


THREE SPIRES ACOUSTICS

Reliant Construction

Land off Stottercliffe Road Penistone

Environmental Noise Assessment & Noise Mitigation Scheme

Report No. CH/ENA/2010/16

Three Spires Acoustics Ltd

October 2010

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Environmental Noise Assessment

REPORT NO:	**CH/ENA/2010/16**
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REVISION HISTORY:

Revision No.	Date Issued	Reason/Comments
00	October 2010	Initial

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EXECUTIVE SUMMARY

Three Spires Acoustics Ltd (TSA) have been commissioned by Reliant Building Contractors to undertake an acoustic assessment of land off Stottercliffe Road, Penistone to assess the suitability of the site for a mixed use development.

An acoustic assessment of the proposed development has been carried out in accordance with the requirements of:

- Planning Policy Guidance 24 (PPG24);
- Barnsley Metropolitan Borough Council
- BS8233: 1999 - Sound insulation and noise reduction for buildings. Code of Practice;
- BS4142: 1997 - Method for rating industrial noise affecting mixed residential and industrial areas;

A noise survey has been conducted to establish the existing ambient noise levels in the area.

A PPG24 assessment has been undertaken which confirms that the site will be suitable for residential use. It will be necessary to install acoustic glazing and acoustically treated ventilation to certain bedrooms and living rooms in order for the internal noise level requirements of Barnsley Metropolitan Borough Council to be achieved.

Noise from commercial vehicles using Stottercliffe Road to access the relocated commercial units has been assessed and is not expected to have an adverse effect on the amenity of occupants of proposed properties.

Amenity areas will also achieve the councils external noise criteria.

Limiting criteria for mechanical plant/equipment noise emission have been determined based on BS4142.

Sound Insulation performance standards have been recommended for separating partitions within the work/live units.

Provided the recommendations in this report are implemented, the proposed development is expected to comply with the noise requirements of Barnsley Metropolitan Borough Council and relevant British Standards and guidelines.

Introduction

Three Spires Acoustics Ltd have been instructed by Reliant Builders, to undertake a survey of the ambient noise climate at a proposed mixed use development located at land off Stottercliffe Road, Pensitone, and recommend construction specifications to demonstrate compliance with acoustic design requirements of the Local Planning Authority, Barnsley Metropolitan Borough Council.

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1.1. OBJECTIVES

- To establish the existing A-weighted, L_{90}, L_{eq} L_{Max} noise levels at the site through a 24 hour daytime and night time survey;
- To establish the specific noise impact from the existing commercial uses on the proposed residential development.
- To make recommendations regarding noise control options for the building fabric in order to achieve the local authority planning criteria.
- To consider the noise impact from mechanical services on new and existing residents.
- To consider and make recommendations regarding sound insulation for mixed use units.

2. SITE DESCRIPTION

The site consists of a mixed use development, with a mix of two and three bedroom houses and live work units and a mix of commercial & retail units. The site is located off Stottercliffe Road, Penistone close to the town centre and newly built Tesco Supermarket. The existing site comprises of three commercial units which are to be relocated to the west of the site, an existing Regency house which is used for retail purposes and vacant coal drop arches which will form commercial/retail units.

There is an existing auto repair shop located in an old cinema building which is structurally adjoining an existing residential property in Stottercliffe Road. The permitted hours of use for the relocated units are 7.30-18.00 Mon – Friday & 07.30-13.00 Saturday. There are existing residential dwellings to the front of the development off Stottercliff Road & to the rear of the development along Talbot Street. A site plan of the proposed development is contained in Appendix A.

3. NOISE CRITERIA

3.1. LOCAL AUTHORITY

The Local Planning Authority, Barnsley Metropolitan Borough Council, have requested in a written response to the developer;

" an acoustic report be submitted providing details of glazing specifications along with sound insulation measures within the live/work units and between the residential properties and commercial units. If it

is proposed to introduce restaurants, cafes, or hot food takeaways to the site then details of flues and appropriate methods of ventilation would also need to be provided."

