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2nd September 2020**Euro Garages**

Assessment of the noise impact of the
proposed Coffee Shop with Drive Thru,
Havant Asda, PO9 3QW.

Prepared for:-

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1.0 SUMMARY

The proposed development is located in an area where the noise climate is dominated by traffic on the nearby main roads and of course the traffic accessing the main Asda site. The proposed activity will therefore have the character of the existing activity and so should be aurally indistinguishable from it. Other sources such as mechanical equipment are unlikely to be audible at residential properties.

Overall modelled noise levels are based on a fairly extreme worst case of the busiest 1-hour period of a weekday assumed to persist throughout the entire day and evening from 07:00 to 23:00. Predicted levels are well within BS 8233 criteria and well below levels which would rate under BS 4142 as *“low Impact depending on the context”*.



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P J Durell

2.0 INTRODUCTION

ADC was instructed by Euro Garages to carry out an independent assessment of the above site with regards to its suitability from a noise perspective for development as Coffee Shop including Drive Thru. The purpose of the assessment is to establish the potential noise impacts associated with the development.

This report begins by summarising assessment standards and, where appropriate, discusses alternative interpretations.

After a brief statement of survey details we discuss basic results and the resulting assessment. The feasibility of achieving the criteria is discussed along with any recommendations for mitigation.

3.0 ASSESSMENT STANDARDS

3.1 NPPF, NPSE and NPPG

The National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the National Planning Practice Guidance (NPPG) provide nothing in the way of quantitative criteria but instead provide general policy aims and statements and some guidance on how certain situation can be interpreted.

The NPPF's main statement on noise is to be found in paragraph 180:-

- 180 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^(footnote here refers to NPSE – see below);
 - 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.

Paragraph 182 is also relevant:-

- 182 Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

The NPPF refers to the NPSE which sets out the following aims:-

1. avoid significant adverse impacts on health and quality of life;
2. mitigate and minimise adverse impacts on health and quality of life; and
3. where possible, contribute to the improvement of health and quality of life.

It also introduces the concepts of:

- NOEL – No Observed Effect Level. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur.

SOAEL is clearly something the policy seeks to avoid in aim 1. Aim 2 represents situations between SOAEL and LOAEL, and seeks to minimise and mitigate the effects.

The NPPG section on noise adds some further detail, much of it reproducing the NPPF and NPSE, but some useful qualitative guidance is provided in a table as reproduced below.

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

It also makes the point that the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation, including the level of the noise in absolute terms and how it might compare with the underlying background noise, the impulsiveness or intermittence pattern of the noise, its spectral content, and the time of day. It discusses in very general terms the issues to consider when introducing noise sources to existing noise sensitive area, new residential development in areas affected by existing noise sources (most of which have their own specific guidance, such as BS 4142, BS 8233, etc.) and the potential impact on wildlife.

3.2 BS 8233

BS 8233 was updated in March 2014. Quantitatively, however, the design criteria are little changed – just expressed differently to reduce ambiguity in certain situations.

Table 4 of BS 8233 gives the desirable criteria for indoor ambient noise levels for dwellings as follows:-

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

Note that the standard accepts the widely used rule of thumb that, for a partly open window, the levels just outside will be 15dB higher than those just inside. This brings us to an external equivalent of the above table, as follows:-

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	50 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	55 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	50 dB $L_{Aeq,16hour}$	45 dB $L_{Aeq,16hour}$

It goes on to state that, where necessary, the criteria can be relaxed by up to 5 dB and still achieve reasonable conditions. Note that the new version does not explicitly state criteria for bedroom noise in terms of dB L_{Amax} .

Garden area criteria are unchanged with 50 dB L_{Aeq} and 55 dB L_{Aeq} being considered desirable and reasonable respectively.

Note that the new version of BS 8233 more explicitly specifies the assessment periods as 16 hour and 8 hour for daytime and night time respectively.

3.3 BS 4142

BS 4142 was updated in November 2014. The standard is very complicated but, basically, it 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 at industrial and/or commercial premises
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described in this British 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.

Characteristics and Context

Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, we need to add a character correction to the specific sound level to obtain the rating level.

These features can include tonality, impulsivity and intermittency with corrections typically ranging potentially from 0dB to 9 dB. Corrections at the higher end would represent characteristics which are highly perceptible in the context of the ambient noise as a whole. Corrections at the lower end would represent characteristics which are just perceptible in the presence of the ambient noise as a whole,

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. 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.

Assessment

We obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and considering the following.

- 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 source having a low impact, depending on the context.

Where the initial estimate of the impact needs to be modified due to the context, pertinent factors need to be taken into consideration, including the following.

1) The absolute level of sound.

For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

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.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound.

We need to consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

3.4 Local Authority

We understand that the LPA has requested a noise assessment.

