OAKDALE CONCEPT PLAN

MASTERPLAN NOISE ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 07070
VERSION C

WILKINSON MURRAY

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PREPARED FOR

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EXECUTIVE SUMMARY

The following Concept Plan acoustic report has been prepared in relation to a proposed Business Park known as Oakdale at Kemps Creek and Horsley Park. The site is located to the south of the Sydney Water Pipeline which passes through Erskine Park.

The report sets out the design criteria and control concepts in relation to:

- Construction noise;
- Road traffic noise on the new link road; and
- Operational noise

Conventional methods will be applied during detailed design to address all of these issues:

- Construction noise must be managed to mitigate the noise impact at residences;
- Airborne noise from road traffic will be mitigated where required by the provision of road side barriers or facade treatments at identified residential receivers;
- Noise emissions from the development will be controlled by appropriate orientation of building shielding, plant selection, location and engineering noise controls.

Noise criteria have been established for construction and operational stages of the development. These goals should be adopted in the design development stage of the project. In addition individual Development Applications for new facilities on lots within the Oakdale Concept Plan should address the criteria established in this assessment.

It is also concluded that appropriate detail design and selection of facilities and mechanical plant should be conducted at the design stage of the project referencing the established criteria and planning recommendations made in this report.

1 INTRODUCTION

Wilkinson Murray Pty Limited was engaged by Goodman International Limited (Goodman) to provide a Concept plan noise assessment in relation to an industrial business park development at Erskine Park known as Oakdale. The following report sets out the design concepts for in relation to:

- Construction noise;
- Road traffic noise on the new link road; and
- Noise emissions from the operation of the development.

1.1 Project & Site Description

Goodman is preparing a concept plan for the Oakdale development in accordance with the provisions of Part 3A of the Environmental Planning and Assessment Act 1979. Goodman proposes to develop an integrated light industrial, logistics, service, warehousing and distribution park in Kemps Creek and Horsley Park, New South Wales. It will be located south of the Sydney Water Pipeline which passes through Erskine Park.

The site selected for the Oakdale Concept Plan comprises several rural landholdings currently used primarily for grazing and agriculture and covers an area of approximately 421 hectares. For the purposes of the concept plan, the development site has been divided into the following 'precincts':

- Central Precinct – comprising Lot 2 DP 120673 (62 ha);
- South Precinct – comprising that part of Lot 82 DP 752041 east of Ropes Creek and Lot 87 DP 75204 (3 ha);
- West Precinct – comprising Lot 1 DP 120673 (127 ha) and that part of Lot 82 DP 752041 (141 ha) west of Ropes Creek; and
- East Precinct – comprising Lot 1 DP 843901 (88 ha), which is the site of an existing Austral Bricks quarry and brick making plant.

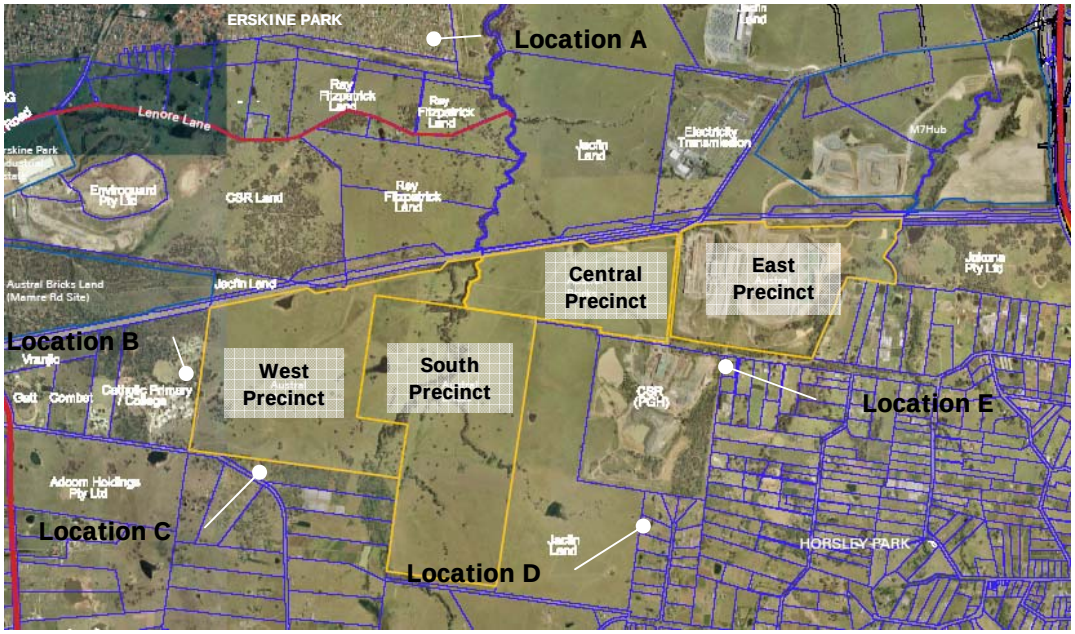
In terms of staging, it is likely that the Central Precinct would be developed first, and is therefore referred to in this report as 'Stage 1'. Indicative staging from Stage 1 would likely progress to the South Precinct ('Stage 2'), then the West Precinct ('Stage 3'), and finally the East Precinct ('Stage 4'). It is noted that the existing Austral quarry / brick making plant is planned to continue operating in accordance with existing approvals for the foreseeable future, and would only be developed following the cessation of quarrying / brick making and rehabilitation of the site.

This report has been prepared with respect to the three precincts, Stages 1-3, that are proposed within the site having regard to the natural features of the site and surrounding receivers as indicated in Figure 1-1. The site occurs within a rural residential setting, with homes situated on rural land around the site. The ambient noise levels in the area can be characterised as typical of a rural environment. Surrounding Receivers have been identified as:

- Erskine Park Residences to the North at a distance of 1.5km from the northern site boundary (Residential Location A)
- Emmaus College and Retirement Village adjacent to the West Precinct (Residential Location B);
- Bakers Road Residences to the south of the West Precinct. (Residential Location C);
- Greenway Drive Residences to the east of the South Precinct (Residential Location D); and

- Burley Road Residences to the south of the East Precinct (Residential Location E).

Figure 1-1 Proposed Site Layout Showing Surrounding Residences & Noise Measurement Locations



1.2 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in Appendix C.

2 AMBIENT NOISE LEVELS

Ambient noise levels were monitored at four locations around the site, selected to cover the range of environments in the potentially-affected area. The locations are presented in Table 2-1. The logger locations are shown in Figure 2-1 and Figure 2-3.

Table 2-1 Long-Term Noise Monitoring Locations

Site	Address	Relevant Noises Noted on Site Visits
A	12 Shaula Place Erskine Park	Local Traffic
B	Emmaus College and Retirement Village	School noise and Local traffic
C	20 Bakers Road	Occasional local traffic
D	27 Greenway Place, Horsley Park	Occasional local traffic

Figure 2-1 Location A – 12 Shaula Drive Erskine Park north of the site

Figure 2-2 Locations B & C – Emmaus College & Retirement Village west of the site & Bakers Road Residences south of the site

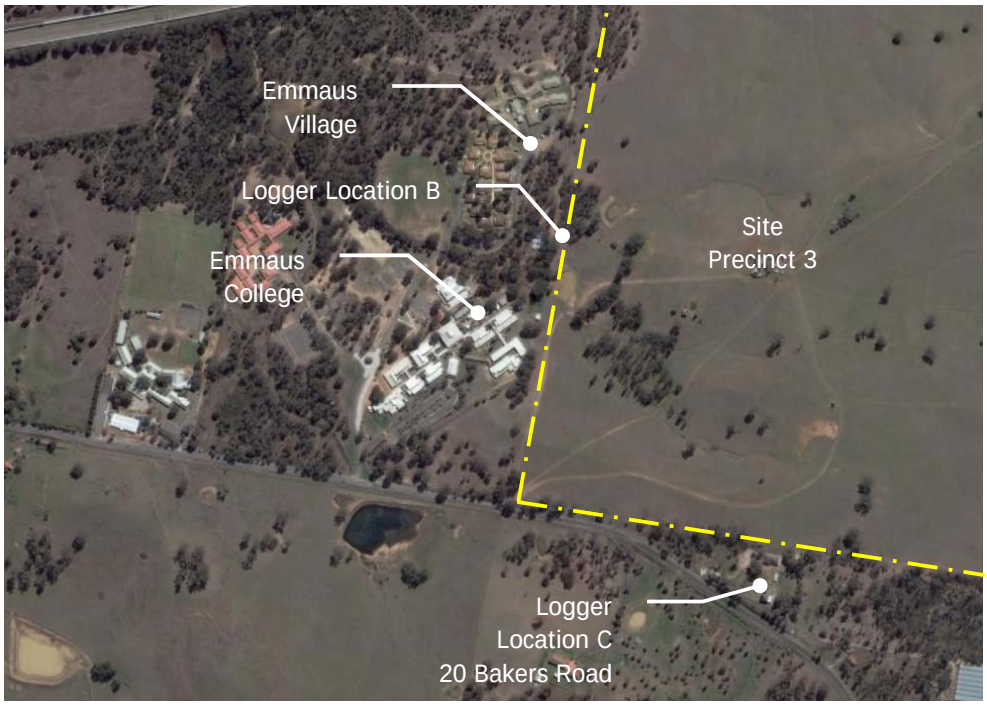


Figure 2-3 Location D – 27 Greenway Place, Horsley Park east of the site

In all cases, monitoring was conducted between Friday, 9 and Friday, 16 March 2007. The noise monitoring equipment used for these measurements consisted of environmental noise loggers set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Appendix A for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. The L_{A90} level is normally taken as the background noise level during the relevant period.

Detailed results for each monitoring location are shown in graphical form in Appendix B. The graphs show measured values of L_{Aeq}, L_{A90}, L_{A10} and L_{A1} for each 15-minute monitoring period. Table 2-2 summarises the results, for daytime, evening and night time periods as defined in the NSW Department of Environment & Climate Change's (DECC) *NSW Industrial Noise Policy (INP)*. The summary values are:

- $L_{Aeq,Period}$ – the overall LAeq noise level measured over the assessment period; and
- RBL – Rating Background Level is a measure of typical background noise levels which are used in determining noise criteria.