Further discussion with Lucy Allen, Senior Environmental Health Officer have indicated that when proposing mitigation measures for control of noise *the "good standard" in BS8233 regarding indoor ambient noise criteria, the upper limit for amenity areas detailed in WHO Community Noise 1999 and a BS4142 rating level of -5 for mechanical services plant should be achieved. The council have also requested that numbers of commercial vehicle movements be assessed to identify if this may have a potential negative noise impact.*

3.2. PLANNING POLICY GUIDANCE 24

When assessing a proposal for residential development near an existing source of noise local planning authorities are guided by Planning Policy Guidance 24 – Planning and noise. The guidance sets out Noise Exposure Categories (NECs), ranging from A-D, to assist local planning authorities in their consideration of applications for residential development near transport-related noise sources. The noise exposure categories displayed in Annex 1 of PPG24 are as follows:

Table 1: PPG24 Noise Exposure Categories

Noise Levels[0] Corresponding To The Noise Exposure Categories For New Dwellings $L_{Aeq,T}$ dB				
	Noise Exposure Category			
Noise Source	**A**	**B**	**C**	**D**
road traffic				
07.00 - 23.00	<55	55 - 63	63 - 72	>72
23.00 - 07.00[1]	<45	45 - 57	57 - 66	>66
rail traffic				
07.00 - 23.00	<55	55 - 66	66 - 74	>74
23.00 - 07.00[1]	<45	45 - 59	59 - 66	>66
air traffic[2]				
07.00 - 23.00	<57	57 - 66	66 - 72	>72
23.00 - 07.00[1]	<48	48 - 57	57 - 66	>66
mixed sources[3]				
07.00 - 23.00	<55	55 - 63	63 - 72	>72
23.00 - 07.00[1]	<45	45 - 57	57 - 66	>66

In addition to the above, PPG24 states that during the night (23:00 – 07:00hrs): *"sites where individual noise events regularly exceed 82dB L_{Amax} several times in any one hour should be treated as NEC C regardless of the $L_{Aeq(8\text{-}hour)}$ (except where the $L_{Aeq(8\text{-}hour)}$ already puts the site into NEC D)."*

Local Planning Authorities should then take into account the advice for the corresponding NEC, as below:

Table 2: PPG24 Noise Exposure Category Outcomes

NEC	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

3.3. *BS8233:1999: SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS*

Where measures are required to ensure a commensurate level of protection it is necessary to assess the means of achieving guideline internal noise levels within habitable rooms which are likely to be affected by the dominant noise levels.

PPG24 states in annex 6: Paragraph 8 that "*Guidance on suitable internal noise levels can be found in BS8233: 1987.* This has been withdrawn and replaced by *BS8233:1999: Sound insulation and noise reduction for buildings*. Section 7.6.1 of BS8233: 1999 suggest indoor ambient noise criterion for reasonable resting and sleeping conditions in bedrooms and living rooms. In respect of residential dwellings the following criterion is presented in table 3 below; BS8223 states that normally only the reasonable standard need apply.

Table 3: Internal Target Noise Criteria

Typical Situation	Design Range $L_{Aeq,T}$ dB	
	Good	Reasonable
Living Room Bedroom	30 30	40 35
Utility Rooms (Kitchen & Bathrooms)	45	45

BS8233 also recommends that "for a reasonable standard in bedrooms at night, individual noise events measured with F time-weighting should not normally exceed 45dB LAmax"

3.4. WHO GUIDELINES FOR COMMUNITY NOISE 1999- EXTERNAL AMENITY AREAS

The World Health Organisation (WHO) Community Noise Report 1999, states "*During the daytime, few people are seriously annoyed by activities with LAeq levels below 55 dB; or moderately annoyed with LAeq levels below 50 dB".* The council have required that the 55dB(A) limit is achieved for amenity areas."

3.5. BRITISH STANDARD 4142: 1997

PPG24 advises that the likelihood of complaints about noise of an industrial nature can be assessed, using guidance in British Standard 4142. The standard describes a method of determining the level of noise of an industrial nature, together with procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity.

The standard is based upon the likelihood of complaint in response to a noise being dependent upon factors including the margin by which it exceeds the background noise level, its absolute level, time of day, change in the noise environment etc. The standard is only concerned with rating noise of an industrial nature, based on the margin by which it exceeds the background noise level with an appropriate allowance for acoustic features present in the noise. As the margin increases, so does the likelihood of complaint. The interpretation of the difference between the *rating level* and the *background noise level* is shown in the table 4 below.

Table 4 : BS4142 Interpretation

Difference in noise level (dB)	Significance
Around +10	**Complaints are likely**
Around +5	**Marginal**
-10	**Positive indication that complaints are unlikely**

4. NOISE SURVEY

An environmental noise survey was undertaken between 12.23 on Monday 20th September until 09.46 on Tuesday 21st September 2010 to establish levels of existing noise at the development site. Noise measurements locations are shown as MP1& MP2 on the site plan in appendix A. These positions are considered to provide representative data on the noise incident upon the sensitive facades at the front of the proposed development.

