PO Box 1030, Warrington, Cheshire WA4 9FJ
t. 01925 723333 www.adcacoustics.co.uk

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Hallmark Developments (NW) Ltd

Assessment of noise at the Former Dexine Site, Rochdale, OL12 6AU, for proposed redevelopment, including demolition of the existing mill building and other site buildings, and the erection of industrial units and dwellings.

Prepared for :-

Hallmark Developments (NW) Ltd
132 Manchester Road
Rochdale
OL11 4JQ

Prepared by :-

Andrew Raymond

ADC Acoustics is a trading name of Acoustic Design & Control Limited
Registered Office: One City Place, Queens Road, Chester, CH1 3BQ Registered in England and Wales 5117653

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1.0 SUMMARY

The general noise climate was dominated at all times by the noise from traffic on the A680 Spotland Road and, to a much lesser extent, traffic on the A6060 Mellor St. There was also noise from surrounding industrial units off site, including occasional loud bangs.

The proposed residential units have been assessed against the noisiest times of day and night. All proposed facades should be adequate with basic thermal double glazing and non-acoustic vents, apart from habitable rooms overlooking Spotland Road which will require acoustic vents (or a whole house system which requires no external vents) and upgraded acoustic glazing.

The proposed industrial units have all been modelled as B2 uses with assumed activity levels likely to represent a somewhat extreme worst case, including cars, HGV deliveries, internal noise break-out and mechanical equipment. Apart from the possible exception of Units 2, 4 and 8 there is no reason why all units should not be able to operate within reasonable levels, apart from HGV deliveries which may be unacceptable during the evening and night.





A R Raymond

P J Durell

2.0 INTRODUCTION

ADC was asked to carry out an independent assessment of the above site with regards to its suitability for redevelopment, including demolition of the existing mill building and other site buildings, and the erection of industrial units and dwellings, from a noise perspective.

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, along with any mitigation which might be implied. We sum-up and conclude at the end, along with brief recommendations.

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 BS4142, BS8233, etc.) and the potential impact on wildlife.

3.2 BS8233/WHO Guidelines

BS8233 was updated in March 2014. Quantitatively, however, the design criteria are little changed – just expressed differently to reduce ambiguity in certain situations. The criteria are very similar to those of the recently superseded WHO Guidelines for Community Noise.

Table 4 of BS8233 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 BS8233 more explicitly specifies the assessment periods as 16 hour and 8 hour for daytime and night time respectively.

3.3 BS4142

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:

a) sound from industrial and manufacturing processes

b) sound from fixed installations which comprise mechanical and electrical plant and equipment

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises

d) 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 are not aware of any requirements from the local authority that this stage.

4.0 GUIDE TO MODELLING

The modelling has essentially been done in three parts.

Firstly, the existing noise climate was assessed on the current site. The proposed site is clearly very different and so the existing sources of noise (surrounding roads, commercial premises, etc) will be different with the new layout, so this has to be established.

Secondly we have the impact of future noise levels to the front and rear facades of the proposed residential units and external noise break-in to the proposed habitable rooms is then calculated.

Finally, the noise from proposed industrial uses is modelled to give predicted levels at the existing residential properties.

4.1 General

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 mainly reflective (coefficient of 0.25 assumed).

2. Calculations are based on two orders of reflections.

3. The proposed site buildings and the surrounding buildings are assumed to be mainly reflective (0.5 dB loss on reflection assumed).

4. The fencing and walls around the existing and proposed sites are assumed to be mainly reflective (again 0.5 dB loss on reflection assumed).

4.2 Existing Site Set-Up

As the site is currently undeveloped, some modelling is required to derive the noise affecting proposed facades, some of which will be heavily screened from the main sources and some of which will be more exposed. The image below shows the result of a modelling exercise using the CadnaA software. Note that it is not intended to be a full-blown traffic noise modelling process - its purpose is simply to show how the noise can be expected to vary between the current and proposed site layouts.

1. The main surrounding roads are set up as line sources 0.5 m above the ground.

2. The immediately surrounding buildings are entered which act as both screens and reflectors.

3. The model was then set up to represent the current measurement conditions, ie. no development at this stage. We then set up the sound power generated by the roads so as to reproduce the levels measured at the measurement positions. The following image shows the results. Note that the image is cropped and the roads continue some distance each way in the actual model. The line sources for the roads are shown by pale blue lines and the buildings are beige. The magenta lines are existing walls. The receiver positions are the harlequined circles and represent the site measurement positions.



4. This result is a “calibrated” model from which we go on to enter the actual site plan.

5. The proposed buildings are then entered with the same reflective properties assumed.

6. A selection of receiver positions is entered to represent different external facades.

4.3 Proposed Industrial Units

1. We cannot know what type of uses each unit will be put but they are likely to comprise a combination of visiting cars and deliveries, activities within the units breaking out through walls and roof, and external mechanical equipment.