Table 2-2 Summary of Measured Noise Levels

Noise Logging Site	RBL (dBA)			$L_{Aeq,Period}$ (dBA)		
	Daytime 7am-6pm	Evening 6-10pm	Night Time 10pm-7am	Daytime 7am-6pm	Evening 6-10pm	Night Time 10pm-7am
A	34	39	40	50	54	55
B	34	34	34	48	54	45
C	34	35	33	51	50	45
D	34	38	38	50	48	45

It is noted that at some locations, particularly at Location A, noise levels increased during the evening and night periods. This is contrary to what might be expected for such locations and is likely to be due to sources such as crickets or the like. Therefore these levels have been discounted in our assessment. In these cases the lower daytime noise level has been adopted for the evening and night periods also.

The values shown in Table 2-2 are considered typical for the relevant areas. The lowest background noise levels are at Sites B, C and D, which are all in relatively quiet rural areas. The highest night time background levels were recorded at Site A, which is in a suburban area.

As background noise levels at Sites B, C and D are almost the same we have used the results at Site B for initial assessment purposes of residences surrounding the site. This includes Site E.

3 ACOUSTIC PERFORMANCE CRITERIA

The following sections detail the applicable noise criteria based on the guidelines of the NSW Department of Environment & Climate Change (DECC).

3.1 Construction Noise Criteria

The assessment of construction is dependent on the duration of construction in the vicinity of the potentially affected residential receiver. The DECC in Chapter 171 of the *Environmental Noise Control Manual (ENCM)* suggests the following noise control guidelines.

Level Restrictions

(i) Construction period of 4 weeks and under.
The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).

(ii) Construction period greater than 4 weeks and not exceeding 26 weeks.
The L_{10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).

Time Restrictions

Monday to Friday	*7am–6pm*
Saturday	*7am–1pm (if inaudible at residential premises)*
	8am–1pm (if audible at residential premises)

No construction work to take place on Sundays or Public Holidays

Silencing

All possible steps should be taken to silence construction site equipment. It is particularly important that silenced equipment should be used on road or rail works where 24 hour operation is necessary.

Where the construction period is likely to be over 26 weeks, a construction noise goal based on a background + 5dBA approach (assuming a conservative RBL of 34dBA for all receivers) is usually adopted. Table 3-1 presents the applicable criteria.

Table 3-1 Construction Noise Criteria - dBA

Receiver	Construction Duration – (Daytime)		
	Up to 4 weeks	4 to 26 weeks	> 26 weeks
All receivers	54	44	39

3.2 Traffic Noise Criteria

Criteria for assessment of road traffic noise are set out in the NSW Government's *Environmental Criteria for Road Traffic Noise (ECRTN)*. Under the definitions in that document, the new Link Road associated with this project would be described as a "*New collector road corridor*".

Table 3-2 shows the relevant noise criteria for this case. The criteria in columns 2 and 3 of the table are referred to as "base" criteria. These should be met in all cases, where possible. Criteria in the fourth column of the table are referred to as "allowance" criteria. The "existing" noise levels referred to here represent traffic noise levels in the year of opening of the project. In this report, these levels are predicted based on traffic volumes for the year 2007. Noise levels for comparison with these criteria should be for a time 10 years after opening of the project, and in this report, predicted traffic volumes for the year 2017 are used in noise assessment.

In summary the noise level goals at the residential receivers, for this project, based on the *ECRTN* are:

- $L_{Aeq,1hr}$ = 60dBA;
- LAeq,1hr = 55dBA; or
- where base criteria are already exceeded, *ECRTN* allowance criteria (existing +0.5dBA) applies.

Table 3-2 Traffic noise criteria extracted from the NSW *ECRTN*

TYPE OF DEVELOPMENT	CRITERIA		
	DAY (7AM-10PM) dB(A)	NIGHT (10PM-7AM) dB(A)	WHERE CRITERIA ARE ALREADY EXCEEDED
New collector road corridor	$L_{Aeq,1hr}$ 60	$L_{Aeq,1hr}$ 55	The new road should be designed so as not to increase noise levels by more than 0.5 dBA Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may be only achievable through long term planning strategies, such as improved planning, design and construction of adjoining land use developments, reduced vehicle emission levels through new vehicle standards and the regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage.

Accordingly all residences potentially affected by traffic noise will be assessed with respect to the above criteria.

3.3 Industrial Noise Criteria

The *NSW Industrial Noise Policy (INP)* recommends two criteria, "Intrusiveness" and "Amenity", both of which are relevant for the assessment of noise. In most situations, one of these is more stringent than the other and dominates the noise assessment. The criteria are based on the L_{Aeq} descriptor, which is explained in Appendix C.

3.3.1 Intrusiveness Criterion

An intrusiveness criterion applies for residential receivers only.

The intrusiveness criterion requires that the L_{Aeq} noise level from the source being assessed, when measured over 15 minutes, should not exceed the Rating Background Noise Level (RBL) by more than 5dBA. The RBL represents the 'background' noise in the area, and is determined from measurement of L_{A90} noise levels, in the absence of noise from the source. The definition of L_{A90} and RBL is given in Appendix C.

3.3.2 Amenity Criterion

The amenity criterion sets a limit on the total noise level from all industrial noise sources affecting a receiver. Different criteria apply for different types of receiver (e.g. residence, school classroom); different areas (e.g. rural, suburban); and different time periods, namely daytime (7.00am-6.00pm), evening (6.00pm-10.00pm) and night time (10.00pm-7.00am).

The noise level to be compared with this criterion is the L_{Aeq} noise level, measured over the time period in question, due to all industrial noise sources, but excluding non-industrial sources such as transportation.

Where a new noise source is proposed in an area with negligible existing industrial noise, the amenity criterion for that source may be taken as being equal to the overall amenity criterion. However, if there is significant existing industrial noise, the criterion for any new source must be set at a lower value. If existing industrial noise already exceeds the relevant amenity criterion, noise from any new source must be set well below the overall criterion to ensure that any increase in noise levels is negligible. Methods for determining a source-specific amenity criterion where there is existing industrial noise are set out in the *INP.*

3.3.3 Determination of Site Specific Industrial Noise Criteria

Table 3-3 show the relevant noise industrial noise criteria for this project based on a suburban and rural area classification.

Table 3-3 Industrial Intrusiveness & Amenity Criteria

Receiver Area	Time Period	RBL (dBA)	Intrusiveness Criterion $L_{Aeq,15min}$ (dBA)	Project-Specific Amenity Criterion
A	Daytime (7.00am–6.00pm)	34	39	55
	Evening (6.00–10.00pm)	39	39	45
	Night time (10.00pm–7.00am)	40	39	40
B, C, D, E	Daytime (7.00am–6.00pm)	34	39	50
	Evening (6.00–10.00pm)	34	39	45
	Night time (10.00pm–7.00am)	34	39	40

In this case, there is insignificant industrial noise existing in the area. Whilst there are quarries around Location E no significant noise was observed during a site visit. Traffic noise levels are unlikely to reduce in the future therefore the full amenity criteria are applicable.

3.3.4 Sleep Disturbance Noise Criteria

In order to minimise sleep disturbance due to transient (short-term) sounds, the DECC recommends that the L_{A1} noise level measured over a 1-minute period outside residential windows should not exceed the repeatable L_{A90} background level by more than 15dBA. This criterion should be applied to the assessment of noise from events such as reversing alarms or impact related noises between 10.00pm-7.00am.

The DECC's sleep arousal criteria are therefore dependent on existing background noise levels. The sleep arousal criterion during the night-time period is 49dBA.

4 NOISE SOURCE LEVELS

Noise sources that are likely to be associated with the development are identified in the following sections.

4.1 Construction Noise Sources

Typical Sound Power Levels (SWL) of the plant likely to be used during earthworks and road building when the site is being established at various stages of the works are identified in Table 4-1. These SWLs have recently been measured at other similar construction sites.

Table 4-1 Typical Construction Plant Sound Power Levels (SWL)

Plant	SWL (dBA)
Excavator	107
Front End - Low Loader	112
Dump Trucks	112
Tower Crane or Mobile Crane	105
Generators	95
Smooth Drum Roller	107
Scrapers	119
Graders	109
Dozer	119
Concrete Trucks	109
Concrete Paver Roller	121
Water Truck	110
Vibratory Rollers	110
Skid Steer loader	112
Concrete Plant	103
Asphalt Plant	114
Paving machine Asphalt	109

4.2 Operational Noise Sources

Whilst noise associated with facilities will be the subject of each particular facility there are a number of sources that are likely to generate noise be such as trucks, forklifts, mechanical plant (condensers and fans) and cars. Typical noise sources are listed in Table 4-2 along with their associated sound power levels.

Table 4-2 Typical Plant Sound Power Levels (SWL)

Plant	SWL (dBA)
Forklift outside	102
Truck manoeuvring	104
Truck idling	95
Car	90
Reverse alarm	110
Truck door	110

The following sections detail an assessment of potential noise impact and mitigation based on noise levels presented in this section.

5 CONSTRUCTION NOISE ASSESSMENT

During the initial site consolidation stage the following works are proposed:

- Construction of the required traffic facilities;
- Upgrade of existing roads and construction of new roads and bridges in the vicinity of the site;
- Construction (and use) of utility connections to the site;
- Demolition, relocation or removal of existing dwellings and structures on the site;
- Sub-division of the site and associated sub-division works including construction of roads; stormwater drainage systems, sewerage and water works, utilities and services; landscaping and earthworks;
- Works for the site water management strategy;
- Remediation of the Riparian corridor on site; and
- Construction and use of buildings and associated works.

The loudest construction period is expected to be the earthmoving phase and, with perhaps six machines including excavators, trucks, a dozer and a grader working around the site simultaneously, a total site sound power of 116dBA can be expected. Earthmoving activity is likely to occur in various sections of the development and given the size of the site it would only be that equipment that is in the vicinity of residences that would be acoustically significant.