In considering the level of activity, discussion with the Hire Shop owner indicated commercial vehicles movements throughout the day were not untypical but not a worst case. However, during the measurement period there were several movements per hour of construction vehicles accessing the Tesco compound, (which is temporarily located on the land to be used for the relocation of the existing commercial units). These have been included so as to represent an increased level of site activity and as a "worst case scenario"

Measurements were not able to be undertaken outside the existing auto shop due to extraneous noise interference from a generator used within the Tesco's construction compound. Three Spires however, has noise data for auto shop activities from previous surveys which is regarded as representative and has been used for assessment purposes. Subjectively the noise from the auto shop was the least significant of the existing commercial users. It was also noted that there was no noise breakout from the existing auto repair unit located within the old cinema building during the measurement period. This is structurally adjoining a residential property which is undergoing redevelopment and in very close proximity to properties on Stottercliffe Rd.

The weather conditions and wind were both noted and were satisfactory throughout the survey period.

Measurements were carried out using Bruel & Kjaer 2250's real time analysers complying with IEC 651 Type 1. The analysers were set to record all broadband and statistical A-weighted and octave band sound pressure levels including L_{90}, and $L_{eq.}$ The analysers were set to log measurements every 1 second and 1 minute. The meters were calibrated with a Bruel and Kjaer type 4231 calibrator both before and after the surveys and no significant drift was observed. Timed audio recording of 2.5 minutes in every fifteen and audio level triggers were utilised to capture audio data which would help establish the source of noise emissions.

The principle sources of environmental noise are considered to be road traffic using the B6264 accessing Tesco's supermarket and the Town Centre, vehicles using the site access road off Stottercliffe Rd to access commercial units, skip hire vehicles delivering and collecting skips and use of the Tool Hire Centre and Auto Shop. The noise from vehicles is exacerbated by the poor condition of the access road, which will reduce significantly if permission is granted and the road is resurfaced. Time History Graphs and full-tabulated noise measurement results from this survey are contained in Appendix B.

5. RESULTS

In order to compare the results of the survey with the NEC's and guidelines set out in PPG24 it is necessary to convert the measured levels into single figure daytime $L_{Aeq(16\text{-}hour)}$ (07:00 – 23:00 hours) and night time $L_{Aeq(8\text{-}hour)}$ (23:00 – 07:00 hours) levels. Additionally the working day $L_{Aeq,8hr}$ and highest measured $L_{Aeq,1hr}$ have are presented in the Table 5 below;

Table 5: PPG 24 Measurement Results

Position	Daytime L_{AeqT}	Working Day $L_{Aeq(8\text{-}hour)}$	Highest Hour $L_{Aeq(1\text{-}hour)}$	Night time $L_{Aeq(8\text{-}hour)}$	Highest Hour $L_{Aeq(1\text{-}hour)}$
MP1	60	61	66	42	48
MP2	59	61	63	49	55

Free field measurements

Closer examination of the 1 minute intervals for the night time period has also been undertaken and there were 2 events which exceed 82dBA L_{max}.

In accordance with PPG24 road traffic has been determined to be the dominant noise source for day and night for both positions. With reference to the above Noise Exposure Categories the front facades of the site falls within category B for both day and night time.

Noise mitigation measures will therefore be required to control internal noise levels within habitable rooms of the dwellings.

5.1 Assessment of Noise from Relocated Commercial Units

Auto Shop

The data in Appendix B has been used to calculate the likely noise levels which would be apparent at the proposed residential properties.

The calculations consider a worst case with the maximum use of the work bays and the assumption that the bay doors will remain open at all times during operating hours. The assumed workload includes;

Fitting 10 tyres
Replacing 2 exhaust
Fitting 2 sets of brakes
Fitting 2 shock absorbers
MOT bay in constant use.

Hire Company

The measurement results from MP1, which was located 5m outside the Hire Company entrance and 5m from the skip drop off and pick up point is considered to be representative of the noise emissions from the relocated Hire Company. The highest LAeq,1hour has been used for assessment purposes and combined with the Auto Shop calculations to predict the received noise level at the proposed residential dwellings are presented in Table 6 below.

Table 6: Predicted Noise from Relocated Commercial Units

Activity	LW(A)/hr	Nos Events	Total LW(A)
Tyre Fitting	73	10	83
Exhaust Fitting	72	2	75
Brake Fitting	73	2	76
Shock Absorber Fitting	72	2	75
Total			85
Hire Shop			
LW=LP+20Logr+8-D (LP=66@5m)			85
Total			88
Receiver Level			
LP=LW-20Log(r)-8+D			57dB(A)

It can be seen from the result that the predicated received levels for the worst case hour are 57dB(A) LAeq,1hr. Further protection to the ground floor rooms and external amenity areas to the rear of the proposed development will be offered by the installation of a 2 metre acoustic fence which will ensure that amenity areas achieve a better level than the 55dB(A) daytime requirement. Figure 1 in Appendix D details the position of the acoustic fence.