2. Vehicle movements are based on a series of 20 to 25 m segments which include a vehicle pulling forwards from a standstill, accelerating to 20 km/hr, and slowing to a stop. The source of the noise data was from our own database, measured at 10 m 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 10 m from a 25 m 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.

HGVs are approximately 12 dB louder at these speeds and are entered as separate sources taking largely the same routes but some slight differences (eg. car parks for cars and turning circles for HGVs).

The derivation of these adjustments is shown in Appendix 2.

3. Noise within the industrial units is pessimistically assumed to be 85 dB L_{Aeq} at worker positions. For an 8 hour day, anything above this would require action to reduce operator exposure and so it should represent a pessimistic assumption, especially given that it is assumed to take place continuously in all units. We have pessimistically estimated that this will be equivalent to a level of 80 dB L_{Aeq} across all internal surfaces of the walls and roofs. We have assumed that the building envelopes are typical industrial cladding such as Kingspan KS100 RW.

4. Source data for potential mechanical equipment is taken from data sheets for Mitsubishi air con and inverter external units, published data is well known and easily accessible. As typical examples, all units have been given a Mitsubishi PUHZ-ZRP71VHA. The larger units have also been given an additional Mitsubishi PUHZ-RP250YKA.

4.4 <u>External Noise Break-in to Proposed Residential Units</u>

The basic approach is as follows.

1. The external noise break-in is based on the level of external noise just outside the façade(s), the area of the façade(s), the sound insulation properties of the façade(s) and the internal absorption of the room.

2. The first input to the calculation process is the area of the exposed façade. Where more than one façade is exposed, then they can all be entered. The room depth is also entered so as to derive the room volume. Where the room is not a straight forward rectangular shape, an “effective depth” is sometimes entered so as to derive the approximate room volume. Judgement may occasionally be used if the room is not simple, such as a very unusual shape or a multi-use room such as a through-kitchen/dining room/living room, or studio-style area.

3. The reverberation time (RT) is entered. Usually this is a standardised 0.5 seconds and represents the absorption properties of the room.

4. Two corrections result from the above inputs. Firstly, we have the Area Correction. Put simply, the greater the exposed area, the more noise will break in. The correction is 10 x log(Effective Area) and is usually a positive number. Note that the “Effective Area” takes account of the method of modelling vents – see later. The Room

Correction takes account of the room absorption (more absorption reduces the noise) and the room volume (a larger volume disperses, and so reduces, the noise). The correction is 10 x log(RT/0.163/Volume) and is usually a negative number.

5. These corrections, together with the sound insulation properties of the façade(s) give us the basic outside-to-inside level difference. The sound insulation properties of the façade(s), known as the Sound Reduction Index (SRI or just R) are effectively the sound insulation of $1m^2$ of material (apart from vents – see later). Of course, a façade is usually made up of more than one element – windows and walls for instance. The overall SRI or R is referred to as the Composite SRI or composite R and is related to the SRI or R or the individual elements and their respective areas. SRI or R figures are usually based on laboratory tests and therefore somewhat idealised.

6. An additional complication is that performance data for vents is generally standardised to $10m^2$. The area of a vent is therefore usually entered as $10m^2$, even though its actual area will usually be nowhere near that much.

7. So, the composite SRI or R, combined with the areas and room corrections gives us the basic level difference to be expected under perfect (laboratory) conditions. However, actual site conditions are affected by workmanship, which can never be guaranteed to be perfect, and flanking paths (noise paths other than straight through the façade(s)). We add a generous 5 dB allowance for this.

8. The process is repeated in octave bands across the frequency range to derive the predicted internal levels.

5.0 SURVEY DETAILS

5.1 Site Times and Personnel

The measurements were carried out by Mark Pickering of ADC Acoustics.

Measurements were mainly carried out from the afternoon of 19th August 2019 through to the end of rush hour the following morning. Times were approximately as follows:-

- 16:00 to 18:00 at Position 2 to represent rush hour.
- 23:00 to 01:00 at Positions 1 and 2 to represent early night time
- 07:00 to 09:00 at Position 1 to represent rush hour

These periods are likely to cover the *noisiest* times and are used for assessing the external noise break-in to the proposed dwellings.