4.0 GUIDE TO CALCULATIONS AND MODELLING

We have used the well-established CadnaA modelling software which calculates noise propagation based on the processes of *ISO 9613 : Acoustics – Attenuation of sound during propagation outdoors*. Obviously, modelling software is reliant on the inputs and assumptions. The key ones are:-

1. The ground is pessimistically assumed to be a mixture of absorptive and reflective (coefficient of 0.5 assumed).

2. The proposed site buildings and the surrounding buildings are assumed to be mainly reflective (0.5 dB loss on reflection assumed).
3. Two orders of reflection are used.
4. There are 5 main components to the modelling – Vehicle Movements, Vehicles Idling, Drive Thru Intercoms and speech, and Mechanical equipment.
5. For each of these source groups, the continuous source levels are corrected for their durations in a busy 1 hour period. More detail is given below.

Appendix 2 shows the full calculations for the assessment and the figures which are input to the model.

4.1 Visitor Numbers

We have been provided with estimated vehicle numbers using the site. These were provided by the traffic consultants, based on the TRICS database. We understand that there is discussion between the LPA and the project's Traffic Consultants but the impact on the noise assessment will be negligible.

This data covers 05:00 to 00:00 although the opening hours are likely to be far less (07:00 to 23:00 at the very most). We have used the busiest 1-hour period for daytime and have effectively assumed that the busiest 1 hour weekday period persists all day and all evening right up to 23:00. There can be no doubt that we have assumed a worst case in this respect.

The figures are given in Appendix 3.

4.2 Vehicle Movements

Vehicle movements are based on a series of 20 to 25m segments which include a vehicle pulling forwards from a standstill, accelerating to 15 km/hr, and slowing to a stop. The source of the noise data was from our own database and includes an "average" of various cars, all measured at 10m from the drive-past centre over hard ground. Each segment takes about 12 seconds. The figures are almost identical to a steady 40 to 50 km/hr drive past and so cover the steady and stop/start scenarios. Within the model, the source data is entered as a Sound Power Level per meter and calibrated to give the exact measured level at 10m from a 25m long line source. The actual line source entered can then be any length with the same Sound Power per meter. We then enter adjustments for the duration of the source data and for the number of vehicles per hour. There are of course different values for vehicle numbers using the access roads, car parks and petrol pumps. In the case of the latter, the total number of vehicles for fuel is split evenly across all pumps.

The derivation of these corrections is shown in Appendix 2.

4.3 Vehicles Idling

Idling vehicles are based on a simple point source measurement of the same vehicles idling. It has been estimated that Drive Thru vehicles will idle around 30 seconds to order and around 60 seconds to queue/pay/collect.

For each, the model includes a correction for the duration of each event per hour and a correction for the number of events per hour (the number of vehicles). The derivation of these corrections is shown in Appendix 2.

4.4 Drive Thru Intercom

Verbal communication is based on typical raised speech levels of 70 dB L_{Aeq} at 1m, which also match a McDonald's study in the USA which showed similar levels. Actual measurement is extremely difficult as they are always located in busy areas, always screened by a car, and are of course set up to be heard at only 1m or so away, and are therefore more or less inaudible, and certainly unmeasurable at greater distances. However, there is simply no reason for them be any louder than raised speech levels, so we are confident that a reasonable source is being used. The model has assumed about 20 seconds of continuous speech for ordering and a similar duration for collection. Of course it takes place at the same time as the vehicle idling.

For each, the model includes a correction for the duration of each event per hour and a correction for the number of events per hour (the number of vehicles). The derivation of these corrections is shown in Appendix 2.

4.5 Mechanical Equipment

The details of the proposed mechanical is as follows:-

- A large Mitsubishi PUHZ-RP250YKA Heat Pump Air Conditioning Unit
- Two small Elta SJ250A Extract Fans

The units are assumed to run constantly.

4.6 Other Issues

The following covers issues which are rarely a problem but which some local authorities like to see considered.

Vehicle Doors

Door closing is an impulsive event (ie. of very short duration) and so is only a relevant measure for night time. However, we discuss it briefly.

We assume that a door is opened and closed (not slammed for now) twice for every vehicle visiting Coffee shop car park. We begin with source levels for a car door opening and closing in terms of dB L_{Ax} which

is explained in the footnote¹ and dB L_{Amax} which represents the “peak”. The L_{Ax} figure is adjusted for the number of events and the total duration of the events over 1 hour (3600 seconds). This gives the 1 hour “average” dB L_{Aeq} level. Along with the “peak” dB L_{Amax} level. It is then adjusted to for distance to give levels at the houses. We show later that the impact is negligible and discuss how much more force would be required for slammed doors to make any significant impact.

Deliveries

Deliveries have not been individually modelled but are clearly going to be insignificant compared with the large number of vehicle movements assumed in the overall figures.

Speech

Speech is rarely a problem but can be roughly analysed as follows:-

Normal speech is generally 60 dB L_{Aeq} and 70 dB L_{Amax} at 1m from a person talking relentlessly without any pause. We have done a lot of work on Pub and Club smoking areas and a rule of thumb is that noise levels increase by 5 dB L_{Aeq} and 2 dB L_{Amax} per doubling of speakers². Note also that these levels are for these number of people taking continuously, unrelentingly, and without a pause. On the basis that there will be at least one person listening at any given time, and allowing for pauses, the actual number of people is generally four times the figure used in calculations.

