

SHARPS REDMORE

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Report

Proposed KFC restaurant with drive-thru facility at Larchwood Avenue, Bedhampton

Environmental Noise
Assessment

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1.0 Introduction

- 1.1 Sharps Redmore (SR) has been instructed to undertake a noise assessment of a proposed KFC restaurant with drive-through facility at Larchwood Avenue, Bedhampton.
- 1.2 The site is located adjacent to the main access road into the Asda store; to the south is the Asda car park, with a McDonalds drive thru to the immediate north and the Asda petrol filling station (PFS) beyond. To the west is a small industrial estate, with the nearest residential properties to the east.
- 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 those adjacent residences.
- 1.4 The context of the site is that the Asda store trades on an unrestricted 24 hour basis, as does the PFS, whilst the McDonalds trades between 0600 and 2300 hours. Hence there is noise generated by the operation of these commercial units at all times.
- 1.5 On the basis of these contextual considerations, and that the McDonalds drive thru is closer to residential properties than the proposed KFC, this assessment provides a desktop noise assessment of the proposed KFC restaurant and drive thru.
- 1.6 Section 2 of this report contains a discussion of the available methods of assessment and assessment criteria.
- 1.7 The different components of operational noise are considered in sections 3 to 5 of this report.
- 1.8 The assessment conclusions are contained in section 6 of this report and a guide to the acoustic terminology used in this report is shown in Appendix C.

2.0 Assessment methodology and criteria

National Policy

- 2.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 123 of the NPPF states the following:

- *Planning policies and decisions should aim to:*
- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions, while recognising that many developments will create some noise; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason*

- 2.2 The NPPF reinforces 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."*

- 2.3 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."

- 2.4 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. British Standard (BS) 8233:2014 and World Health Organisation (WHO) *"Guidelines for Community Noise"* contain such guidelines.
 - 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 to compare the resultant sound level against the background sound level (L_{A90}) of the area. This is the method employed by BS 4142:2014 to determine the significance of sound impact from sources of industrial and/or commercial nature. The sources that the new 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.

Guideline noise values

- 2.5 There are a number of guidance documents that contain recommended guideline noise values. These are discussed below.
- 2.6 British Standard 8233:2014 is principally intended to assist in the design of new dwellings; however, the Standard does state that it may be used in the assessment of noise from new sources being brought to existing dwellings.
- 2.7 The WHO guideline 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 The National Physical Laboratory document *"Health Effect based noise assessment methods; a review and feasibility study"*, (September 1998) contains an "interpretation" of the WHO guidelines (then in draft form) for the DETR. The summary of this section of the NPL report states *"In essence, the WHO guidelines represent a consensus view of international expert opinion on the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached"* (paragraph 5.4).

- 2.9 The guideline values, may be put into context by noting that some 40% of the population of the European Union are exposed to road traffic noise above the 55 dBA guideline value (ref WHO Guidelines page iii). A similar analysis, undertaken by the Building Research Establishment, found that 56% of the sample population surveyed in the United Kingdom experienced levels of above 55 dBA (BRE Information Paper “The noise climate around our homes”). Thus the guideline values are to a certain extent aspirational, rather than upper limits.
- 2.10 The World Health Organisation/BS 8233 guideline noise values are summarised in the following table:

TABLE 1: WHO/BS 8233 guideline noise values

Document	Level	Guidance
World Health Organisation “Community Noise 2000”	$L_{AeqT} = 55 \text{ dB}$	Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	$L_{AeqT} = 50 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	$L_{AeqT} = 35 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	$L_{AeqT} = 30 \text{ dB}$	Sleep disturbance, night-time (indoors)
	$L_{AMAX} = 60 \text{ dB}$	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
	$L_{AMAX} = 45 \text{ dB}$	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)
BS 8233:2014 “Sound Insulation and noise reduction for buildings”	$L_{AeqT} = 55 \text{ dB}$	Upper limit for external steady noise. (gardens and patios).
	$L_{AeqT} = 50 \text{ dB}$	Desirable limit for external steady noise. (gardens and patios).
	$L_{Aeq \text{ 16 hours}} = 35 \text{ dB}$	Resting, living room day. (Internal – steady noise)
	$L_{Aeq \text{ 16 hours}} = 40 \text{ dB}$	Dining, dining room day. (Internal – steady noise)
	$L_{Aeq \text{ 16 hour}} = 35 \text{ dB}$	Sleeping, bedroom day (Internal – steady noise)
	$L_{Aeq \text{ 8 hours}} = 30 \text{ dB}$	Sleeping, bedroom night (Internal – steady noise)

- 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 the guidance documents.