5.2 Commercial Vehicle Movements

Discussion with the owners of the Skip Hire Company have indicated that during the busiest periods, 7am-8am and 4pm -5pm, there could be up to 4 collections and deliveries per hour. These will

include various size vehicles from pickup trucks to HGV vehicles. He has also indicated that typically there will be 10-12 vehicles being worked on in the auto repair shop unit with movements of these vehicles at the start and the end of the day and less activity during other times. Observations throughout the measurement period and analysis of the time history profiles with audio capture data verifies there are typically several vehicle movements up and down the access road per hour and these increase during the peak early morning and late afternoon periods. The $L_{Aeq,1hour}$ for these periods are not significantly above the working day or whole day period and have been used for glazing design purposes to afford a higher standard than required with PPG24. The noise from vehicles is exacerbated by the poor condition of the access road, which will reduce significantly if permission is granted and the road is resurfaced. It is considered that relative low numbers of vehicle movements per hour will not have a negative impact upon the proposed development. It is noted that there are existing residential properties in close proximity to the commercial units and access road which has been in operation for several years with anecdotally no complaint history. Further the proposed relocation of the Auto Shop will be at a greater distance from existing and proposed residential properties.

6. ASSESSMENT & RECOMMENDATIONS

A summary of the results and estimated noise reduction required to achieve the Council's requirements are contained in Table 7 below.

Table 7– Required Noise Reduction level – Front Façade Stottefcliffe Rd

Period	Index	Noise Level		Internal Criteria	Target Reduction	
		MP1	MP2		MP1	MP2
Day	LAeq16hr	60	59	30	30	29
Day	LAeq,1hr	66	63	30	36	33
Night	LAeq,8hr	42	49	30	12	19
Night	LAFmax	80	87	45	35	42

Table 8– Required Noise Reduction level – Relocation of Commercial Units

Period	Cumulative LAeq,T	Internal Criteria	Target Reduction
Day	57	30	27

Three Spires have reviewed the components of the proposed building envelope construction in accordance with the procedures set out in BS8233. The proposed facade and roof construction

should provide adequate attenuation, however to achieve the required internal noise criteria indicative glazing specifications are detailed in Table 9. The assessment has followed the simple method in section 6.7.1 of BS8233.

Table 9– Facade Recommendations to Achieve Local Authority Criteria

Elevation	Level	Space	Recommendations
			Glass Type
Front	MP1	Bedroom	5/16/8.8 Double Glazing (glass/air space/glass) (RW40)
		Living/family	5/16/8.8 Double Glazing (glass/air space/glass) (RW40)
		Bath/utility	4/12/4 Double Glazing (glass/air space/glass) (RW31)
Front	MP2	Bedroom	10/16/12.8mm Double Glazing (glass/air space/glass) (RW45)
		Living/family	4/12/8.8 Double Glazing (glass/air space/glass) (RW36)
		Bath/utility	4/12/4 Double Glazing (glass/air space/glass) (RW31)
Rear	All	Bedroom	4/12/4 Double Glazing (glass/air space/glass) (RW31)
		Living/family	4/12/4 Double Glazing (glass/air space/glass) (RW31)
		Bath/utility	4/12/4 Double Glazing (glass/air space/glass) (RW31)

6.1 GENERAL REMARKS

Glazed areas will normally be the weakest acoustic elements and therefore will be the controlling factor in the sound reduction performance of the façade. To achieve the internal noise criteria the glazing detailed in Table 5 should be installed. All windows/doors should be well sealed (air tight) when closed with good seals such as **Q-LON**® acoustic seals (or equivalent) around all sides. Any air gap will significantly reduce the performance of the glazing in terms of the ability to attenuate noise. All of the above assumed that the glass is properly sealed air tight.

The acoustic integrity of the building envelope will also be compromised in the event windows are opened for ventilation purposes reducing the insulation to no more than 10 to 15 dBA. In order to provide background ventilation to rooms alternative means of attenuated ventilation will also be required. It will be necessary to incorporate acoustically treated ventilation openings

such as CMS Acoustics, Acoustic Core Ventilator with Cowl or equivalent, examples are contained in Appendix C.

6.2 MECHANICAL SERVICES NOISE

The development will include commercial units including an A3 restaurant. To protect the amenity of neighboring residents from noise from kitchen extraction and any air conditioning/air handling plant, a design criteria based on the criteria contained in BS4142 is proposed. The LAeq noise emission from mechanical plant/extract systems should be 5dBA below the lowest measured background levels 1m from the façade of the nearest noise sensitive premises. Should the new mechanical services contain any tonal or impulsive characteristics then the above target criteria will be reduced by a further 5dB. The proposed criteria are contained in Table 10.