For the impact of the proposed industrial units on the existing and proposed residential properties, the following periods were also assessed:-

- 13:30 to 15:30 at Position 1 to represent non-rush hour daytime.
- 22:00 to 23:00 at Position 1 to represent late evening
- 01:00 to 07:00 at Position 1 to represent through the night

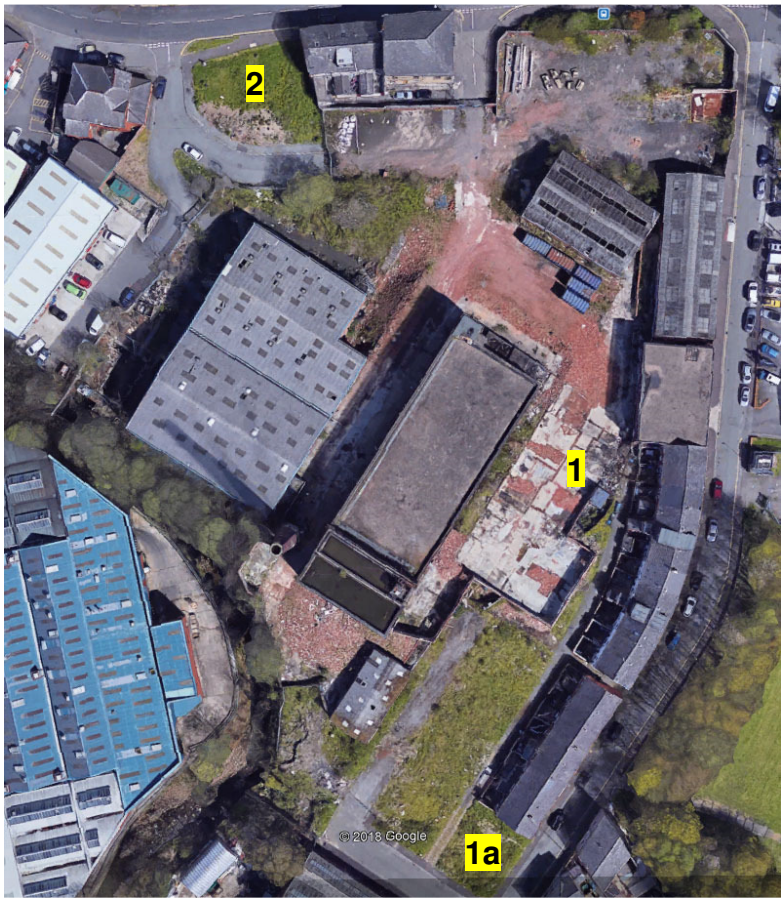
These periods are likely to cover the *quietest* times and are used to assess the impact of the industrial units on existing and proposed residential properties.

5.2 Instrumentation

Instrumentation used were two Rion NL-52s. These are precision grade sound level meters which hold a current calibration certificates and which were field-calibrated before and after the measurements with no drift noted. The meters were set up to measure continuous 5 minute samples 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 positions were as shown on the following plan.



Position 1 was chosen to represent the existing residential buildings to the east. Position 2 was chosen to represent the proposed residential development to the north. Brief sample measurements were also made at Position 1a which represents the proposed residential developments to the south, but it was found to be almost identical to Position 1.

In all cases the microphone was located approximately 1.5m above the ground.

5.4 Survey Conditions

We have no reason to believe that the conditions we found on the survey were anything other than representative of normal conditions.

Weather conditions were as follows :-

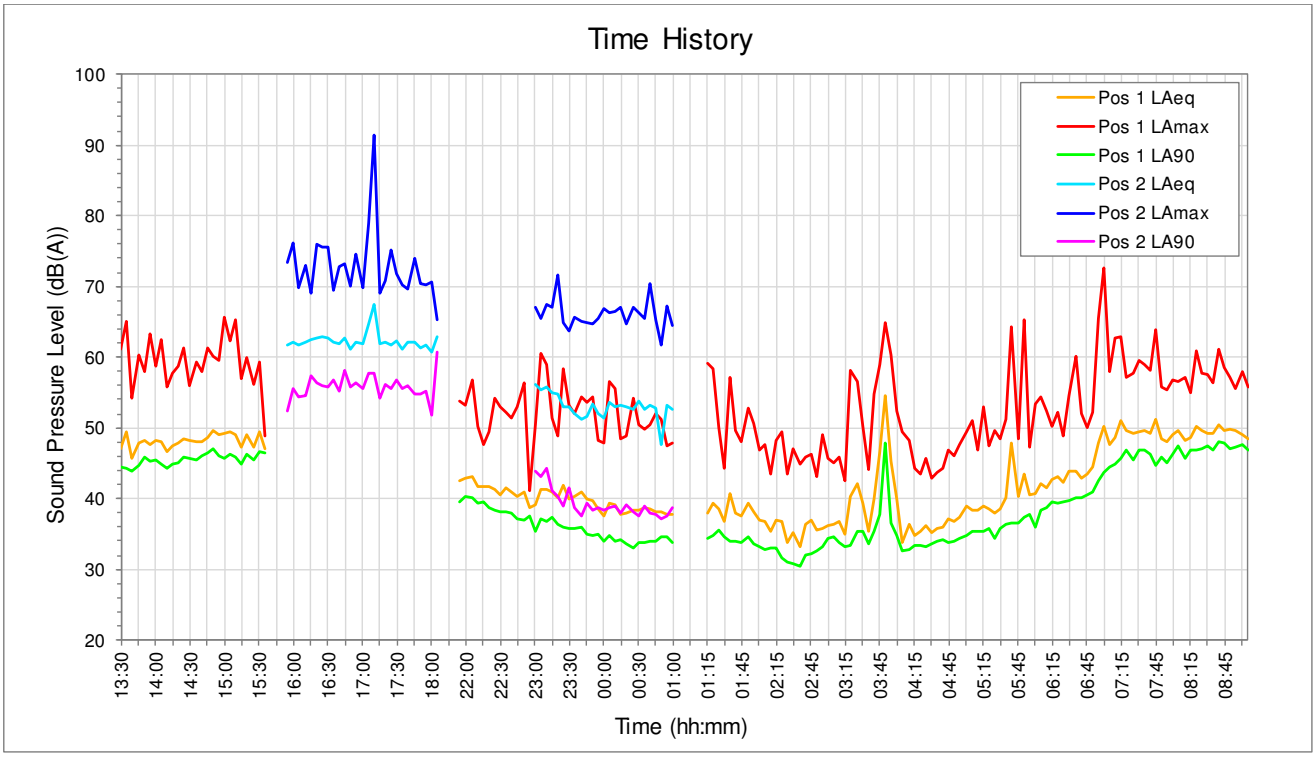
Rain	:	mainly dry, some occasional light drizzle
Cloud	:	50 to 100%
Temperature	:	11 to 18 Celsius
Wind	:	0 to 5m/s, generally from SW, occasional gusts