Changes in noise level

- 2.12 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} .
- 2.13 The following table shows the response to changes in noise (known as a semantic scale); this table has been developed from general consensus opinion of acousticians.

TABLE 2: 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

Assessment using BS 4142:2014

- 2.14 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:
- Determine the background sound levels, in terms of the index L_{A90} , at the receptor locations of interest.
 - 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.
 - Apply a rating level acoustic feature correction if the source sound has tonal, impulsive, intermittent, or other characteristics which attract attention.
 - Compare the rating sound level with the background sound level; the greater the difference between the two, the higher the likelihood of adverse impact.
 - 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.
 - The general 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 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*”.

- 2.15 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). *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”* (our emphasis).
- 2.16 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;
- 2.17 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 Fixed plant noise

- 3.1 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 background sound level (L_{A90}) of an area to establish the significance of the sound impact.
- 3.2 As explained in paragraph 1.5, this assessment proposes to undertake a desktop study of the proposed KFC development. Plant noise limits could be secured through imposition of a suitably worded planning condition, based on a future survey of background sound levels.
- 3.3 To ensure that the amenity of local residents would not be affected, it is proposed that the rating level from fixed plant equipment should not exceed the typical measured background sound level. 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').
- 3.4 The 2014 version of BS 4142 no longer refers to what sound levels are considered to be very low; BS 4142:1997 stated that background noise levels below about 30 dB and rating levels below 35 dB were both considered to be very low. This information was used to justify a lower level limit for setting plant sound criteria in situations where background sound levels were very low, this tended to avoid situations requiring plant sound limits lower than 35 dB (which would result in internal levels, with partially open windows, of 20 to 25 dB, well below the WHO/BS 8233 guideline noise values).
- 3.5 With due regard to the current advice in BS 4142:2014 and the previous 1997 version in relation to 35 dB being considered a 'very low' rating level, 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 the existing background sound level or 35 dB whichever is the higher at all other times. The sound levels shall be determined by measurement or calculation at the nearest noise sensitive premises in Willowdene Close/Chestnut Avenue. The measurements and assessment shall be made according to BS 4142:2014."

- 3.6 Although this report does not contain a full assessment of plant noise, the following plant units are typical for such KFC developments.

TABLE 3: Proposed plant equipment units

Equipment description	Source noise level dB
1x Condensing units for chilled rooms	41 dBA at 10 metres
2x Condensing units for freezer room	38 dBA at 10 metres (each)
1x Heat recovery unit CU1	60 dBA at 1metre
EF1 Kitchen extract fan	67 dBA at 3 metres
EF2 Staff area extract fan	53 dBA at 3 metres
SF1 Kitchen fresh air supply fan	63 dBA at 3 metres

- 3.7 The closest residential properties to the proposed KFC unit are in Willowdene Close/Chestnut Avenue approximately 140 metres to the east. The following plant noise levels are predicted based solely on distance attenuation.

TABLE 4: Predicted plant noise levels: 28 Chestnut Avenue

Equipment description	Source noise level dB	Source reference distance (metres)	Distance to receptor (metres)	Distance attenuation dB	Noise level at receptor dB
Condensing units for chilled rooms	41 dBA	10 m	140 m	- 23 dB	18 dBA
Condensing units for freezer room	38 dBA	10 m	140 m	- 23 dB	15 dBA
Condensing units for freezer room	38 dBA	10 m	140 m	- 23 dB	15 dBA
Heat recovery unit CU1	60 dBA	1 m	140 m	- 43 dB	17 dBA
EF1 Kitchen extract fan	67 dBA	3 m	140 m	- 33 dB	34 dBA
EF2 Staff area extract fan	53 dBA	3 m	140 m	- 33 dB	20 dBA
SF1 Kitchen fresh air supply fan	63 dBA	3 m	140 m	- 33 dB	30 dBA
Overall at receptor					35 dBA

- 3.8 The predicted sound levels in Table 4 above indicate compliance with the proposed plant noise planning condition in paragraph 3.5. These predicted plant noise levels could be refined with a more detailed assessment to take account of attenuation afforded by distance, outlet reflection, angular and surface directivity and acoustic screening.

4.0 Noise from 'drive-thru' activity

- 4.1 SR have previously undertaken measurements of customer activity and associated noise levels from the drive-through facility of such a restaurant at similar sites.
- 4.2 There are principally four events associated with a customer visit to the drive-through 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.
- 4.3 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 the drive-through facility are not particularly high.
- 4.4 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 5: '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

- 4.5 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.
- 4.6 The nearest noise sensitive receptors to the proposed 'drive-thru' facility are in Chestnut Avenue (approximately 135 metres away).
- 4.7 Sharps Redmore has provided noise assessment reports for a number of proposed 'drive-thru' facilities. These assessments have used forecasted customer arrival data; usage varies depending on the site location but typically the number of customer arrivals in the peak hour can be approximately 50 events in an hour, with off peak events being typically up to 35 vehicle movements.