Table 5-1 presents the results of initial noise calculations at surrounding residential receivers based on distance attenuation alone allowing for the noise source to be generally around the centre of each zone.

Table 5-1 Predicted L_{A10} Construction Noise Levels at Residential Receivers - dBA

Noise Zone *	Receiver Location				
	A	B	C	D	E
1	43	35	33	36	40
2	40	35	38	46	35
3	41	50	52	41	35
4	41	58	53	39	34

* See Appendix A for defined noise zones

These initial calculations show the construction noise criterion is likely to be exceeded during the earthmoving phase at rural residences whilst residences in Erskine Park are unlikely to be adversely affected by noise from the site. Exceedances of construction noise criteria are quite common for construction projects and given the relatively short duration of construction work compared to the life of the development, some tolerance is usually expected.

While it is impractical to require strict compliance with the construction noise criteria at all times, the following noise mitigation measures are considered reasonable and feasible:

- Construction activities that are likely to be audible at any residence must not occur outside the usual hours of 7.00am-6.00pm Monday to Friday and 8.00am-1.00pm on Saturday. Construction vehicles should not approach the site before 7.00am.

- Noisy activities such as earthworks in close proximity to residences should ideally be programmed to avoid early mornings and Saturdays. While this may not be always practical, consideration should be given to surrounding residential receivers when planning the construction program.
- Noise barriers on Bakers Road (as discussed in the preliminary traffic noise assessment, Section 7) should be installed as early in the construction schedule as possible, to provide an acoustic barrier for remaining road construction work.
- Spoil quantities should be carefully considered to avoid truck movements to and from the site to provide additional fill or remove excess spoil.
- Diesel powered machines such as trucks, bobcats and excavators should be switched off if not required for more than a few minutes rather than left idling unnecessarily.
- Machines used on site should be maintained in good condition, particularly considering the exhaust system on diesel powered machines, to minimise noise emissions. Excessively loud machines should be repaired, modified or removed from the site. Sound pressure level measurements should be conducted on all plant prior to works beginning on-site.
- A representative from the construction contractor should be available to respond to questions and complaints from the community in a professional, considerate and timely manner.
- Reverse alarms should be controlled to the minimum sound level consistent with safety by replacing, shielding or relocating the alarm unit on noisy machines.

The above noise control recommendations may not necessarily result in the construction noise criteria being met at all times, although they will result in the lowest possible noise impacts consistent with efficient and safe construction work on the site.

Construction activities that generate noise above the noise criteria detailed in Table 3-1 should only be permitted to occur between the hours of 7.00am-6.00pm on weekdays, 8.00am-1.00pm on Saturdays, and not on Sundays and public holidays.

6 OPERATIONAL NOISE ASSESSMENT

The site is proposed to be located in a rural area and subsequently, ambient noise levels are relatively low. As a result, noise emissions associated with proposed facilities will need to be carefully managed to protect the acoustic amenity of these surrounding residences.

The following features have been adopted in the planning layout prepared by Goodman:

- The western side of Stage 3 is proposed to be a light industrial / commercial area. Commercial land use in particular is likely to produce less noise, operate during the day only and provide a noise buffer between Emmaus College and Retirement Village and other areas of the development.
- Residences in Erskine Park are a considerable distance from the site and associated link road.
- It is understood that the land to the south of the Western Precinct on Bakers Road has been identified by the NSW Government as potential employment lands. Further there is an option of other parties to buy much of the land including the lot immediately adjacent to the southern boundary of the western precinct for such a use. Should this occur any noise impact in these residences would be negated.

6.1 Facility Noise

Warehouse / distribution type facilities are not typically associated with major manufacturing plant and as such do not require significant noise controls on process plant. Associated stationary noise sources such as fans, air-conditioning and refrigeration plant, compressors and operations within buildings can be controlled by planning, engineering noise control (silencers, acoustic louvers enclosures etc.) or selection of building components (masonry walls etc).

These strategies must be implemented during the plant selection and installation process to optimise the control of noise emission from the mechanical plant and equipment, based on detailed spectral noise data to assess the need for possible tonality corrections in accordance with the *INP*.

The future site activities, operations and associated noise produced by activities in each lot of the proposed development are not currently known. Therefore, the impact of noise can not be established at this early stage of the development. Variables such as the type of use and hours of operations can only be addressed when individual Development / Project Applications for each unit are submitted.

As such, some facilities may generate low noise emissions whilst others may require the implementation of noise control measures within individual lots. However it would be inappropriate for the first “noisy facility” to “use up” all the established noise criteria, thereby placing a greater impost on other future facilities to control noise. In addition, such an approach would be difficult for authorities to manage as uses of various facilities changed.

Therefore individual Zone specific noise emission criteria have been established to ensure that noise emissions from the entire site do exceed the overall noise criteria at surrounding residences. The noise zones are shown in Appendix A.

The following zone specific noise emission criteria have been established and are detailed in Table 6-1 to Table 6-4 allow for the distance of each Zone from the residences.

Table 6-1 Specific Site Noise Emission Criteria at Erskine Park Residences

Noise Zone	Noise Criteria $L_{Aeq,15min}$ (dBA)		
	Daytime 7am–6pm	Evening 6-10pm	Night 10pm-7am
1	35	35	36
2	31	31	32
3	33	33	34
4	32	32	33
Total	**39**	**39**	**39**

Table 6-2 Specific Site Noise Emission Criteria at Emmaus School & Village

Noise Zone	Noise Criteria $L_{Aeq,15min}$ (dBA)		
	Daytime 7am–6pm	Evening 6-10pm	Night 10pm-7am
1	20	20	20
2	23	23	23
3	30	30	30
4	38	38	38
Total	**39**	**39**	**39**

Table 6-3 Specific Site Noise Emission Criteria at Baker Road Residences

Noise Zone	Noise Criteria $L_{Aeq,15min}$ (dBA)		
	Daytime 7am–6pm	Evening 6-10pm	Night 10pm-7am
1	24	24	24
2	29	29	29
3	35	35	35
4	36	36	36
Total	**39**	**39**	**39**

Table 6-4 Specific Site Noise Emission Criteria at Greenway Drive* Residences

Noise Zone	Noise Criteria $L_{Aeq,15min}$ (dBA)		
	Daytime 7am–6pm	Evening 6-10pm	Night 10pm-7am
1	34	34	34
2	36	36	36
3	30	30	30
4	29	29	29
Total	**39**	**39**	**39**

* These noise criteria should also be applied for residences on Burley Road Residences (Location E).

As the site is to be operated and managed by Goodman it is proposed the site will be acoustically modelled to manage the developments against the above criteria. This will allow determination of the cumulative impact of new developments at residences and consider shielding from buildings and topography as well as take into account meteorological effects. Such a planning tool will allow appropriate noise control measures to be adopted along with siting advice on activities that are potentially disruptive to surrounding receivers.

6.2 Indicative Operational Noise Levels

As fixed plant can be controlled by engineering measures the major source of noise emission associated with these facilities is expected to be that associated with the movement of trucks and loading / unloading operations at the loading bays and yard areas.

In general the buildings will generally be set back from the surrounding residences. This will be a positive contribution towards reducing noise emission to residences. Similarly, the future development area and the "noise buffer" zones provided between the site and identified residences will assist in reducing noise emission levels at the residences.

A review of the indicative resultant noise levels at surrounding residences has been conducted based on a "worst case no controls" yard operation being:

- Major buildings operating 24-hours, i.e. night operation;
- 10 trucks manoeuvring on site simultaneously;
- No shielding from surrounding buildings or barriers; and
- Average distances have been estimated from the acoustic centre of the each noise zone i.e. 1 to 4.

Table 6-5 Indicative Levels at Residences without noise controls - dBA

Receiver	Distance (m)	Attenuation	Resultant	Exceedance
A	1700	78	36	
	2560	76	38	
	2120	75	39	
	2350	75	39	
		Total	**44**	**5**
B	2500	81	33	
	1800	81	33	
	770	66	48	
	300	58	56	
		Total	**57**	**18**
C	2330	83	31	
	1240	78	36	
	640	64	50	
	560	63	51	
		Total	**54**	**15**
D	1500	80	34	
	1200	70	44	
	2240	75	39	

Receiver	Distance (m)	Attenuation	Resultant	Exceedance
	2370	75	39	
		Total	**47**	**8**
E	960	76	38	
	1800	81	33	
	2550	81	33	
	2760	82	32	
		Total	**41**	**2**

The exceedances indicated above are considered manageable by prudent design incorporating building orientation and barriers. Accordingly noise control measures will be necessary to manage noise emissions from the site. This can be achieved by the following measures:

- Orientate yard and dock areas away from residences so that the building shields noise from these activities;
- Utilise mass elements on the facility walls to contain noise. Where ventilation is required on walls facing a residence, acoustic louvers should be installed;
- Allow barrier / berms in the areas between residences and precincts where there is potential for disturbance, particularly prior to any barrier being achieved by smaller buildings on the perimeter lots. We recommend barriers in the order of 3m would be appropriate on the southern side of the Western Precinct. The barrier can consist of a berm and a fence to meet the desired objective; and
- The provision of recessed loading docks would also contribute to the minimisation of noise emission by eliminating any requirement for external loading / unloading using forklifts, etc.

6.3 Sleep Disturbance

In the case of noise from events such as reversing alarms, there is the potential for sleep disturbance from areas that potentially operate in the night period. A review of predicted noise levels presented in Table 6-6 indicates no exceedance of sleep disturbance criteria at residences on Bakers Road. However, should truck alarms occur towards the boundaries at night time, noise levels up to 76dB are predicted without noise control measures.

Table 6-6 Predicted Truck Reversing Alarm Noise Levels at Residences - dBA

Zone	Receiver Location				
	A	**B**	**C**	**D**	**E**
1	37	29	27	30	34
2	34	29	32	40	29
3	35	34	46	35	29
4	35	42	47	33	28
Noise Criteria	49	49	49	49	49

In the absence of detailed development and operational data it is considered prudent to allow for a barrier / berm to protect the acoustic amenity of residences on Bakers Road residences. A barrier in the order of 4m would be required to address this issue. In addition such a barrier would provide amelioration of noise before the entire site is developed. This assumes that the option over these properties has not been exercised.