6.0 RESULTS AND DISCUSSIONS

The general noise climate was dominated at all times by the noise from traffic on the A680 Spotland Road and, to a much lesser extent, traffic on the A6060 Mellor St. There was also noise from surrounding industrial units off site, including occasional loud bangs.

6.1 Existing Noise Levels

Full details are given in Appendix 2. In summary, the results are best viewed graphically, with overall figures shown below them.



The lowest levels to be used for assessing the impact of the industrial units on existing residential locations are summarised as follows:-

Time Period	*Index*	***dB(A)***
Pos 1 : Quietest 1 hr Period Daytime	Leq	**48**
	Lmax	**61**
	L90	**45**
Pos 1 : Quietest 1 hr Period Evening	Leq	**41**
	Lmax	**53**
	L90	**39**
Pos 1 : Quietest 1 hr Period Night Time	Leq	**36**
	Lmax	**47**
	L90	**32**

In terms of the underlying background levels these are represented by the dB(A) L_{90} index, or the dB L_{A90} index.

The overall rush hour and early night time levels used for assessing noise break-in to the proposed residential units are summarised as follows:-

Time Period	*Index*	***dB(A)***
Pos 1 : Rush Hour	Leq	**49**
	Lmax	**62**
	L90	**47**
Pos 2 : Rush Hour	Leq	**63**
	Lmax	**79**
	L90	**56**
Pos : 1 Early Night Time	Leq	**39**
	Lmax	**54**
	L90	**35**
Pos : 2 Early Night Time	Leq	**53**
	Lmax	**67**
	L90	**40**

6.2 Proposed Residential Units

The CadnaA model is used to predict the noise levels to which the facades of the proposed residential units will be exposed with the new layout[1].

[1] It is shown in 6.3 below that the addition of the industrial units will make negligible difference to these positions.



Note, of course, that these levels are based upon the assumption that night-time noise levels are represented by measurements around midnight and that daytime noise levels are represented by measurements around rush hour. In other words, they should represent a worst-case.

Mitigation for Proposed Residential Units

Outdoor living areas (rear gardens) already show levels within BS 8233 criteria. With basic domestic garden fencing, the levels should be lower still.

Moving on to noise breaking into habitable rooms, a partly open window can be expected to provide about 15 dB reduction. This will be sufficient to achieve BS 8233 criteria for “desirable” conditions to all rear facades and facades on blocks which do not directly overlook one of the surrounding roads. It will also be sufficient to achieve BS 8233 criteria for “reasonable” conditions to the front façade of the units overlooking primrose street.

The facade overlooking Spotland Road will only meet criteria if windows are closed. This implies that ventilation will be required such that occupants have the realistic option of keeping windows shut. This can

be achieved using active or passive ventilation which provides a suitable sound insulation. This could take the form of ventilation through acoustic vents or a whole house-type system which does not require any wall or window vents.

Note that this assessment provides the specification for the acoustic performance of vents. Ventilation needs should be determined by others.

A summary of mitigation (or building elements assumed in our calculations) is as follows:-

Façade	Room Type	Make-Up on Which Calculations are Based
Position 1	Front	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
	Rear	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300
Position 2	Front	Walls: Traditional Masonry Glazing: 40 dB Rw eg. 6+50+4 or 10+12+6.4(lam) Vents: 42 dB Dn,e,w eg.Passivent TVALdB 800
	Rear (and all facades of the internal block)	Walls: Traditional Masonry Glazing: Basic thermal eg. 4+20+4 Vents: Non-acoustic eg. Simon Airstrip 300

In essence, all proposed residential facades should be adequate with basic thermal double glazing and non-acoustic vents, apart from habitable rooms overlooking Spotland Road which will require acoustic vents (or a whole house system which requires no external vents) and upgraded acoustic glazing.

