	56 dB	95 m	-20 dB	0 dB	36 dB
Ordering	70 dB	86	54 dB	113 m	-21 dB	0 dB	33 dB
Collection of order	72 dB	86	56 dB	120 m	-22 dB	-10 dB	24 dB
Departure of vehicle	72 dB	86	56 dB	105 m	-20 dB	0 dB	35 dB
						Overall dB $L_{Aeq\ 1\ hour}$	40 dB

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: weekday PM peak hour at 1 to 4 Manor Farm Cottages

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	72	55 dB	95 m	-20 dB	0 dB	35 dB
Ordering	70 dB	72	53 dB	113 m	-21 dB	0 dB	32 dB
Collection of order	72 dB	72	55 dB	120 m	-22 dB	-10 dB	23 dB
Departure of vehicle	72 dB	72	55 dB	105 m	-20 dB	0 dB	35 dB
						Overall dB $L_{Aeq\ 1\ hour}$	39 dB

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: Saturday AM peak hour at 1 to 4 Manor Farm Cottages

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	85	56 dB	95 m	-20 dB	0 dB	36 dB
Ordering	70 dB	85	54 dB	113 m	-21 dB	0 dB	33 dB
Collection of order	72 dB	85	56 dB	120 m	-22 dB	-10 dB	24 dB
Departure of vehicle	72 dB	85	56 dB	105 m	-20 dB	0 dB	35 dB
						Overall dB $L_{Aeq\ 1\ hour}$	40 dB

Drive thru ambient noise ($L_{Aeq\ T}$) level predictions: Saturday PM peak hour at 1 to 4 Manor Farm Cottages

Activity	SEL at 10 metres	No. of events	$L_{Aeq\ 1\ hour}$ at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	$L_{Aeq\ 1\ hour}$ at receptor
Arrival of vehicle	72 dB	81	56 dB	95 m	-20 dB	0 dB	36 dB
Ordering	70 dB	81	54 dB	113 m	-21 dB	0 dB	32 dB
Collection of order	72 dB	81	56 dB	120 m	-22 dB	-10 dB	24 dB
Departure of vehicle	72 dB	81	56 dB	105 m	-20 dB	0 dB	35 dB
						Overall dB $L_{Aeq\ 1\ hour}$	40 dB

Drive thru peak noise (L_{Amax}) level predictions

Activity	L_{Amax} at 10 metres	Distance to receptor (metres)	Distance attenuation (dB)	Screening attenuation (dB)	L_{Amax} at receptor
Arrival of vehicle	63 dB	95 m	-20 dB	0 dB	43 dB
Ordering	61 dB	113 m	-21 dB	0 dB	40 dB
Collection of order	62 dB	120 m	-22 dB	-10 dB	30 dB
Departure of vehicle	63 dB	105 m	-20 dB	0 dB	43 dB
				Highest dB L_{amax}	43 dB

APPENDIX D

ACOUSTIC TERMINOLOGY

Acoustic Terminology

D1 Noise, defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. 50 dB + 50 dB = 53 dB. Increases in continuous sound are perceived in the following manner:

1 dB increase - barely perceptible.

3 dB increase - just noticeable.

10 dB increase - perceived as twice as loud.

D2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.

D3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).

D4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p. Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p.

D5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.

D6 The main noise indices in use in the UK are:

L_{A90}: The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.

L_{Aeq}: The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other

words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.

L_{A10}: The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

L_{AMAX}: The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

D7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB}.$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

D8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \text{ Log } {}^{160}/_{10} = 60 - 24 = 36 \text{ dB}.$$