6.4 Cumulative Noise Impact

The *INP* has been designed to provide the means to manage noise from multiple developments with the object of attaining the best possible balance between noise and other relevant socio-economic factors. Applying the principles of the *INP* at the planning stage can avoid future land use conflicts over noise.

Typically when a new industrial estate is proposed, planning studies are carried out and planning instrument is released. This could be in the form of a Masterplan, Precinct Plan or Development Control Plan. These documents often specify the new land use zonings for the area, the permitted types of development for the zone and various other requirements.

In developing the noise control requirements for the new industrial estate, a strategic approach can be set out within the planning instrument.

As the number of residences potentially affected by noise from the operation of the proposed business park are relatively few it is proposed to adopt the "Greystanes" approach (Langgons D, 2001). The approach that was adopted to deal with noise control for the industrial component at the Greystanes site can be summarised as follows:

1. Appropriate amenity noise levels are determined for the residences surrounding the various precincts. The *INP's* "rural" amenity area category noise levels of 50dB(A), 45dB(A) and 40dB(A) levels for daytime, evening and night time respectively are adopted.
2. The industrial land was divided into four zones, in this case corresponding to the four precincts.
3. A noise limit for each zone applies at the nearest residential area. The combined limits for all four zones complied with the adopted noise objectives for the residential area.

The approach aims to minimise the potential for exceedance of the amenity goals, allow for a more equitable share of the noise "budget" and allow some flexibility to the land developer.

A review of the site indicates that residences are well spread out and in many cases will be potentially affected by noise from mainly one precinct. However noise from the centre and west precincts may both contribute to resultant noise levels at Erskine Park residences. In this case the allowable noise emissions should be reduced by 3dB to ensure compliance with criteria. This issue can be addressed by the development of a whole of site acoustic model.

7 TRAFFIC NOISE ASSESSMENT

To assess likely conformance to the *ECRTN* criteria, the traffic noise level emissions associated with the site when fully developed has been calculated for hourly intervals during peak hourly periods.

Noise predictions have been based on projected traffic volumes in 2017 (as supplied by the traffic consultant Traffix) using the *Calculation of Road Traffic Noise (CORTN)* traffic noise prediction technique. Table 7-1 presents vehicle speed and percentage of heavy vehicles used in the model.

Table 7-1 2017 Traffic Volumes – PM Peak Hour Flows

Roadway	VPH	Speed	% Heavy Vehicles
Link Road - East	1355	70	8
Link Road West – Bakers Road end	2593	70	8

Preliminary predictions of traffic noise levels at residential locations identified at A, C and E have been conducted. The following PM peak hour facade reflected noise levels are predicted based on traffic flows, topography and distance:

- Location A 47 dBA
- Location C 70 dBA
- Location E 49 dBA

The results indicate compliance at all potentially affected residences with the exception of residences overlooking the site (Location C). Accordingly, assuming these residences still remain at time of construction, noise mitigation would be required to ensure compliance with established traffic noise criteria. The following mitigation measures are available.

Noise Barrier – A noise barriers on the roadside can be adopted to reduce traffic noise at the residences at Locations B and C. The barriers should be in the order of 3 m in height on the Northern Side of Bakers Road. The height and length and construction of the barrier should be optimised based on RTA procedures during the detail design stage of the development.

Architectural Treatment - Architectural treatment aims to ensure that satisfactory internal noise levels are achieved. Architectural treatments (typically involving acoustic treatment of facades) are recommended where future noise levels are more than 5dBA in excess of relevant *ECRTN* noise criteria.

Architectural mitigation measures are designed to achieve internal noise levels that would have normally prevailed if the external noise criteria were achieved. The typical outdoor to indoor noise reductions provided by most standard dwellings (i.e. without special acoustical treatment) is generally accepted as being 10dBA with windows open (allowing for natural ventilation) and 20dBA with windows and doors closed.

Ventilation - As mentioned above, for naturally ventilated dwellings, the average noise reduction provided by an opened window or door is 10dBA. As the design noise levels cannot be achieved within dwellings fronting the road with windows and/or doors open, a system of “mechanical ventilation” would be required to enable openings in the external facade to remain tightly closed during noisy periods.

8 SUMMARY OF RECOMMENDATIONS

Based on our investigations of the site at the Concept plan stage of the development the following recommendations have been established.

8.1 Noise Criteria

Noise criteria for construction and operation have been established based on noise measurements processed in accordance with DECC procedures. These criteria should be imposed on any facilities at the Development / Project Application stage. Individual assessment in the context of the entire site is proposed to ensure that the cumulative impact of noise associated with these facilities does not exceed acceptable noise levels.

8.2 Construction Noise

Noise from construction activities will potentially exceed established noise goals. Therefore the planning and management of construction activities should take into account the sensitivities of surrounding residences to minimise the impact of construction noise at these receivers.

The control of construction noise should form a part of the site Environmental Management Plan where best practice procedures and community consultation is employed.

Further it is recommended that any noise barriers that are recommended for traffic and operation noise control are constructed at an early stage as possible so that these items are utilised in reducing noise during construction.

8.3 Operational Noise

Noise from fixed plant and buildings can be controlled by the implementation of engineering noise controls such as enclosures, silencers and acoustic louvers. These measures are likely to be more extensive than similar facilities in urban areas due to relatively low noise criteria.

Management of yard activities and associated noise should be conducted on a precinct by precinct basis whereby the following measures should be adopted to protect the acoustic amenity of surrounding residences:

- Orientate yard and dock areas away from residences so that the building shields noise from these activities;
- Where docks are required on either end of the building build end fins to shield residences from dock and yard noise; and

8.4 Traffic Noise

Residences on Bakers Road will be subject to significantly increased traffic noise that is predicted to exceed established noise goals. As a result the following options for noise mitigation options have been identified:

- A roadside noise barrier; or
- Facade treatment and ventilation to affected residences.

Should the properties be purchased for employment land use then these measures will not be necessary.

9 CONCLUSION

This assessment establishes that noise criteria should be able to be met during operation of the proposed Oakdale Concept Plan. The noise criteria can be achieved by using a combination of engineering and management measures to minimise noise emissions. It is proposed to manage noise emissions from site by developing a site noise model to manage noise emissions. This is considered a practical approach as Goodman propose to retain management of the entire site and as such can plan and ensure the acoustic amenity of surrounding residences is maintained.

Construction activities are likely to exceed established goals at surrounding rural properties; accordingly management of this issue will require particular attention in minimising the acoustic impact at residences.

These measures have been discussed in sufficient detail in the report to allow detailed design of engineering modifications and inclusion of management measures in site operating procedures. It should be noted that other noise mitigation measures are usually available although this report recommends strategies considered to be the most practical and cost effective for this application.

Road traffic noise levels are likely to exceed appropriate criteria at identified residences on Barkers Road and traffic noise reduction measures are likely to be appropriate for these residences should they continue to occupy this area. Discussion with the owners of the identified properties is recommended before a final decision is made regarding noise control options for these residences.

The identified noise impact at residences on Bakers Road will not be relevant should the option to purchase these lands for employment lands be exercised.

10 REFERENCES

- NSW Department of Environment & Climate Change (DECC), 2001 – *NSW Industrial Noise Policy*
- NSW Department of Environment & Climate Change (DECC), 1999 – *Environmental Criteria for Road Traffic Noise*
- Langgons D, 2001 *Noise Control Planning for New Industrial Estates*, Australian Acoustical Society Annual Conference 2001

Note
All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

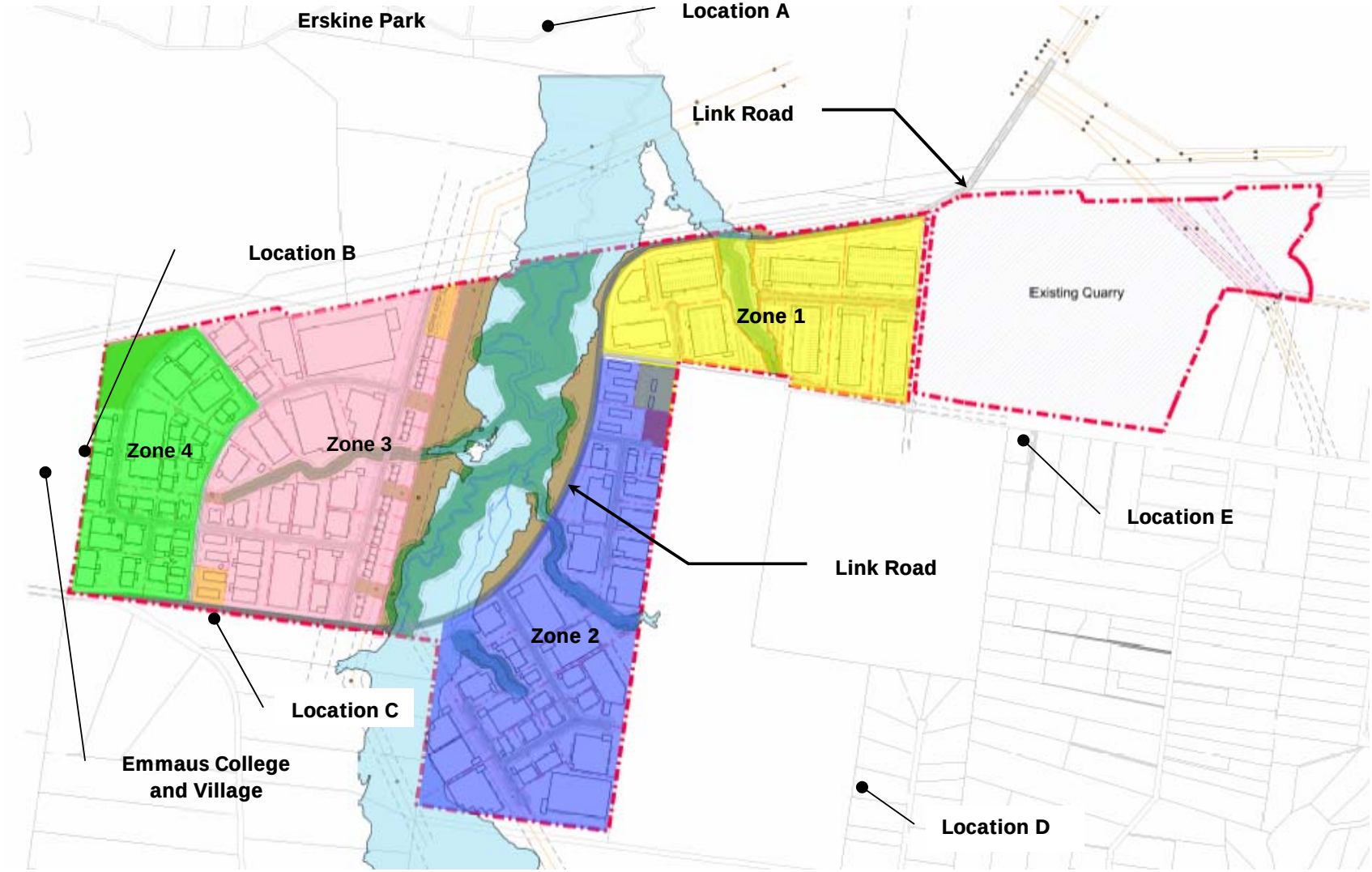
Quality Assurance
We are committed to and have implemented AS/NZS ISO 9001:2000 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC
This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
C	Final	26 July 2007	Brian Clarke	Sam Demasi