From these source levels we correct for distance from 1m to the nearest residential locations.

Car Audio Systems

It is not realistic to treat this issue analytically but it is discussed pragmatically.

Antisocial Behaviour

It is also not realistic to treat this issue analytically but it is discussed pragmatically.

¹ L_{Ax} or SEL is a useful, but not particularly intuitive, method of processing impulsive or transient noise. Basically the noise from an event, here the opening and closing of a car door, is compressed into a 1 second period. We then adjust this level for the number of events and the time period being considered.

² It is well known that doubling the power of a sound increases the level by 3 dB. So doubling the number of people could be expected to increase the speech noise by 3 dB. However, in speech, the noisier environment causes speakers to increase the levels of their voices, typically by 2 dB per doubling of speakers. The net effect is a 5 dB per doubling for the L_{Aeq} level. The L_{Amax} level increases by 2 dB per doubling or is 1 dB above the L_{Aeq} level, whichever is the greater.

5.0 SURVEY DETAILS

5.1 Site times and Personnel

The survey on the proposed site was carried out on 18th August 2020 from approximately 12:00 to 23:00. The survey work was carried out by Andrew Frisby of ADC Acoustics.

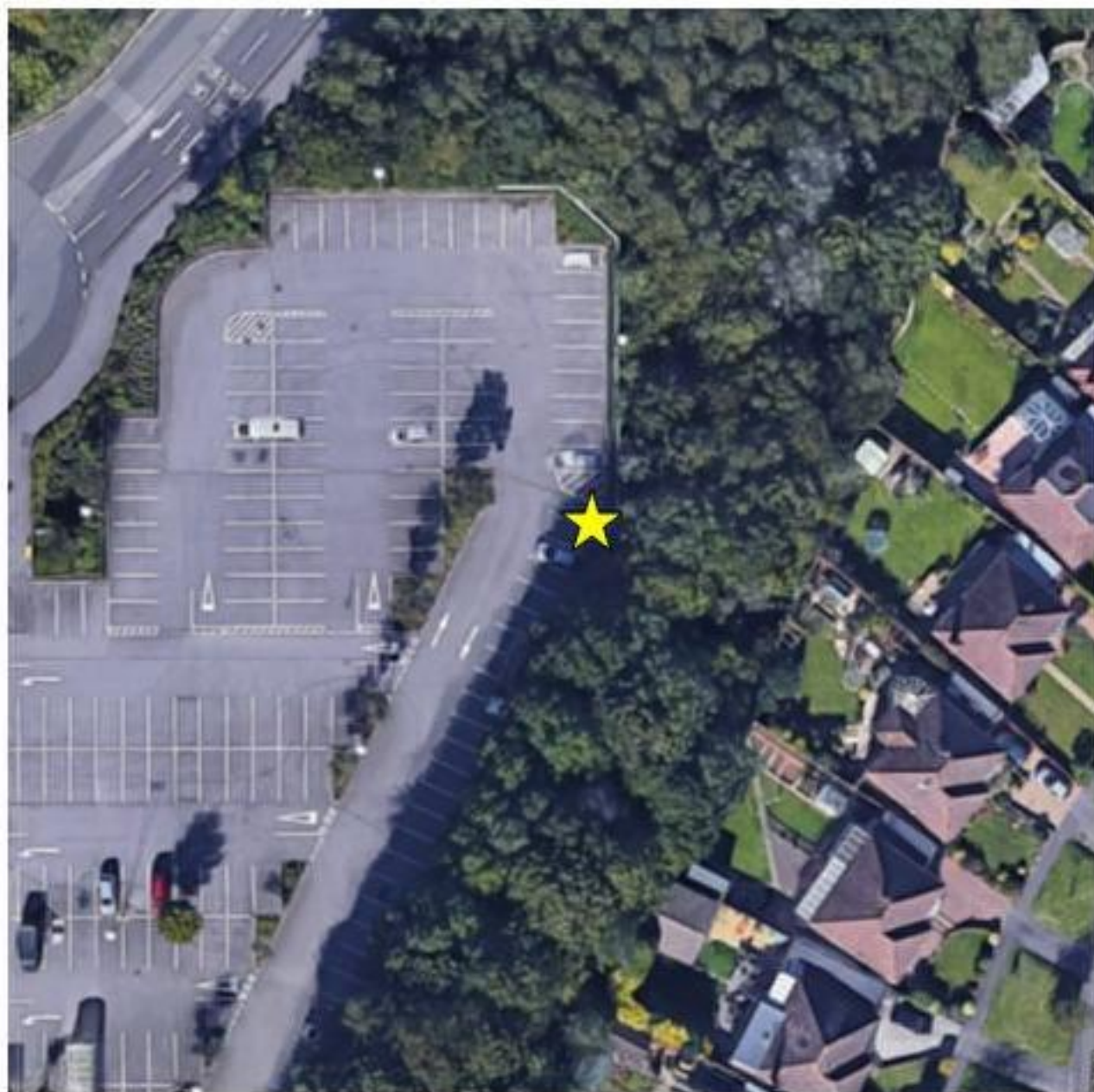
5.2 Instrumentation

Instrumentation used was a Norsonics NOR140. This is a Class I sound level meter which holds a current calibration certificate and which was field-calibrated as necessary. The meter was set up to measure consecutive 15 minute samples of background noise.