Note that the table provides the acoustic specifications (such as R_w for windows and $D_{n,e,w}$ for vents) to meet appropriate criteria. The glazing build-ups and vent models which are also shown are examples and many other options achieving the same acoustic performance are available.

Full calculation details are shown in Appendix 2 and a summary of predicted internal noise levels is as follows:-

Façade	Room Type	Time	Index	**dB(A)**
Position 1	Front	Rush	Leq	**35**
		Night	Leq	**25**
			Lmax	**40**
	Rear	Rush	Leq	**26**
		Night	Leq	**16**
			Lmax	**31**
Position 2	Front	Rush	Leq	**35**
		Night	Leq	**25**
			Lmax	**41**
	Rear (and all facades of the internal block)	Rush	Leq	**26**
		Night	Leq	**16**
			Lmax	**30**

Of course, these assessments are very robust as they use what are likely to be the noisier times of day and night.

6.3 Impact of Industrial Units

The CadnaA software was used to model the potential impact of the units as described in Section 4.

The model is based on all units running throughout the day, evening and night, including 12 cars and 2 HGVs per hour during the day, and 8 cars per hour and 4 cars per hour during the evening and night respectively. No HGV deliveries are assumed during the evening and night time.



Note that:-

- The beige shapes are surrounding buildings and the application site building in its proposed form.
- The magenta lines are fences.
- The yellow crosses are the mechanical equipment point sources.
- The blue lines are the vehicle routes.
- The harlequined circles are the receiver positions just outside first floor windows.

Note that levels are significantly below what BS 4142 would describe as the “residual sound level”. This is the noise climate without development described in terms of the “average” dB L_{Aeq} index. It therefore has negligible impact on the assessment of external noise break-in to the proposed residential units in section 6.2.

For the assessment of proposed industrial noise, BS 4142 requires us to assess the predicted industrial noise against the "background sound level" which is the noise climate without development described in terms of the underlying dB L_{A90} index.

The noisiest position in terms of proposed industrial impact is 43 dB L_{Aeq} daytime which is below the quietest 1 hour period of existing daytime background sound level of 45 dB L_{A90}. This would rate under BS 4142 as *"low impact depending on the context"*. For evening and night time (the same activities as daytime, but slightly fewer cars and no HGV deliveries) the levels are reduced to 39 dB L_{Aeq}, which is the same as the late evening background sound level and would therefore rate as *"low impact depending on the context"*. As we move through to the quietest time of night, the background noise drops to 32 dB L_{A90} leaving the impact in terms of a BS 4142 assessment above *"adverse impact depending on the context"*.

The context of course is an established B2 commercial area and the impact, even under these somewhat extreme assumptions is likely to be negligible during the day, although during the evening and having the potential for some impact during the night if all units operate as described. Although we cannot know at this stage what sort of businesses will occupy the units, such levels of activity are clearly unlikely.

However, continuing for now with the assumption of these higher levels of activity, or reduced night time scenario has also been modelled. If units 2, 4 and 8 are conditioned such that they do not run at night or that only quieter activities are carried out, then the following reduce night time model is presented.

The same position is now reduced to 32 dB L_{Aeq} and rates as *"low impact depending on the context"*. Note that the existing residential property near the site entrance is a little higher, but the predicted levels are entirely dominated by cars accessing the site and the context is even more important as they are likely to be aurally indistinguishable from general traffic noise, and we would suggest that the impact here is also low.



6.4 Assessments

We emphasise again that the above modelling is based on somewhat extreme assumptions of noisy internal activity running through the day, evening and night, mechanical equipment running through the day, evening and night, on-site car movements through the day, evening and night, and daytime HGV deliveries. So, summarising the BS414 assessments at the noisiest residential location to the SE, we have:-

Daytime (all units running as described):

Specific sound level	43 dB L_{Aeq}
Character corrections[2]	0 dB
Rating level	43 dB L_{Ar}
Background sound Level	45 dB L_{A90}
Rating Level excess	-2dB
Impact	below *"low impact depending on the context"*

[2] Not expected to be tonal or impulsive but adjustments can be considered at conditions stage. Vehicles will be intermitted but unlikely to be in any way distinct from the general traffic.

Evening (as daytime but no HGV deliveries):

Specific sound level	39 dB L_{Aeq}
Character corrections[2]	0 dB
Rating level	39 dB L_{Ar}
Background sound Level	39 dB L_{A90}
Rating Level excess	0 dB
Impact	*"low impact depending on the context"*

Night Time (as daytime but no HGV deliveries):

Specific sound level	39 dB L_{Aeq}
Character corrections[2]	0 dB
Rating level	39 dB L_{Ar}
Background sound Level	32 dB L_{A90}
Rating Level excess	7 dB
Impact	Above *"adverse impact depending on the context"*, however context is important (established B" use, etc) and likely to reduce impact.