Table 10: Mechanical Services Noise Criteria (Assessed 1m from façade of nearest noise sensitive premises)

Receiver Position	Time	Criteria	
		(Standard)	(Impulsive, Tonal etc)
	Day	45 dB(A) $L_{Aeq,(1hour)}$	40dB(A) $L_{Aeq,(1hour)}$
	Night	40dB(A) $L_{Aeq,(5min)}$	35dB(A) $L_{Aeq,(5min)}$

At this stage, the design and selection of the mechanical equipment has not been finalised. This condition can be added as a “consent condition” which is to be discharged prior to construction works commencing.

In general, based on previous experience with similar size commercial/residential developments, a number of amelioration measures can be implemented to control the noise emission. Typical amelioration measures are outlined below (not necessarily limited to):

- Location of plant equipment away from noise sensitive receivers;
- The extraction systems to be constructed such that the outlet is either shielded from the noise sensitive premises and/or is pointing in a direction at least 90 degrees away from the nearest residence;
- Achieving no direct ‘line of sight’ path between the nearest residence and all the major plant equipment and air conditioning and extraction systems;

- Ensure mechanical services are designed to accommodate silencers if required.

6.3 SOUND INSULATION BETWEEN WORK LIVE UNITS

The proposal includes a number of "work-live" units with commercial/retail located below residential areas. The council have requested that sound insulation measures be specified in order to protect the amenity of the residential areas. In such circumstances it is proposed that the sound insulation performance of the separating partitions should achieve a level of 5dB above that required within the Approved Document E – Resistance to the Passage of Sound Building Regulations 2003. This may be achieved through a "consent condition" which can be discharged prior to construction works commencing and maybe through the provision of "robust details" or through post completion testing.

7. CONCLUSIONS

Three Spires Acoustics Ltd (TSA) have been commissioned by Reliant Building Contractors to undertake an acoustic assessment of land off Stottercliffe Road, Penistone to assess the suitability of the site for a mixed use development.

An acoustic assessment of the proposed development has been carried out in accordance with the requirements of:

- Planning Policy Guidance 24 (PPG24);
- Barnsley Metropolitan Borough Council
- BS8233: 1999 - Sound insulation and noise reduction for buildings. Code of Practice;
- BS4142: 1997 - Method for rating industrial noise affecting mixed residential and industrial areas;

A noise survey has been conducted to establish the existing ambient noise levels in the area.

A PPG24 assessment has been undertaken which confirms that the site will be suitable for residential use. It will be necessary to install acoustic glazing and acoustically treated ventilation to certain bedrooms and living rooms in order for the internal noise level requirements of Barnsley Metropolitan Borough Council to be achieved.

Noise from commercial vehicles using Stottercliffe Road to access the relocated commercial units has been assessed and is not expected to have an adverse effect on the amenity of occupants of proposed properties.

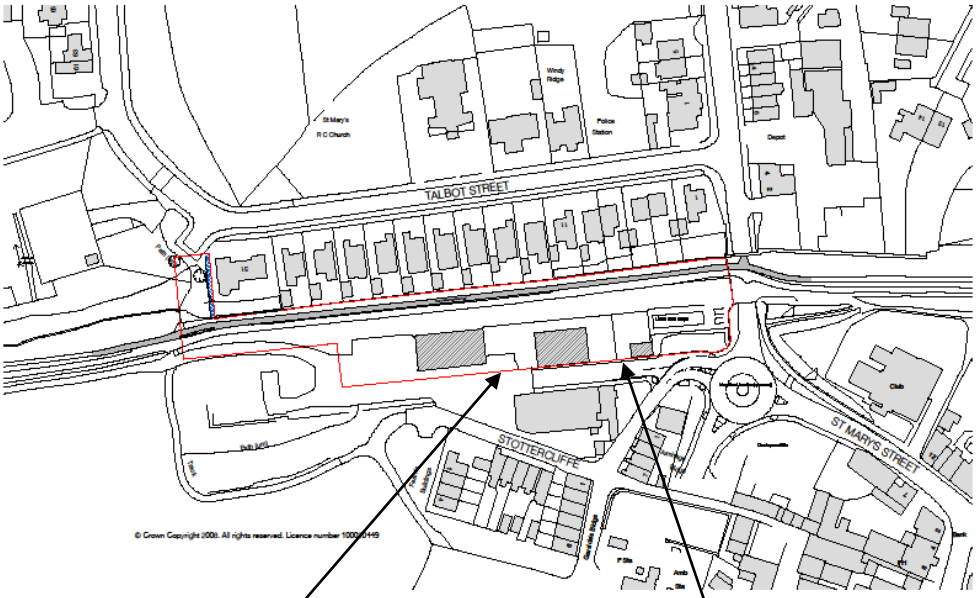
Amenity areas will also achieve the Council's external noise criteria.