- 4.8 Using these typical customer vehicle movements the following overall noise levels are predicted (arrival, ordering, collection and departure) at Chestnut Avenue. The full calculations are presented at Appendix B.

TABLE 6: Predicted 'drive-thru' activity noise levels

Receptor location	Noise level dB		
	Peak hour $L_{Aeq, 1 \text{ hour}}$	Off peak $L_{Aeq, 1 \text{ hour}}$	Peak noise L_{Amax}
Chestnut Avenue	36	35	40

- 4.9 It can be seen that the noise levels predicted to arise from 'drive thru' activity at the proposed KFC restaurant fall well within the WHO guideline values for daytime noise (50-55 dB $L_{Aeq T}$), and would also comply with night time guideline noise values (45 dB $L_{Aeq T}$ and 60 dB L_{Amax})

5.0 Noise from car parking

- 5.1 This assessment considers KFC customer car parking activity noise in the context of guideline noise values.
- 5.2 Surveys of noise levels at the boundaries of drive thru car parks have shown that levels range from $L_{Aeq1hr} = 43$ dB to 48 dB at a distance of 10 metres. The baseline noise value of $L_{Aeq\ 1\ hour} = 48$ dB is considered a robust (worse case) baseline maxima to apply to peak trading hours, whilst the lower value of 43 dB $L_{Aeq\ 1\ hour}$ is appropriate to use to assess off peak trading conditions. Peak noise levels of 66 dB L_{Amax} at 10 metres have been measured from car door slams.
- 5.3 This baseline noise source data includes noise from typical drive thru activity such as cars pulling into the car park, manoeuvring into parking spaces, door slams and vehicle departures.
- 5.4 Taking into account the distance attenuation the predicted noise levels from peak hour car parking activity at Chestnut Avenue would be 27 dB $L_{Aeq\ 1\ hour}$ (48 dB at 10 metres – 20 log (10/110=-21 dB)) and during off peak trading conditions 22 dB $L_{Aeq\ 1\ hour}$. Peak noise levels of 45 dB L_{Amax} could be expected at Chestnut Avenue.
- 5.5 Predicted ambient and peak car park noise levels comfortably comply with the WHO daytime (0700 to 2300 hours) and night time (2300 to 0700 hours) guideline noise values.
- 5.6 Typically peak hour trading at the KFC would likely be during the early evening periods.