All measurements have been gathered in terms of dB L_{eq} , dB L_{max} and dB L_{90} in overall A-weighted terms, and in octave bands across the frequency range. See Definition of Acoustic Terms in Appendix 1.

5.3 Measurement Positions

The main measurement position was as shown by the yellow star on the plan below.



The position was clearly chosen to represent the nearest houses to the site. The microphone was approximately 1.5 m above the ground.

5.4 Survey Conditions

Weather conditions on were as follows :-

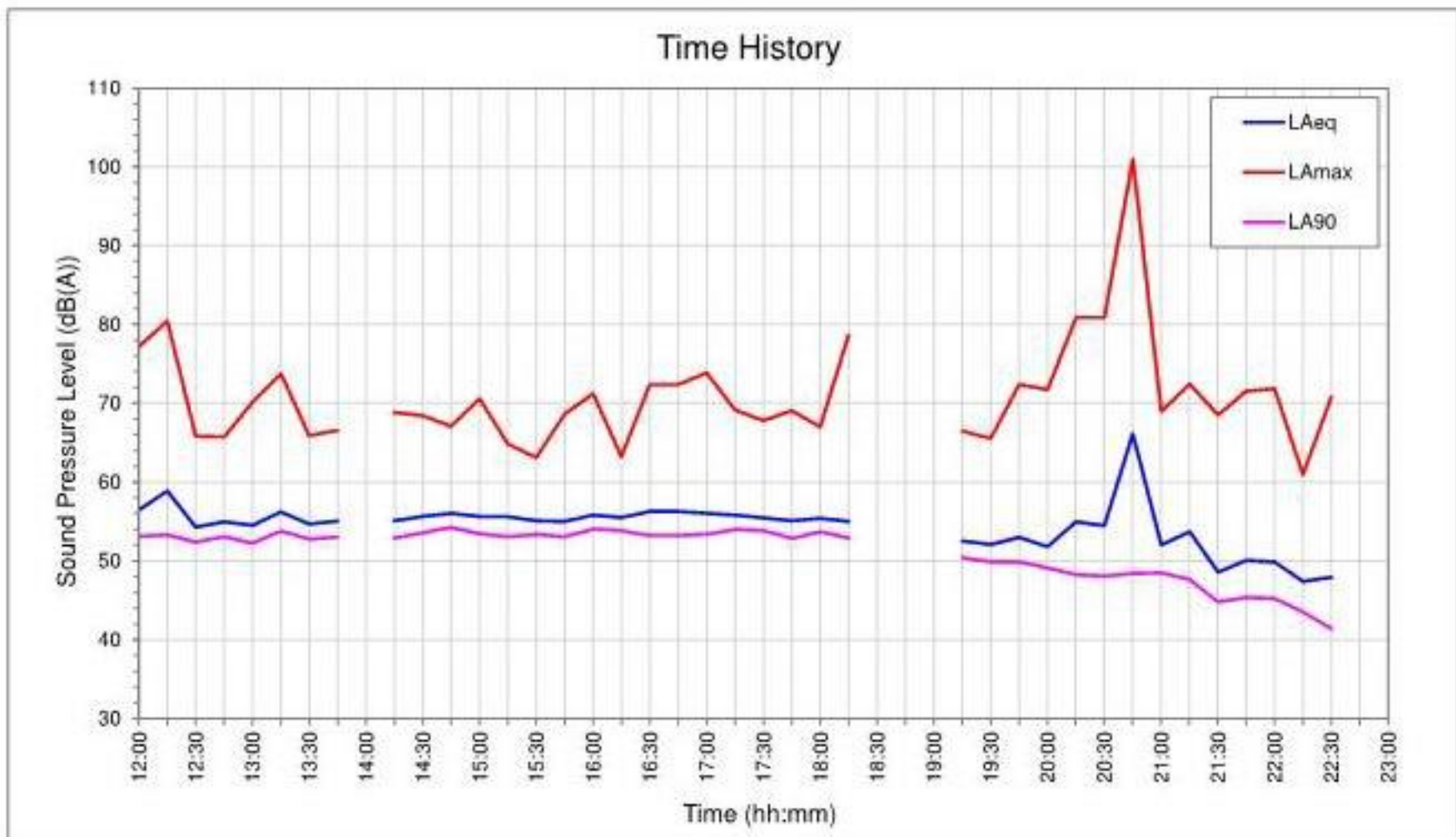
Rain : none, dry roads after 1st hour
Cloud : mostly 100%
Temperature : 21 to 24 Celsius
Wind : mainly negligible, occasional light "gusts"

The general noise climate appeared to be normal and representative and was completely dominated by traffic on the nearby main roads. We cannot know for sure how much impact the current Covid situation had on noise levels but, if anything the level are likely to have been less than usual, ie. making for a *more* robust assessment.