Night Time (as above but Units 2, 4 and 8 not running or quiet):-

Specific sound level	32 dB L_{Aeq}
Character corrections[2]	0 dB
Rating level	32 dB L_{Ar}
Background sound Level	32 dB L_{A90}
Rating Level excess	0 dB
Impact	*"low impact depending on the context"*

At the noisiest residential location to the North, the assessments for daytime and evening are less than the others, apart from the reduced night time assessment which is 5 dB higher and would rate as follows:-

Night Time (as above but Units 2, 4 and 8 not running or quiet):-

Specific sound level	37 dB L_{Aeq}
Character corrections[2]	0 dB
Rating level	37 dB L_{Ar}
Background sound Level	32 dB L_{A90}
Rating Level excess	5 dB
Impact	*"adverse impact depending on the context"*, however context is important (established B2 use, etc and the site noise impact is mainly vehicles) - likely to significantly reduce impact.

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".

The measurements of Background/Residual Sound were taken at times regarded as representing what are likely to be the worst case (quietest) time of the day or night. We have no reason to believe that the conditions were anything other than representative of normal conditions. BS4142 does not state what would be a representative background noise but there is certainly no suggestion that it should be lowest and practices vary widely. However, in order to allow for the possibility of variation in levels, we have used the lowest 1hour period for daytime, evening and night time.

Source date is likely to be highly variable but we have used what is likely to be somewhat extreme worst case assumptions. They are in any case examples only and will be subject to what kind of business occupies the units.

Calculations are based on the processes of *ISO 9613 : Acoustics – Attenuation of sound during propagation outdoors*. We know of no concerns within our industry as to the basic reliability of these methods and it is cited in BS4142 as *"a validated method of calculating sound levels"*. The CadnaA software uses this standard and the input assumptions err on the side of caution and are stated in Section 4.

Varying meteorological conditions are unlikely to have a significant impact on results as the distances involved are small.

7.0 CONCLUSIONS/RECOMMENDATIONS

The general noise climate was dominated at all times by the noise from traffic on the A680 Spotland Road and, to a much lesser extent, traffic on the A6060 Mellor St. There was also noise from surrounding industrial units off site, including occasional loud bangs.

The proposed residential units have been assessed against the noisiest times of day and night. All proposed facades should be adequate with basic thermal double glazing and non-acoustic vents, apart from habitable rooms overlooking Spotland Road which will require acoustic vents (or a whole house system which requires no external vents) and upgraded acoustic glazing.

The proposed industrial units have all been modelled as B2 uses with assumed activity levels likely to represent a somewhat extreme worst case, including cars, HGV deliveries, internal noise break-out and mechanical equipment. Apart from the possible exception of Units 2, 4 and 8 there is no reason why all units should not be able to operate within reasonable levels, apart from HGV deliveries which may be unacceptable during the evening and night.

Our only recommendation is that you submit this report to planners. We would suggest a pre-occupation condition requiring details of noise levels, sound insulation, etc to be submitted and approved.

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 is really should be stated. The threshold of human hearing is a sound pressure of 20μPa or a sound power of 1pW.

A sound pressure level or SPL should be expressed in dB(re. 20μPa). 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 given 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 level are discussed below.

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

Equivalent Continuous Sound Level, L_{eq}

This is a kind of mean 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}. The Noise at Work Regulations use $L_{eq(s)}$ which refers to a sample level.

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_{Amax}.

Statistical (Percentile) Levels, L_n

During a measurement of fluctuating noise, it is often useful to establish the levels exceed 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 exceed 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 form 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.

Appendix 2

Measurement and Calculation Details

Basic Measurements

Measurement Summaries

Time Period	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Pos 1 : Quietest 1 hr Period Daytime	Leq	**48**	56	50	47	43	44	39	33	23
	Lmax	**61**	72	67	62	57	54	51	51	44
	L90	**45**	51	45	42	40	42	36	28	18
Pos 1 : Quietest 1 hr Period Evening	Leq	**41**	50	46	40	37	38	31	22	14
	Lmax	**53**	63	62	53	46	47	44	41	29
	L90	**39**	46	41	37	35	36	28	17	13
Pos 1 : Quietest 1 hr Period Night Time	Leq	**36**	45	39	34	32	32	28	22	18
	Lmax	**47**	57	50	46	42	44	38	32	28
	L90	**32**	41	36	30	30	28	23	17	13