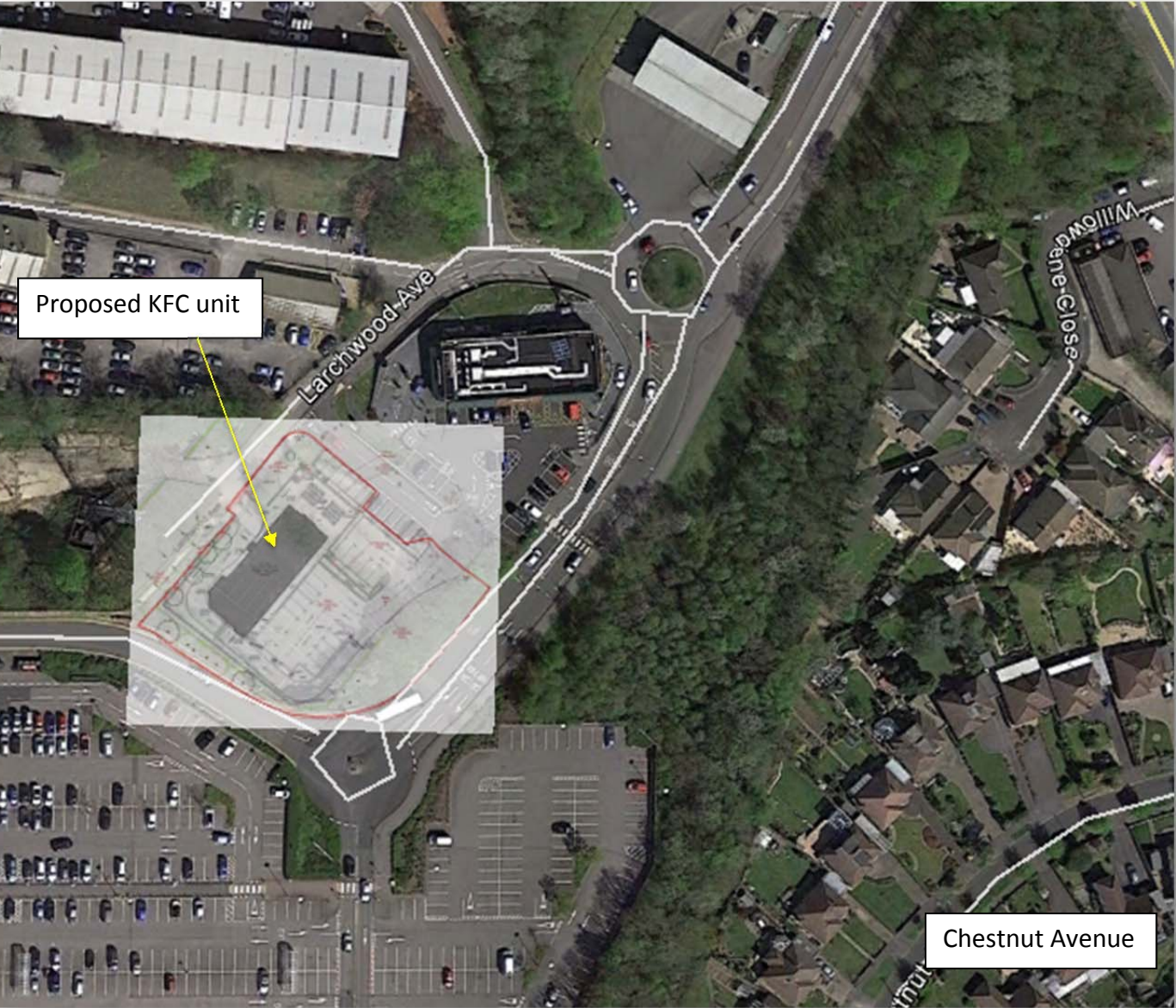
6.0 Assessment conclusions

- 6.1 Having undertaken this assessment against objective criteria it is concluded that noise from the operation of the proposed KFC restaurant and 'drive-thru' at Larchwood Avenue, Bedhampton will not adversely affect the amenity of the nearby residents.
- 6.2 The rating noise level of fixed plant will be designed and controlled so as to not exceed the existing typical background noise climate or a rating level of 35 dB, whichever is the higher.
- 6.3 Noise from 'drive-thru' and customer car parking activity would comply with WHO guidance values.
- 6.4 It is concluded, therefore, that the proposed KFC restaurant with 'drive-thru' facility could trade on a similar basis to the adjacent restaurant and drive thru unit (0600 to 2300 hours) without associated noise causing significant adverse effects in accordance with both national and local policy aims.

APPENDIX A

SITE LAYOUT PLAN

Appendix A: Site plan



APPENDIX B

'DRIVE THRU' NOISE CALCULATIONS

Appendix B: 'Drive-thru' noise calculations: Chestnut Avenue

Ambient noise (L_{AeqT}) level predictions: Typical peak hour usage

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	50	53 dB	135 m	-23 dB	0 dB	31 dB
Ordering	70 dB	50	51 dB	135 m	-23 dB	0 dB	29 dB
Collection of order	72 dB	50	53 dB	135 m	-23 dB	0 dB	31 dB
Departure of vehicle	72 dB	50	53 dB	135 m	-23 dB	0 dB	31 dB
Overall dB L_{Aeq} 1 hour							36 dB

Ambient noise (L_{AeqT}) level predictions: off peak hour usage

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	35	52 dB	135 m	-23 dB	0 dB	29 dB
Ordering	70 dB	35	50 dB	135 m	-23 dB	0 dB	27 dB
Collection of order	72 dB	35	52 dB	135 m	-23 dB	0 dB	29 dB
Departure of vehicle	72 dB	35	52 dB	135 m	-23 dB	0 dB	29 dB
Overall dB L_{Aeq} 1 hour							35 dB

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	135 m	-23 dB	0 dB	40 dB
Ordering	61 dB	135 m	-23 dB	0 dB	38 dB
Collection of order	62 dB	135 m	-23 dB	0 dB	39 dB
Departure of vehicle	63 dB	135 m	-23 dB	0 dB	40 dB
Overall dB L_{Aeq} 1 hour					40 dB

APPENDIX C

ACOUSTIC TERMINOLOGY

Acoustic Terminology

- C1 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.
- C2 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.
- C3 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).
- C4 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 .
- C5 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.
- C6 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.
- C7 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.

- C8 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:

$$60 - 20 \log \frac{160}{10} = 60 - 24 = 36 \text{ dB.}$$