6.0 RESULTS AND DISCUSSIONS

6.1 Noise Survey Results

Results of existing noise measurements are presented graphically as follows:-



A summary of the lowest 15 minute periods (lowest in terms of the dB LA90 index) is as follows:-

Time Period	Index	dB(A)
Lowest Daytime Period (In terms of LA90)	Leq	55
	Lmax	70
	L90	52
Lowest Evening Period (In terms of LA90)	Leq	48
	Lmax	71
	L90	41

Very importantly, BS 4142 does not require the lowest measurements to be used as the representative Background Sound Level. However, we have used the lowest 15 minute periods here as a means of assuming a worst case, for instance to mitigate for variations on different days.

6.2 Results of Modelling

Full details of sources are given in Appendix 2 and methods and assumptions described in Section 4.0 above. The results of the modelling of the busiest 1-hour periods are shown below.



Vehicle routes are the pale blue lines and the point sources (pumps, mechanical equipment, intercoms, idling, etc) are shown as yellow crosses. The magenta line is the boundary fence, and the coloured numbers are the noise levels at the residential facades (note that the software automatically selects the noisiest floor level).

As described in section 4 above, the figures represent the busiest 1-hour period of a weekday and are assumed to persist throughout the day and evening up to 23:00. There can be no doubt that such assumptions represent a significant worst case.

6.3 Mitigation

No mitigation is assumed and none is necessary. The boundary fence is built in but is not relied upon as it makes a 2 to 3 dB difference at first floor level. Also, there is presumably garden fencing as well, which is ignored. The woodland is also ignored.

6.4 Overall Assessment

The first crucial point is that the predicted noise is dominated by traffic. The existing noise climate is also dominated by traffic and so we suggest that the predicted noise climate will be aurally indistinguishable from it. The Drive Thru intercoms, mechanical equipment, etc. make negligible impact. It would be entirely appropriate therefore to assess the predicted levels against BS 8233. The predicted levels are clearly well within them, even if we assume that the busiest weekday 1 hour period is maintained through the entire day and evening.

Vehicles within the site are included in the scope of BS 4142 but we would argue that it is not entirely appropriate in this case as the character and context is unlikely to change in any perceivable way (ie. dominated by traffic). However a BS 4142 assessment would be as follows:-

Specific Sound Level:	27 dB LAeq
Feature Corrections ³	
tonality:	0 dB LAeq
impulsivity:	0 dB LAeq
intermittency:	0 dB LAeq
other:	0 dB LAeq
Rating Level:	27 dB LAr
Lowest Background Sound Level:	41 dB LA90
Rating Level Excess re. Background	-14 dB

This is substantially below what BS 4142 rates as *"low impact depending on the context"*.

The context of course is one of existing general traffic noise and general activity on the Asda carpark. We would expect the impact to be essentially zero.

6.5 Discussion of Uncertainty

BS 4142 requires us to:

"Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty".

³ The noise is clearly not impulsive or tonal. It will be intermittent at source but unlikely to be even audible at the houses. Therefore, no character/feature corrections apply.

The measurements of Background/Residual Sound were taken at times regarded as representing busy periods for the Coffee Shop and quiet periods in terms of existing background levels. BS 4142 does not state what would be a representative background noise but there is certainly no suggestion that it should be the lowest. We have also taken the results at face-value, whereas the current covid situation would suggest that levels would normally be expected to be lower.

Source data taken for the vehicles, etc can of course vary but is based on a lot of measurements and we would expect this uncertainty to be compensated for by the numerous worst case assumptions listed throughout the report.

Varying meteorological conditions can have an impact on results but this should be low at the distances involved here.

Most importantly, the assessment result is nowhere near any margins where uncertainty would be a concern.

6.6 Other Issues

Sometimes queries are raised regarding Vehicle Doors, Speech, Car Audio Systems and Antisocial Behaviour.

These issues are rare on a site like this but we can offer the following discussion for completeness.

Vehicle Doors

This is only a night time issue but we discuss it here for completeness.

It is our firm view that door slamming is infrequent in nearly all situations. It cannot be said never to happen, but it should not be taken as normal. The method of calculation is described in Section 4.

Normal door opening and closing is calculated to give worst case 1 hour night time levels at the houses of 18 dB L_{Aeq} and 43 dB L_{Amax} , not including the presence of the boundary and garden fences. This is for the peak daytime period. These are at least 17 dB below any reasonable criteria, even if this were to occur throughout the night. If it were to occur through the night, then doors would need to be slammed with 50 times the energy used in the calculations. It is clear, therefore that doors are exceptionally unlikely to be a problem.