Time Period	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Pos 1 : Rush Hour	Leq	**49**	58	54	49	45	46	40	32	23
	Lmax	**62**	70	66	60	55	55	53	56	45
	L90	**47**	55	50	45	41	44	37	27	17
Pos 2 : Rush Hour	Leq	**63**	68	63	62	58	59	55	47	41
	Lmax	**79**	82	84	81	75	69	71	68	64
	L90	**56**	61	56	54	50	53	49	38	26
Pos : 1 Early Night Time	Leq	**39**	48	43	38	35	36	30	22	17
	Lmax	**54**	67	60	51	46	50	45	41	42
	L90	**35**	43	38	33	32	32	25	17	13
Pos : 2 Early Night Time	Leq	**53**	58	53	51	47	50	46	37	28
	Lmax	**67**	74	72	66	61	62	59	52	48
	L90	**40**	46	42	37	35	36	32	27	19

Break-in to Proposed Residential Units

Break-in

Position 1 *Front*			***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	2.70 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	2.70 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	6.75 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	16.75 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	20.25 m3		**-**	-	-	-	-	-	-	-	-
Assumed RT	0.50 s		**-**	-	-	-	-	-	-	-	-
Element Area Correction			**-**	12	12	12	12	12	12	12	12
Room Correction 10 x Log (RT/0.163/V)			**-**	-8	-8	-8	-8	-8	-8	-8	-8
Walls: Traditional Masonry	5.31 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.44 m2		**-**	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	16.75 m2		**-**	21	27	25	28	31	31	31	37
Level Difference (Reverberant only)			**-**	-17	-23	-21	-23	-27	-27	-27	-33
Façade relative to Measurement Position	5 dB		**-**	5	5	5	5	5	5	5	5
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**35**	51	41	38	31	29	23	15	0
	Night	Leq	**25**	41	30	27	21	19	13	6	-5
		Lmax	**40**	60	47	40	32	33	28	24	19

Position 1 *Rear*			***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	2.70 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	2.70 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	6.75 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	16.75 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	20.25 m3		**-**	-	-	-	-	-	-	-	-
Assumed RT	0.50 s		**-**	-	-	-	-	-	-	-	-
Element Area Correction			**-**	12	12	12	12	12	12	12	12
Room Correction 10 x Log (RT/0.163/V)			**-**	-8	-8	-8	-8	-8	-8	-8	-8
Walls: Traditional Masonry	5.31 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.44 m2		**-**	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	16.75 m2		**-**	21	27	25	28	31	31	31	37
Level Difference (Reverberant only)			**-**	-17	-23	-21	-23	-27	-27	-27	-33
Façade relative to Measurement Position	-4 dB		**-**	-4	-4	-4	-4	-4	-4	-4	-4
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**26**	42	32	29	22	20	14	6	-9
	Night	Leq	**16**	32	21	18	12	10	4	-3	-14
		Lmax	**31**	51	38	31	23	24	19	15	10

Position 2 *Front*			***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	2.70 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	2.70 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	6.75 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	16.75 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	20.25 m3		**-**	-	-	-	-	-	-	-	-
Assumed RT	0.50 s		**-**	-	-	-	-	-	-	-	-
Element Area Correction			**-**	12	12	12	12	12	12	12	12
Room Correction 10 x Log (RT/0.163/V)			**-**	-8	-8	-8	-8	-8	-8	-8	-8
Walls: Traditional Masonry	5.31 m2		**-**	23	32	41	47	49	53	58	55
Glazing: 40 dB Rw eg. 6+50+4 or 10+12+6.4(lam)	1.44 m2		**-**	20	26	30	35	42	46	54	51
Vents: 42 dB Dn,e,w eg.Passivent TVALdB 800	10.00 m2		**-**	34	46	44	38	43	43	50	50
Composite SRI	16.75 m2		**-**	26	34	39	39	44	45	51	51
Level Difference (Reverberant only)			**-**	-22	-30	-35	-35	-40	-41	-47	-47
Façade relative to Measurement Position	4 dB		**-**	4	4	4	4	4	4	4	4
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**35**	55	43	36	32	28	23	9	3
	Night	Leq	**25**	45	32	25	21	19	14	-1	-9
		Lmax	**41**	62	51	40	36	31	27	14	10