Limiting criteria for mechanical plant/equipment noise emission have been determined based on BS4142.

Sound insulation performance standards have been recommended for separating partitions within the work/live units.

Provided the recommendations in this report are implemented, the proposed development is expected to comply with the noise requirements of Barnsley Metropolitan Borough Council and relevant British Standards and guidelines.

APPENDIX A: SITE PLAN AND MEASUREMENT POSITION



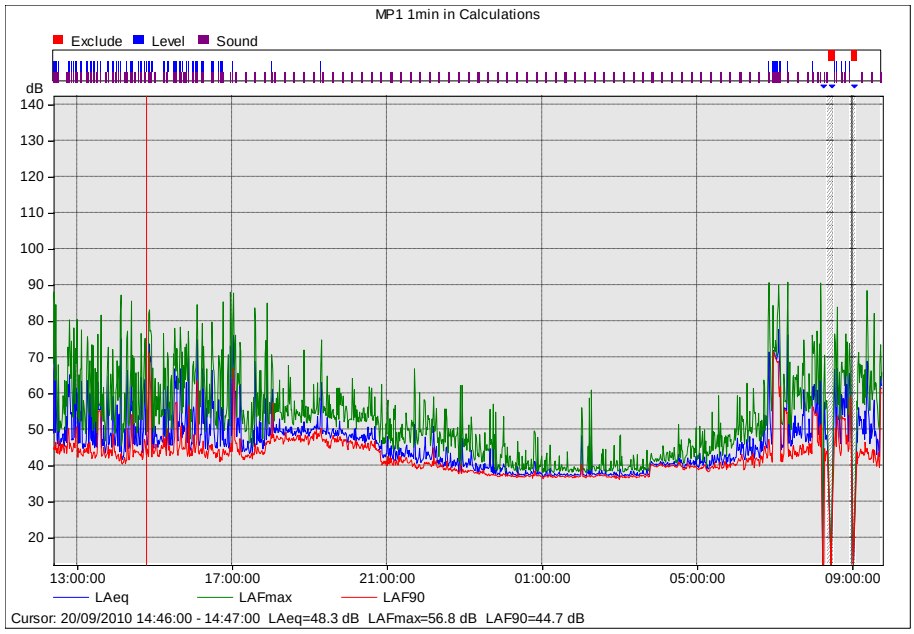
Site Photographs

Existing Auto Repair Shop & Residential Dwellings

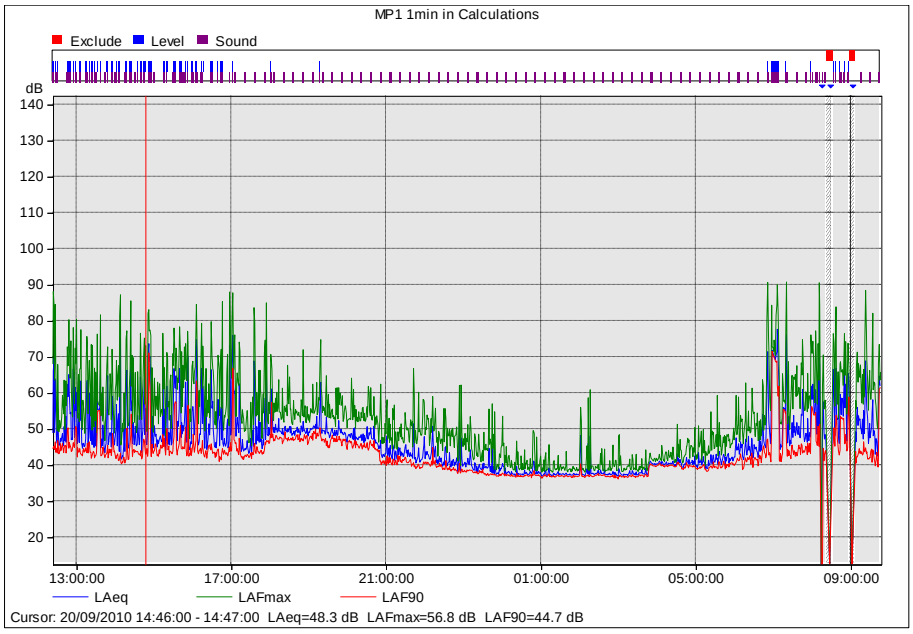
Hire Company & Access Rd

APPENDIX B MEASUREMENT RESULTS

Time History – MP1: 1-Min Measurement Levels-



Time History – MP2: 1-Min Measurement Levels-



Tabulated Noise Measurement Data- MP1 Hourly Measured Results

Start time	LAeq [dB]	LAFmax [dB]	LAF90 [dB]
20/09/2010 13:00:00	56.2	81.6	43.1
20/09/2010 14:00:00	62.7	87.1	42.2
20/09/2010 15:00:00	59.2	78.2	43.8
20/09/2010 16:00:00	60	85.2	43.3
20/09/2010 17:06:04	61.8	87.8	42.9
20/09/2010 18:00:00	53.6	84.9	46.8
20/09/2010 19:00:00	51.1	74.6	46.8
20/09/2010 20:00:00	47.8	64	44.8
20/09/2010 21:00:00	43.8	66.7	40.3
20/09/2010 22:00:00	42.7	58.9	38.9
20/09/2010 23:00:00	41.2	62.1	37.5
21/09/2010 00:00:00	38.1	53.4	36.9
21/09/2010 01:00:00	37.4	47.6	36.7
21/09/2010 02:00:00	39.2	60.8	36.8
21/09/2010 03:00:00	37.8	48.3	36.7
21/09/2010 04:00:00	40.4	51.2	39.5
21/09/2010 05:00:00	41.2	59.2	39
21/09/2010 06:00:00	47.9	80.3	40.5
21/09/2010 07:00:00	65.8	90.6	43.4
21/09/2010 08:00:00	60.1	90.4	44.9
21/09/2010 09:07:30	56.7	88.3	42

Tabulated Noise Measurement Data- MP2 Hourly Measured Results

Start time	LAeq [dB]	LAFmax [dB]	LAF90 [dB]
20/09/2010 16:00:00	61.6	88	49.8
20/09/2010 17:00:00	60	85.5	49.8
20/09/2010 18:00:00	57.4	83.5	50
20/09/2010 19:00:00	57.5	80.6	49.7
20/09/2010 20:00:00	53.8	73.4	46.2