APPENDIX A

NOISE ZONES


Erskine Park
Location A
Link Road
Location B
Existing Quarry
Zone 1
Zone 4
Zone 3
Location E
Link Road
Zone 2
Location C
Emmaus College
and Village
Location D

APPENDIX B

NOISE MEASUREMENT RESULTS

Location A: 12 Shaula Place

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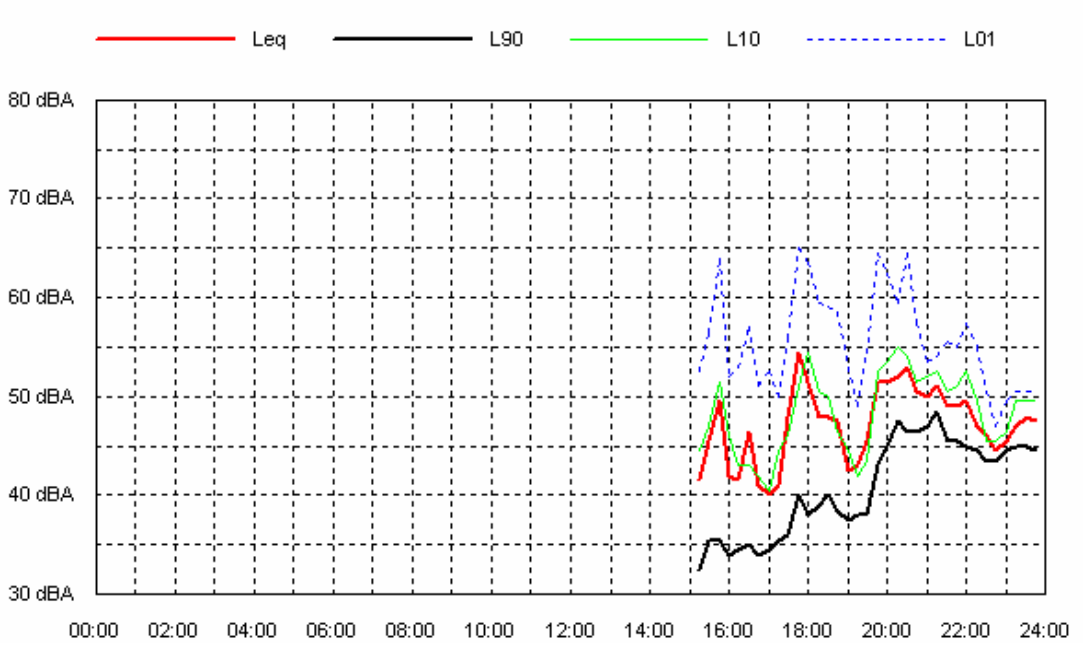

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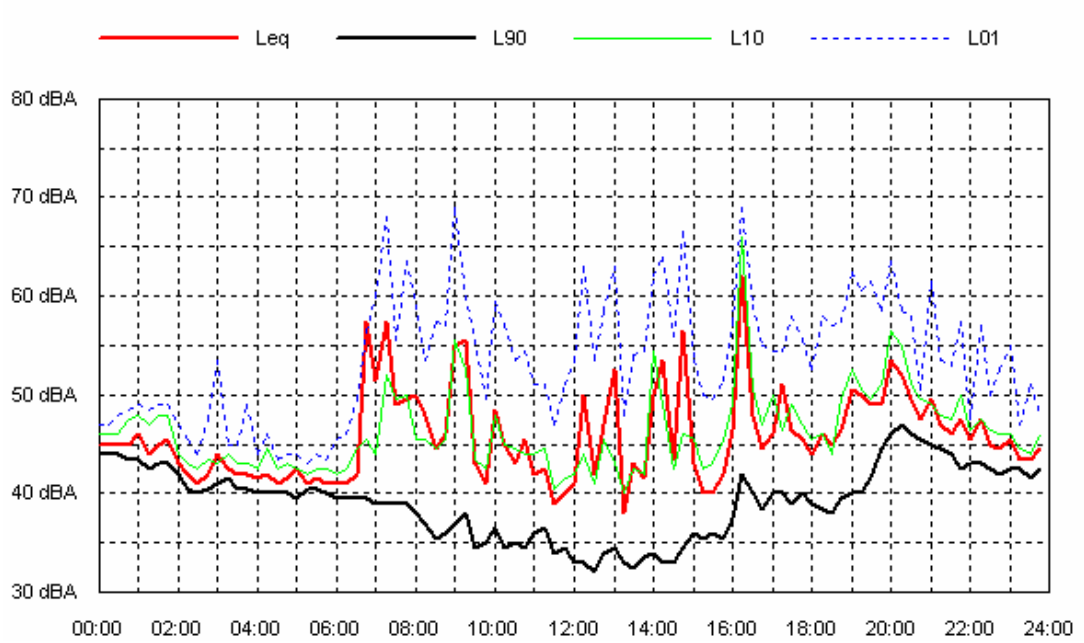

Location A: 12 Shaula Place

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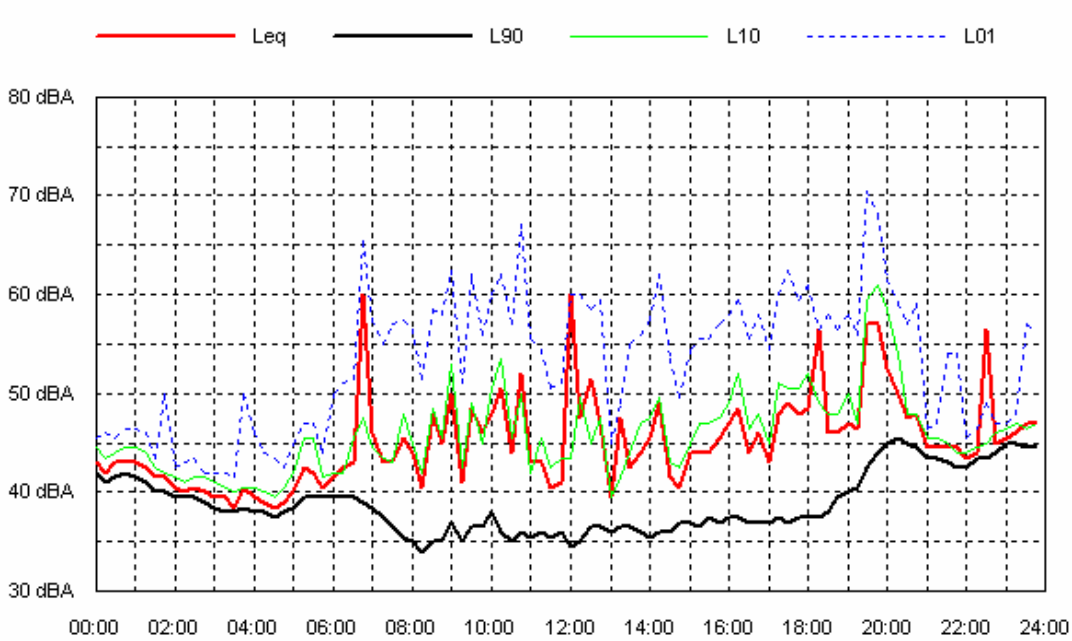

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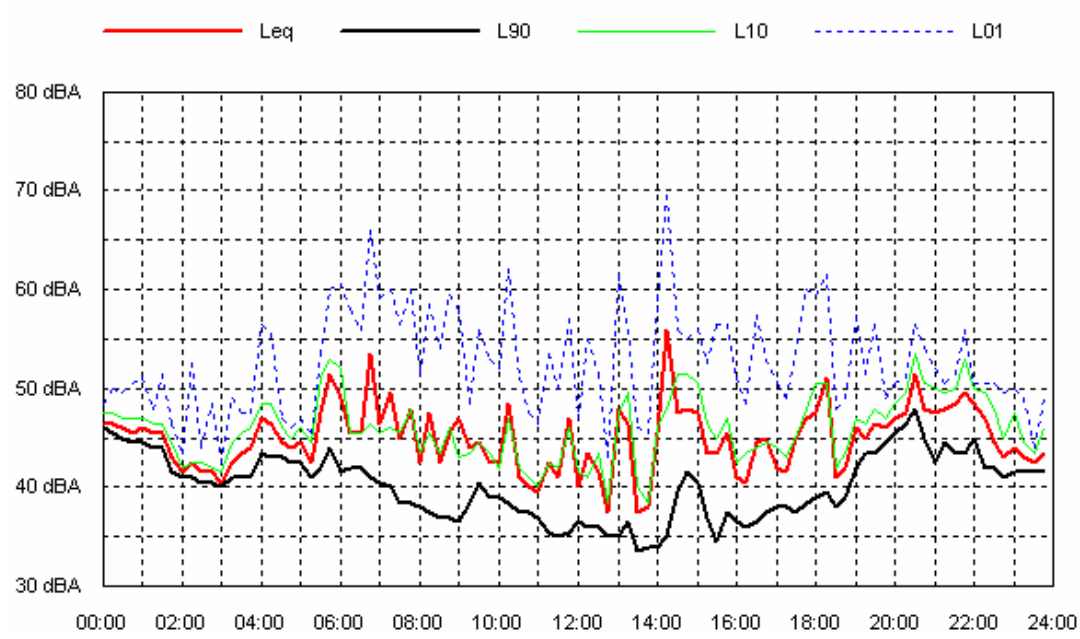