Speech

Notwithstanding antisocial behaviour (see later), we can see no reason why there would be significant amounts of speech other than small numbers of customers sitting outside. However, at the distances involved, very large numbers would be able to have conversations outside before there is any realistic risk of disturbance.

Normal speech is generally 60 dB L_{Aeq} and 70 dB L_{Amax} at 1m from a person talking relentlessly without any pause. We have done a lot of

work on Pub and Club smoking areas and a rule of thumb is that noise levels increase by 5 dB L_{Aeq} and 2 dB L_{Amax} per doubling of speakers⁴.

For an evening period it would require 21 people talking continuously, unrelentingly, and without a pause before levels would be comparable with existing levels, even without considering the acoustic fencing. Bearing in mind that in order for someone to be talking constantly there would need to be at least one person listening. In practice, for a given number of people to be constantly talking, there is likely to be around four times as many people in total. So we can see clearly that the numbers of people required are substantially in excess of anything that is likely.

Car Audio Systems

This is not something which we can deal with analytically. There is clearly no denying that an open top car with a loud sound system can cause disturbance, and that nearly all sound systems would not be a problem with hard top cars and the windows closed. However, notwithstanding antisocial behaviour (see later), our own experience is that we very rarely see it and we would suggest that the chances of disturbance are minimal.

Antisocial Behaviour

Clearly antisocial behaviour can cause disturbance, including speech, and including unreasonable use of car audio systems. However, responsible operators should be able to implement reasonable controls.

7.0 CONCLUSIONS/RECOMMENDATIONS

The proposed development is located in an area where the noise climate is dominated by traffic on the nearby main roads and of course the traffic accessing the main Asda site. The proposed activity will therefore have the character of the existing activity and so should be aurally indistinguishable from it. Other sources such as mechanical equipment are unlikely to be audible at residential properties.

Overall modelled noise levels are based on a fairly extreme worst case of the busiest 1-hour period of a weekday assumed to persist throughout the entire day and evening from 07:00 to 23:00. Predicted levels are well within BS 8233 criteria and well below levels which would rate under BS 4142 as *"low Impact depending on the context"*.

No mitigation is required.

⁴ It is well known that doubling the power of a sound increases the level by 3 dB. So doubling the number of people could be expected to increase the speech noise by 3 dB. However, in speech, the noisier environment causes speakers to increase the levels of their voices, typically by 2 dB per doubling of speakers. The net effect is a 5 dB per doubling for the L_{Aeq} level. The L_{Amax} level increases by 2 dB per doubling or is 1 dB above the L_{Aeq} level, whichever is the greater.

Appendix 1

Definition of Acoustic Terms

The Decibel

The decibel is the basic unit of noise measurement and is denoted dB. Technically, it is a means of expressing the difference in noise level between the measured noise and a standard level of noise. Most often the threshold of human hearing is used as the standard reference but it really should be stated. The threshold of human hearing is a sound pressure of $20\mu\text{Pa}$ or a sound power of 1pW .

A sound pressure level or SPL should be expressed in dB(re. $20\mu\text{Pa}$). A sound power level or SWL should be expressed in dB(re. 1pW). If the reference levels are omitted, it will often (but not always) be safe to assume that they are referenced to the threshold of human hearing.

A-Weighting and dB(A)

The human hearing system responds differently to different frequencies. The A-weighting system takes account of this by emphasising mid and high frequencies more than low frequencies to give an overall level. An A-Weighted noise level, therefore, reflects the way normal, healthy hearing would perceive the overall level of the noise. The basic unit is dB(A), although other systems of expressing an A-weighted levels are discussed below.

Other weighting systems, such as C-Weighting, denoted dB(C), reflect the human hearing system's response at higher noise levels.

NR and NC Levels

NR curves and NC curves are a series of curves representing noise levels across the frequency range. A given noise climate has an NR level or NC level if it equals a point on the curve at any frequency. They are particularly, although by no means exclusively, used as a means of specifying noise limits in an indoor environment, for instance from mechanical services or traffic noise break-in from the outside. They are typically expressed as NR or NC followed by a number, e.g. NR40, NC55, etc.

Equivalent Continuous Sound Level, L_{eq}

This can be simplistically described as a way of expressing the average noise level.

The unit is dB L_{eq} . For A-weighted levels the unit is dB(A) L_{eq} or, in more modern units, dB L_{Aeq} .

Maximum Level, $L_{\max}$

This is the maximum level reached (usually for a fraction of a second) in the measurement period.

The unit is dB $L_{\max}$. For A-weighted levels the unit is dB(A) $L_{\max}$ or, in more modern units, dB $L_{A\max}$.

Statistical (Percentile) Levels, L_n

During a measurement of fluctuating noise, it is often useful to establish the levels exceeded for a percentage of the time. L_n is the index representing the level exceeded for $n\%$ of the measurement period.