20/09/2010 21:00:00	52.1	76.2	40.4
20/09/2010 22:00:00	50.6	70.9	37.6
20/09/2010 23:00:00	49.1	74.7	36.2
21/09/2010 00:00:00	42.5	69.4	34.8
21/09/2010 01:00:00	38.2	58.6	34.6
21/09/2010 02:00:00	45.1	74.2	35
21/09/2010 03:00:00	39.3	62.7	35.2
21/09/2010 04:00:00	40.8	64.5	34.9
21/09/2010 05:00:00	47.4	67.7	35.6
21/09/2010 06:00:00	55.5	87	38.9
21/09/2010 07:00:00	60.8	89.2	48.1
21/09/2010 08:00:00	62.6	84.2	50.4
21/09/2010 09:00:00	60.2	81.1	48.6

Source Noise Data- Auto Repair Shop

Activity	Noise source	Noise Level (dB LpA)	Distance (metres)	Power Level (dB LwA)	On time per hour	LwA, 1hr (dB)	SEL (dB)
Air line	Compressor	65.0	1	70.0	25%	64.0	99.5
Tyre fitting					Seconds		
	Trolley jack dragged	85.0	1	90.0	10	64.4	100.0
	Removing wheel	90.0	1	95.0	6	67.2	102.7
	Bead breaking	95.0	1	100.0	1	64.4	100.0
	Tyre machine	55.0	1	60.0	180	47.0	82.5
	Inflating tyre	95.0	1	100.0	1	64.4	100.0
	Fitting balance weights	75.0	1	80.0	2	47.4	83.0
	Re-fitting wheel	90.0	1	95.0	6	67.2	102.7
Exhaust replacement					Seconds		
	Car with leaking exhaust	85.0	1	90.0	30	69.2	104.7
	Removing exhaust	85.0	1	90.0	10	64.4	100.0
	Dropping exhaust	90.0	1	95.0	1	59.4	95.0
	Exhausts impacting	80.0	1	85.0	1	49.4	85.0
	Re-fittting exhaust	85.0	1	90.0	10	64.4	100.0
	Ramp operating	72.0	1	77.0	30	56.2	91.7
	Ramp flaps	85.0	1	90.0	1	54.4	90.0
Brake repairs					Seconds		
	Removing wheel	90.0	1	95.0	6	67.2	102.7
	Banging	95.0	1	100.0	3	69.2	104.7
	Re-fitting wheel	90.0	1	95.0	6	67.2	102.7
	Ramp operating	72.0	1	77.0	15	53.2	88.7
Shock Absorbers					Seconds		
	Trolley jack dragged	85.0	1	90.0	10	64.4	100.0
	Removing wheel	90.0	1	95.0	6	67.2	102.7
	Dropped shock absorber	90.0	1	95.0	1	59.4	95.0
	Re-fitting wheel	90.0	1	95.0	6	67.2	102.7
	Bonnet slammed	85.0	1	90.0	1	54.4	90.0
Other sounds					Seconds		
	Miscellaneous	92.0	1	97.0	1	61.4	97.0
	Car Horn	93.0	1	98.0	2	65.4	101.0
	Engine revving	80.0	1	85.0	120	70.2	105.8