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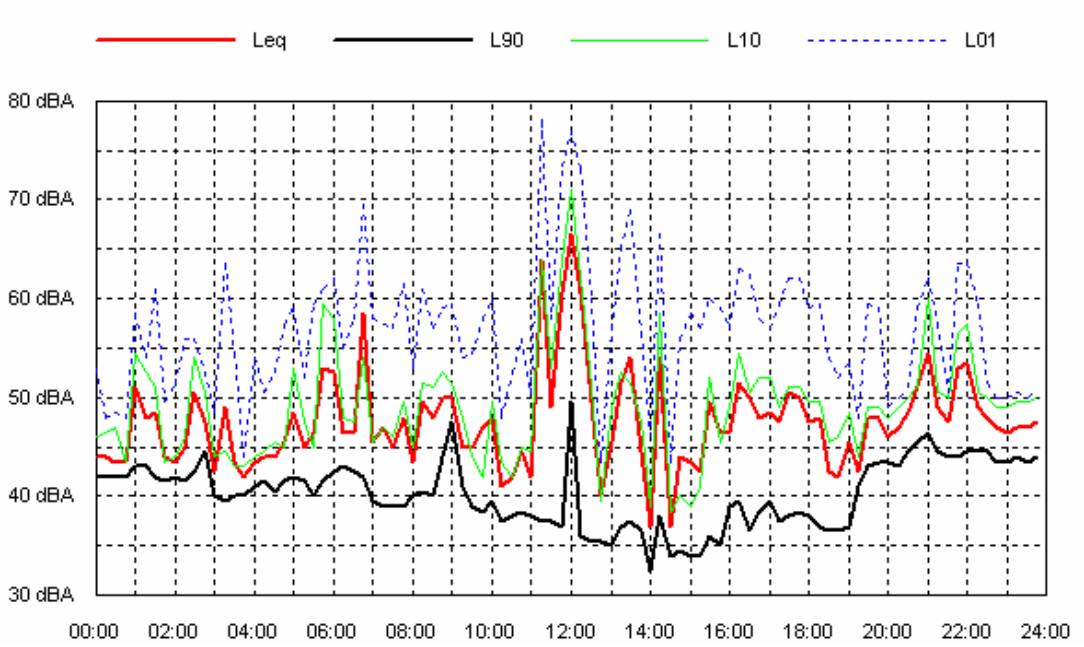

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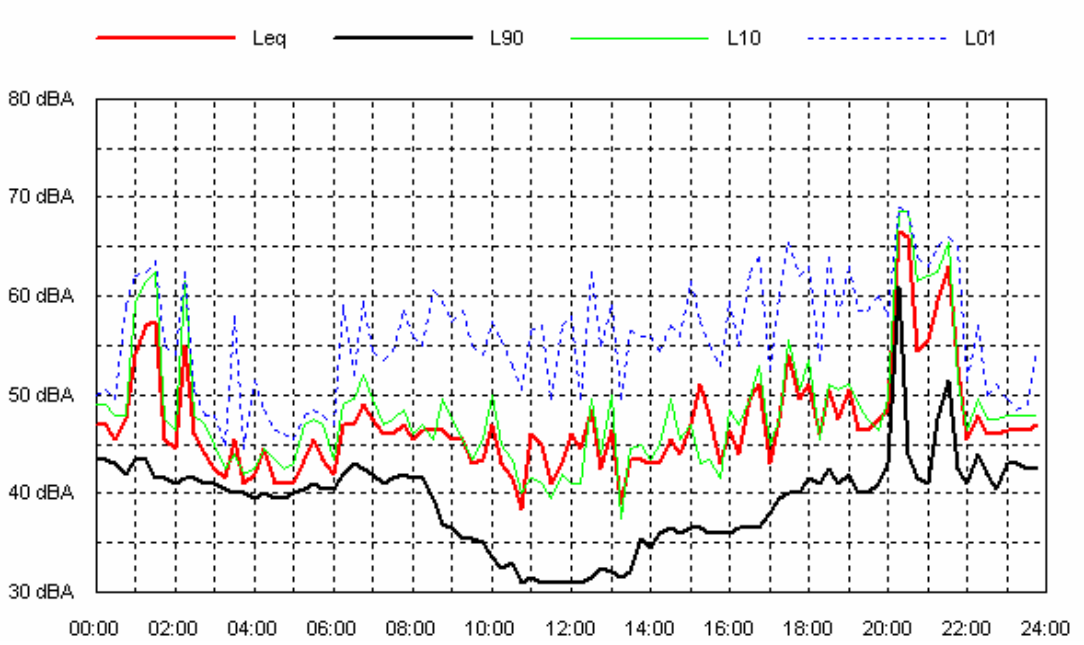

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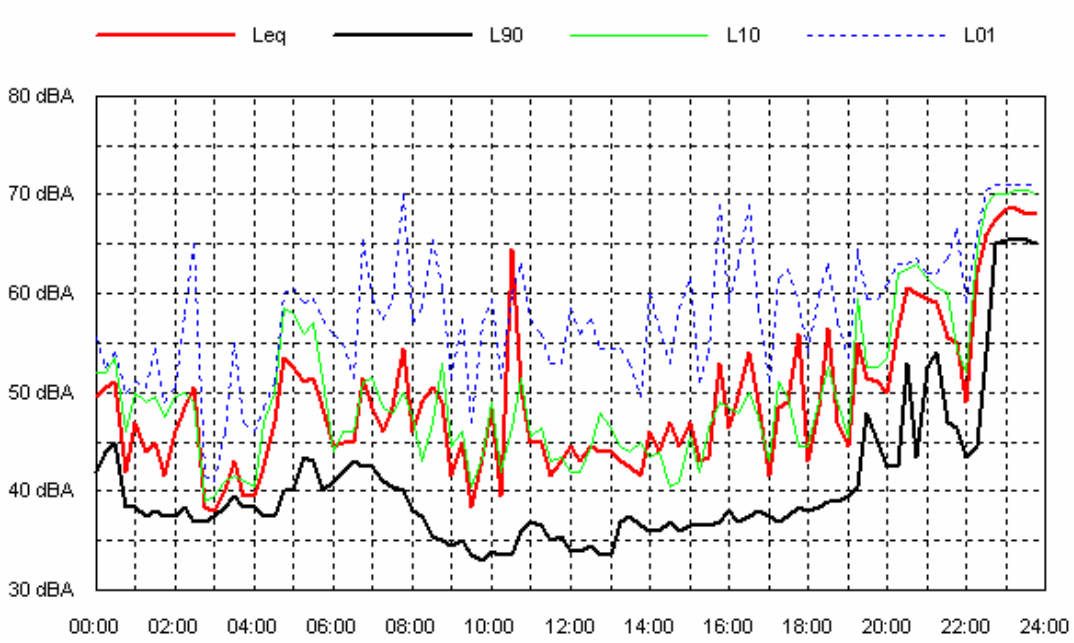

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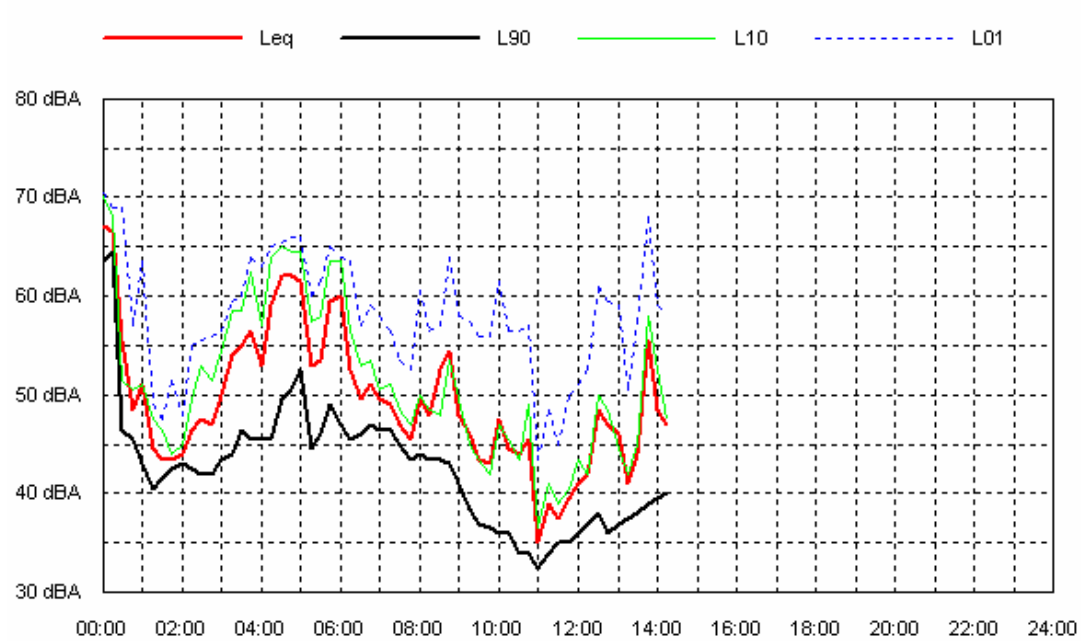