The unit is dB L_n . For A-weighted levels, the unit is dB(A) L_n or, in more modern units, dB L_{An} .

Common examples are as follows :-

dB L_{A90} is the A-weighted level exceeded for 90% of the time and is often used to describe the underlying background noise.

dB L_{A50} is the A-weighted level exceeded for 50% of the time. Mathematically, it is the median, another kind of average.

dB L_{A10} is the A-weighted level exceeded for 10% of the time and has traditionally been used to describe the intermittent highs in the noise climate such as passing cars or aircraft.

Frequency Analysis

Here the audible frequency range is divided up into bands and the noise level is expressed in each frequency band from low pitches to high pitches.

Octave Band analysis is where the frequency range is divided into 8 bands from 63 Hz to 8kHz, or sometimes into 10 bands from 31.5 Hz to 16kHz.

1/3 Octave Band analysis provides more detailed subdivision into 24 bands from 50 Hz to 10kHz, or sometimes into 30 bands from 20Hz to 20kHz.

Narrow Band analysis takes this further with the possibility of many thousands of bands, possibly only 1Hz wide, or even less.

In all types of frequency analysis, the level in each band can be expressed in terms of L_{eq} , $L_{\max}$, L_n , etc. as defined above.

Sound Insulation

Sound insulation is best expressed across the frequency range in octave bands or third octave bands. Often, however, in known environments such as domestic sound insulation and speech privacy, it is simpler to express the sound insulation as a single figure. A higher value means better sound insulation.

The most common ways are dB D_{nTw} , dB R_w and dB_(mean 100-3150Hz). The first two are ways of expressing average sound insulation, weighted to account for speech frequencies. The third is simply an un-weighted mean value.

The Building Regulations Approved Document E (ADE) routinely refer to $D_{nTw} + C_{tr}$. The C_{tr} term is a negative number which is used to modify the D_{nTw} value for the insulation properties at lower frequencies.

ADE also uses the L_{nTw} index for impact sound transmission. It is a measure of the level of noise in the room below a room in which a standard tapping machine is being used. It represents the impact sound transfer such as footfall noise, scraping chairs, washing machines, etc. A lower value means better insulation.

Reverberation Time

The most common measure of Reverberation Time is, effectively the time taken for sound from a steady source to decay by 60 dB after it has been abruptly cut off. In practice it is often difficult to measure a 60 dB decay and so decays of 30 dB, 20 dB, or even 10 dB are often used and adjusted pro rata, although the exact measure is not quite the same.

Reverberation Time is generally expressed as RT in seconds. We may, if we are being precise, add subscripts 60, 30, etc. to show whether the basis of the measure is 60 dB decay, 30 dB decay, etc. E.g. the $RT_{60} = 0.52s$, the $RT_{30} = 0.49s$, etc.

RT can be expressed in octave bands or 1/3 octave bands across the frequency range, or at central frequencies such as 500 Hz or 1kHz.

Appendix 2

Calculation Details

Modelling Inputs

Source Data

Description	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Car Drive Past	Leq	53	70	53	53	50	46	43	39	34
25m/12s long - pull away, pass at 10m, and stop	Lmax	57	73	60	59	53	50	47	44	38
Car Idling at 10m	Leq	46	59	44	42	44	40	38	35	29
Car Door	SEL	58	69	65	60	57	48	46	42	33
5m - Average of 16 open and close of driver's door	Lmax	63	75	71	66	61	52	51	45	34
Intercom/Raised Speech at 10m	Leq	50	20	44	46	51	41	42	35	32
	Lmax	60	30	52	56	60	52	53	45	45
Conversational Speech at 10m	Leq	40	21	40	41	39	34	30	29	22
	Lmax	50	31	46	47	49	44	41	40	34
Mitsubishi PUHZ-ZRP71VHA A/C Unit at 1m	Leq	48	52	53	51	45	42	37	31	27
Mitsubishi PUHZ-RP250YKA A/C Unit at 1m	Leq	60	64	65	63	57	54	49	43	39
Elta SJ250A Extract Fan at 3m at 1m	Leq	53	31	35	43	48	49	45	45	44

1 Hour Levels for Coffee Shop

Length of Vehicle Source Segment 25 m
Duration of Vehicle Segment 12 s
Correction for the Duration of a Segment -25 dB

Description	Activity	Day	Even	Night
Number of Vehicles per hour	DT	9	9	0
	Park	13	13	0
	Total	21	21	0
Correction for number of Cars (dB)	DT	9	9	n/a
	Park	11	11	n/a
	Total	13	13	n/a
Overall Correction for Cars (dB)	DT	-15	-15	n/a
	Park	-14	-14	n/a
	Total	-11	-11	n/a

Ordering idling duration per vehicle 30 s
Queuing/Collection Idling duration per vehicle 60 s
Ordering Intercomm/Speech duration per vehicle 20 s
Queuing/Collection Speech duration per vehicle 20 s