Position 2 *Rear (and all facades of the internal block)*			***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Width of Exposed Façade 1	2.70 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 2	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 3	0.00 m		**-**	-	-	-	-	-	-	-	-
Width of Exposed Façade 4	0.00 m		**-**	-	-	-	-	-	-	-	-
Total Exposed Façade Width	2.70 m		**-**	-	-	-	-	-	-	-	-
Element Height	2.50 m		**-**	-	-	-	-	-	-	-	-
Room Depth (re. Exposed façade 1)	3.00 m										
Element Area	6.75 m2		**-**	-	-	-	-	-	-	-	-
Effective Area (ie. with vents)	16.75 m2		**-**	-	-	-	-	-	-	-	-
Room Volume	20.25 m3		**-**	-	-	-	-	-	-	-	-
Assumed RT	0.50 s		**-**	-	-	-	-	-	-	-	-
Element Area Correction			**-**	12	12	12	12	12	12	12	12
Room Correction 10 x Log (RT/0.163/V)			**-**	-8	-8	-8	-8	-8	-8	-8	-8
Walls: Traditional Masonry	5.31 m2		**-**	23	32	41	47	49	53	58	55
Glazing: Basic thermal eg. 4+20+4	1.44 m2		**-**	15	21	17	25	35	37	31	31
Vents: Non-acoustic eg. Simon Airstrip 300	10.00 m2		**-**	23	28	26	26	29	29	29	36
Composite SRI	16.75 m2		**-**	21	27	25	28	31	31	31	37
Level Difference (Reverberant only)			**-**	-17	-23	-21	-23	-27	-27	-27	-33
Façade relative to Measurement Position	-17 dB		**-**	-17	-17	-17	-17	-17	-17	-17	-17
Allowance for flanking/workmanship	5 dB		**-**	5	5	5	5	5	5	5	5
Predicted Internal Levels	Rush	Leq	**26**	39	28	29	22	20	16	8	-4
	Night	Leq	**16**	28	18	18	11	11	7	-2	-16
		Lmax	**30**	45	37	33	26	23	20	14	3

Predicted Summary

Façade	Room Type	Time	Index	**dB(A)**	63	125	250	500	1k	2k	4k	8k
Position 1	Front	Rush	Leq	**35**	51	41	38	31	29	23	15	0
		Night	Leq	**25**	41	30	27	21	19	13	6	-5
			Lmax	**40**	60	47	40	32	33	28	24	19
	Rear	Rush	Leq	**26**	42	32	29	22	20	14	6	-9
		Night	Leq	**16**	32	21	18	12	10	4	-3	-14
			Lmax	**31**	51	38	31	23	24	19	15	10
Position 2	Front	Rush	Leq	**35**	55	43	36	32	28	23	9	3
		Night	Leq	**25**	45	32	25	21	19	14	-1	-9
			Lmax	**41**	62	51	40	36	31	27	14	10
	Rear (and all facades of the internal block)	Rush	Leq	**26**	39	28	29	22	20	16	8	-4
		Night	Leq	**16**	28	18	18	11	11	7	-2	-16
			Lmax	**30**	45	37	33	26	23	20	14	3

Inputs and Adjustments to Industrial Models

Source Data

Description	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
VW Sharan 2.0 Diesel	Leq	**52**	67	52	52	50	46	43	39	34
25m/12s - pull away, pass at 10m, and stop	Lmax	**57**	73	60	59	53	50	47	44	38
VW Polo 1.0 Petrol	Leq	**53**	72	54	54	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
Typical (Logarithmic Average)	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
VW Sharan	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
Mitsubishi FDC250VSA Heat Pump Condenser at 1m	Leq	**62**	66	67	65	59	56	51	45	41
Mitsubishi PUHZ-ZRP71VHA A/C Unit at 1m	Leq	**48**	52	53	51	45	42	37	31	27
Normalised Road Traffic Noise Spectrum	Leq	**0**	4	2	-2	-4	-4	-8	-13	-20
Light Industry Internal	Leq	**80**	54	61	65	65	67	73	76	75

1 Hour Levels for Vehicles

		Fuel
Number of Vehicles per hour (Rush Hour)		12
Number of Vehicles per hour (Mid Evening)		8
Number of Vehicles per hour (Night Time)		4
Length of Vehicle Source Segment (m)		25
Duration of Vehicle Segment (s)		12
Correction for the Duration of a Segment (dB)		-25
Correction for number of Cars (Daytime) (dB)		11
Correction for number of Cars (Evening) (dB)		9
Correction for number of Cars (Night Time) (dB)		6
Overall Correction for Cars (Daytime) (dB)		-14
Overall Correction for Cars (Evening) (dB)		-16
Overall Correction for Cars (Night Time) (dB)		-19
HGVs Daytime	17%	2
HGVs Evening	0%	0
HGVs Night Time	0%	0
Correction for HGV Numbers Daytime		-8
Correction for HGV Numbers Evening		n/a
Correction for HGV Numbers Night Time		n/a
Overall Correction for HGVs (Rush Hour) (dB)		-22
Overall Correction for HGVs (Evening) (dB)		n/a
Overall Correction for HGVs (Night Time) (dB)		n/a

Vehicle Doors

Number of closes per hour at night 4

Description	*Dist (m)*	*Index*	***dB(A)***	*63*	*125*	*250*	*500*	*1k*	*2k*	*4k*	*8k*
Overall Levels at Source	5	Leq	**28**	39	35	30	27	18	16	12	4
		Lmax	**63**	75	71	66	61	52	51	45	34
Overall Levels at Houses	22	Leq	**15**	26	22	17	14	5	3	-1	-9
		Lmax	**50**	62	58	53	48	39	38	32	21