Location B : Emmaus College

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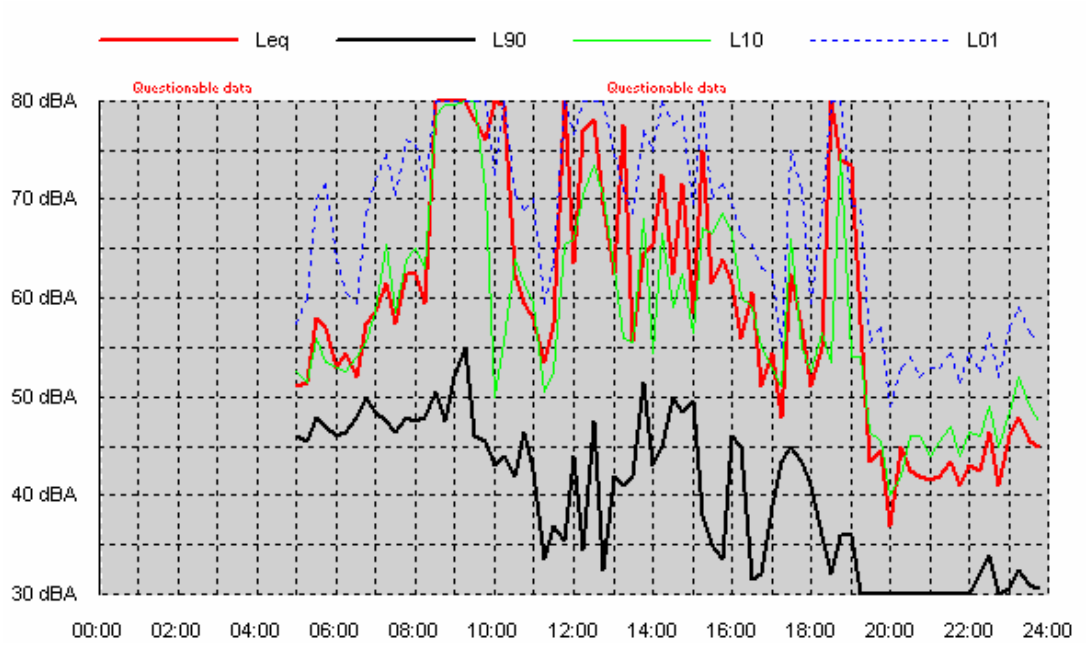

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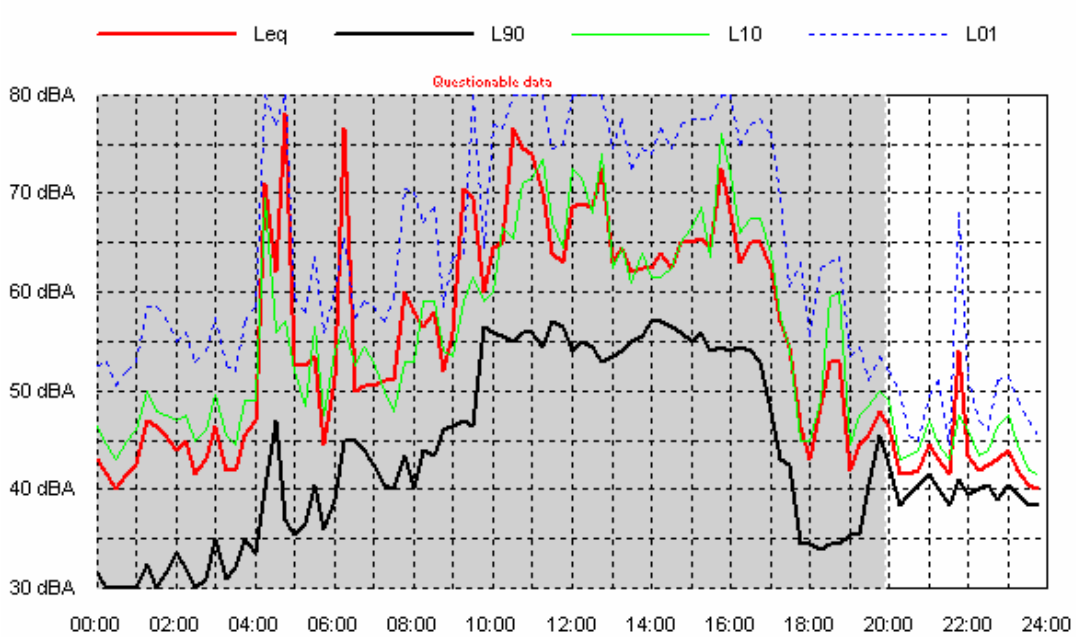

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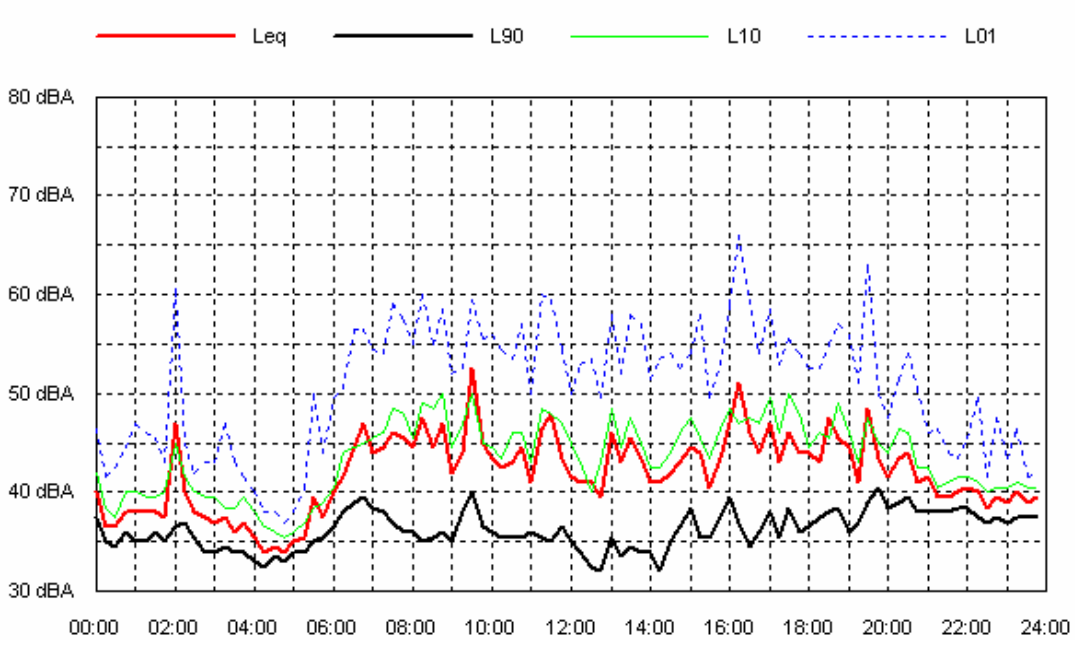

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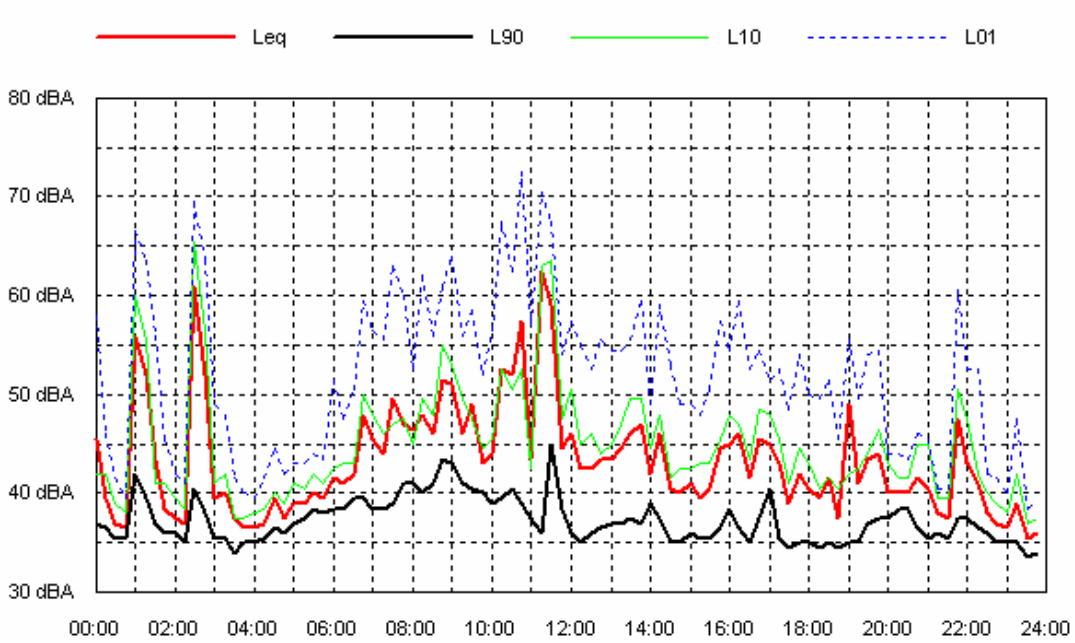

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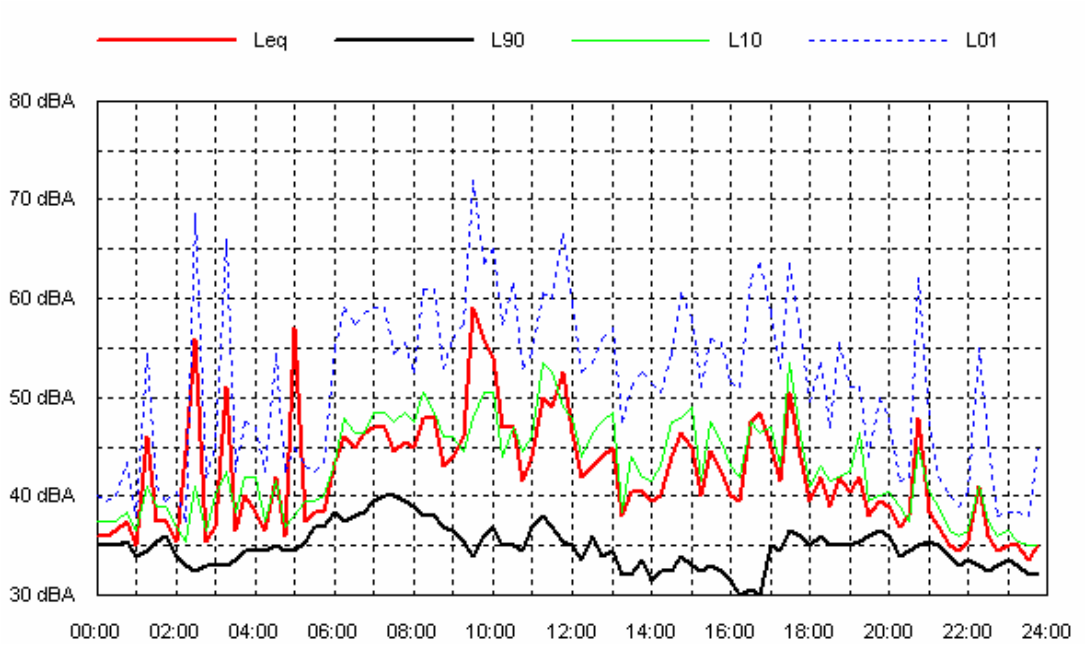