Correction for Ordering Idling -21 dB
Correction for Queuing/Collection Idling -18 dB
Correction for Ordering Intercom/Speech -23 dB
Correction for Queuing/Collection Speech -23 dB

Description	Activity	Day	Even	Night
Correction for number of Cars (dB)	DT	9	9	n/a
Overall Correction for Ordering Idling (dB)	DT	-11	-11	n/a
Overall Correction for Collection Idling (dB)	DT	-8	-8	n/a
Overall Correction for Ordering speech (dB)	DT	-13	-13	n/a
Overall Correction for Collection Speech (dB)	DT	-13	-13	n/a

Vehicle Doors

Number of closes (Peak Hour) 43 (2 per vehicle)

Description	Dist (m)	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Overall Levels at Source	5	Leq	38	50	46	40	37	28	26	23	14
		Lmax	63	75	71	66	61	52	51	45	34
Overall Levels at Houses	50	Leq	18	30	26	20	17	8	6	3	-6
		Lmax	43	55	51	46	41	32	31	25	14

Voices

Number of People talking Outside - Evening 21

Description	Dist (m)	Index	dB(A)	63	125	250	500	1k	2k	4k	8k
Conversational Speech Levels at Source	10	Leq	62	43	61	63	61	55	52	51	43
		Lmax	63	44	62	64	62	56	53	52	44
Conversational Levels at Houses	50	Leq	48	29	47	49	47	41	38	37	29
		Lmax	49	30	48	50	48	42	39	38	30

Appendix 3
Vehicle Counts

TRICS Source Data

Times			TRICS DT Coffee Shop Figures are IN+OUT per 100m2		
			Drive Thru 40%	Park Up 60%	Total 100%
07:00	-	08:00	4.273	6.410	10.683
08:00	-	09:00	6.300	9.449	15.749
09:00	-	10:00	5.235	7.852	13.087
10:00	-	11:00	3.870	5.805	9.675
11:00	-	12:00	5.291	7.936	13.227
12:00	-	13:00	8.425	12.638	21.063
13:00	-	14:00	8.607	12.910	21.517
14:00	-	15:00	6.924	10.385	17.309
15:00	-	16:00	6.823	10.234	17.057
16:00	-	17:00	7.196	10.794	17.990
17:00	-	18:00	7.518	11.278	18.796
18:00	-	19:00	7.760	11.640	19.400
19:00	-	20:00	7.398	11.096	18.494
20:00	-	21:00	4.898	7.347	12.245
21:00	-	22:00	3.215	4.822	8.037
22:00	-	23:00	1.951	2.927	4.878
23:00	-	00:00	0.000	0.000	0.000
00:00	-	01:00	0.000	0.000	0.000
01:00	-	02:00	0.000	0.000	0.000
02:00	-	03:00	0.000	0.000	0.000
03:00	-	04:00	0.000	0.000	0.000
04:00	-	05:00	0.000	0.000	0.000
05:00	-	06:00	0.000	0.000	0.000
06:00	-	07:00	0.000	0.000	0.000

Adjustments to Source Data

Source Data Feature	TRICS DT Coffee Shop	
Source counts per visit	2	
Model counts per visit	1	
Adjustment per visit	x	0.5
Pump no. of source data	-	
Actual Pump Number	-	
Adjustment for Pump Nos.	x	1
Area for source data	100	m2
Actual Area	200	m2
Adjustment for Area	x	2
Total Adjustments	x	1

Adjusted TRICS Levels

Times			TRICS DT Coffee Shop Figures are total visits per hour		
			Drive Thru	Park Up	Total
07:00	-	08:00	4.273	6.410	10.683
08:00	-	09:00	6.300	9.449	15.749
09:00	-	10:00	5.235	7.852	13.087
10:00	-	11:00	3.870	5.805	9.675
11:00	-	12:00	5.291	7.936	13.227
12:00	-	13:00	8.425	12.638	21.063
13:00	-	14:00	8.607	12.910	21.517
14:00	-	15:00	6.924	10.385	17.309
15:00	-	16:00	6.823	10.234	17.057
16:00	-	17:00	7.196	10.794	17.990
17:00	-	18:00	7.518	11.278	18.796
18:00	-	19:00	7.760	11.640	19.400
19:00	-	20:00	7.398	11.096	18.494
20:00	-	21:00	4.898	7.347	12.245
21:00	-	22:00	3.215	4.822	8.037
22:00	-	23:00	1.951	2.927	4.878
23:00	-	00:00	0.000	0.000	0.000
00:00	-	01:00	0.000	0.000	0.000
01:00	-	02:00	0.000	0.000	0.000
02:00	-	03:00	0.000	0.000	0.000
03:00	-	04:00	0.000	0.000	0.000
04:00	-	05:00	0.000	0.000	0.000
05:00	-	06:00	0.000	0.000	0.000
06:00	-	07:00	0.000	0.000	0.000