APPENDIX D: ACOUSTIC VENTILATORS

9x6 Cowled Acoustic Hit and Miss Ventilator Set (continued)

Colours

Cowl	Buff/sand, terracotta.
Extension air brick	Buff/sand, terracotta.
Liner	Black.
Hit and miss ventilator	White.

9x3 Acoustic Hit and Miss Ventilator Set

- Sound insulation minimum 36dB.
- Alternative to trickle ventilators in windows.
- Meets 4000mm² regulation requirements.
- Internal baffles reduce sound, light and draughts.
- Finished with adjustable internal hit & miss ventilator.
- Set consists of 9x6 airbrick, 9x6 acoustic liner and 9x6 hit and miss ventilator

Size

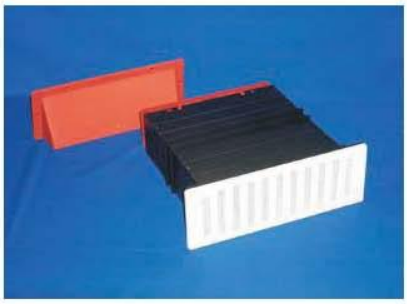
220mm (W) x 71mm (H).
Extends from 250mm to 368mm (L) with extension air brick fitted.

Free Area

4000mm² (40cm²) (6in²) per set.

Colours

Extension air brick	Grey, black, buff/sand, terracotta, white, brown, blue/black.
Liner	Black.
Hit and miss ventilator	White.



9x3 Cowled Acoustic Hit and Miss Ventilator

- Sound insulation minimum 36dB plus 3dB for cowl.
- Alternative to trickle ventilators in windows.
- Meets 4000mm² regulation requirements.
- Internal baffle reduces sound, light and draughts.
- Finished with adjustable hit & miss ventilator.
- Set consists of 9x6 airbrick, 9x6 acoustic liner, 9x6 hit and miss ventilator and 9x6 cowl

Size

Cowl	255mm (L) x 96mm (H) x 44mm (D).
Extension air brick and liner	220mm (W) x 71mm (H).

Extends from 250mm to 368mm (L) with extension air brick fitted.

Free Area

4000mm² (40cm²) (6in²) per set..

Colours

Cowl	Buff/sand, terracotta.
Extension air brick	Buff/sand, terracotta.
Liner	Black.
Hit and miss ventilator	White.

Acoustic Core Ventilator

- Sound insulation 41dB.
- Background ventilator - meets 4000mm² regulation requirements.
- Appliance ventilator - 39cm² Advantica tested Effective Free Area.
- For new or refurbishment projects.

Size

Louvre Ventilators	166mm (L) x 160mm (H).
Tube	127mm (5 in) (Dia.) x 358mm (L).

Free Area for Background Ventilation

4400mm² (44cm²) (6¾ in²) per unit.

Effective Free Area for Heat Producing Appliances (Advantica tested)

3900mm² (39cm²) (6 in²) per unit.
Suitable for an open-flued gas appliance installed in a room or internal space with a gross rated input up to 14kW (47700 Btu/h).

Colours

External Louvre	White, buff/sand, terracotta.
Tube	Black.
Internal Louvre	White.

Figure 1: Location of Acoustic Fence

APPENDIX E: TERMINOLOGY

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2×10^{-5} pascals) and the threshold of pain is around 120 dB. The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow. $L_{Aeq,\ T}$ The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq,\ T}$). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound. L_{AE} Where the overall noise level over a given period is made up of individual noise events, the $L_{Aeq,\ T}$ can be predicted by measuring the noise of the individual noise events using the sound exposure level, L_{AE} (or SEL or L_{AX}). It is defined as the level that, if maintained constant for a period of one second, would deliver the same A weighted sound energy as the actual noise event.

L_{A1} The level exceeded for 1% of the time is sometimes used to represent typical noise maxima.

L_{A10} The level exceeded for 10% of the time is often used to describe road traffic noise. L_{A90} The level exceeded for 90% of the time is normally used to describe background noise.

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB. Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.