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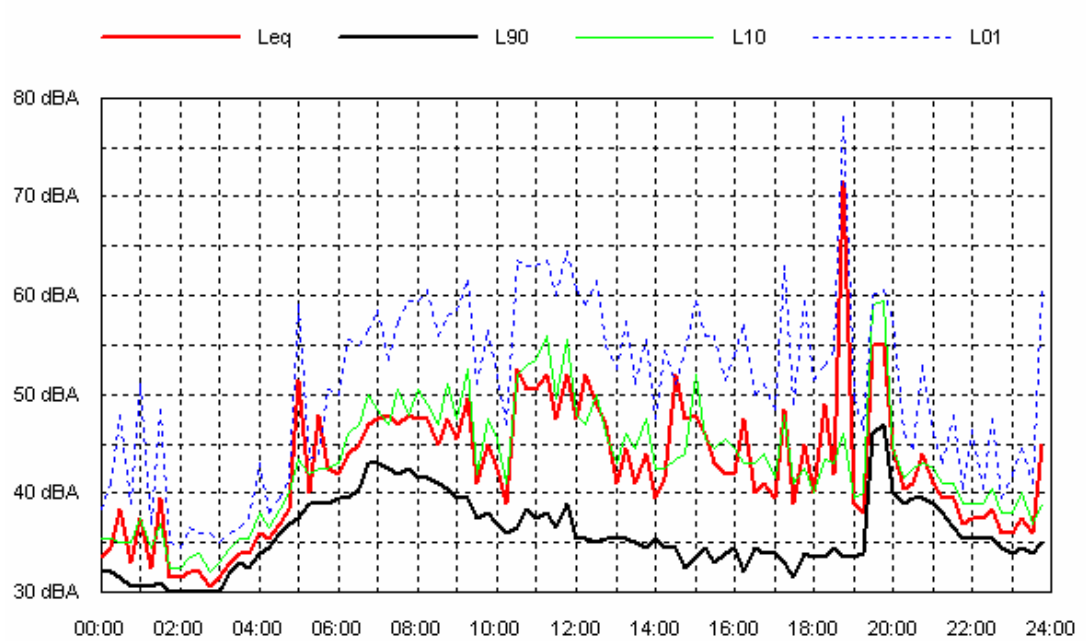

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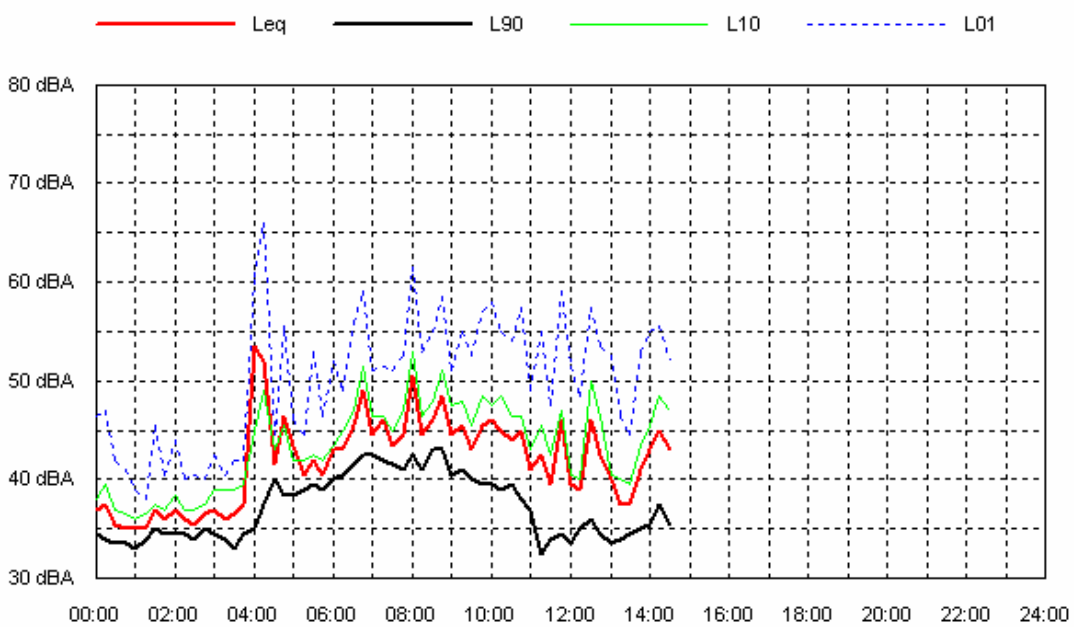

Location C: 20 Baker Road

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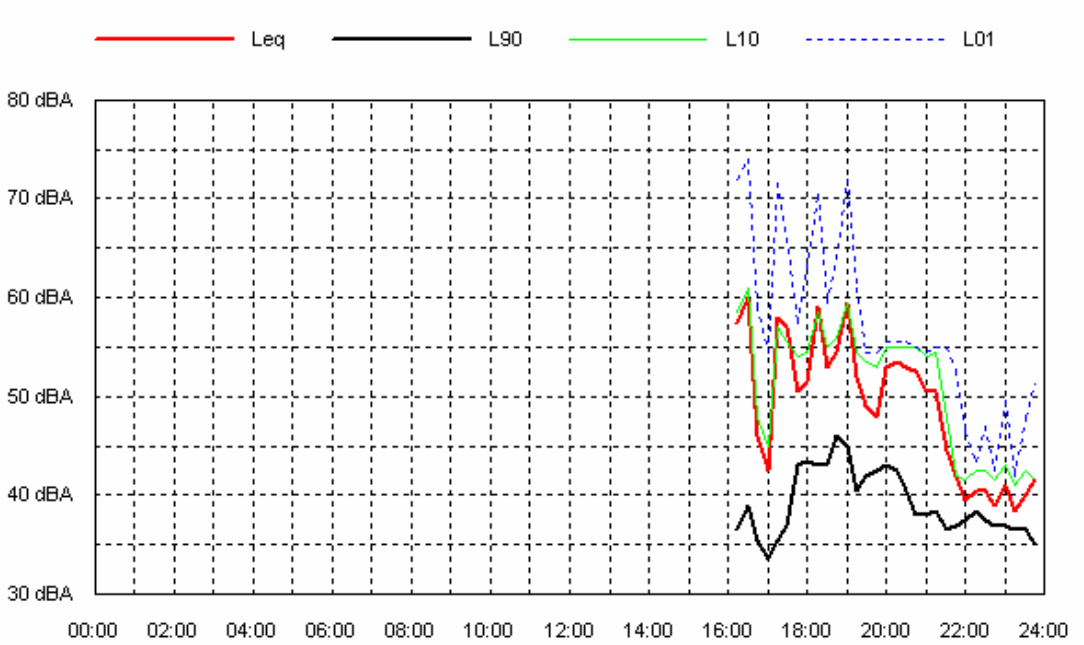

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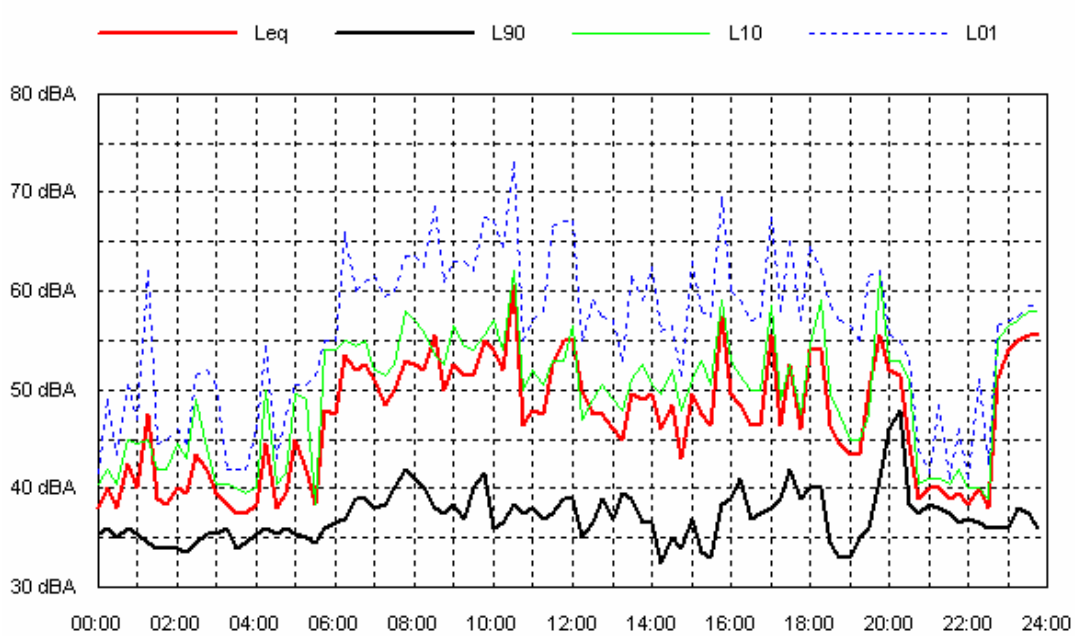

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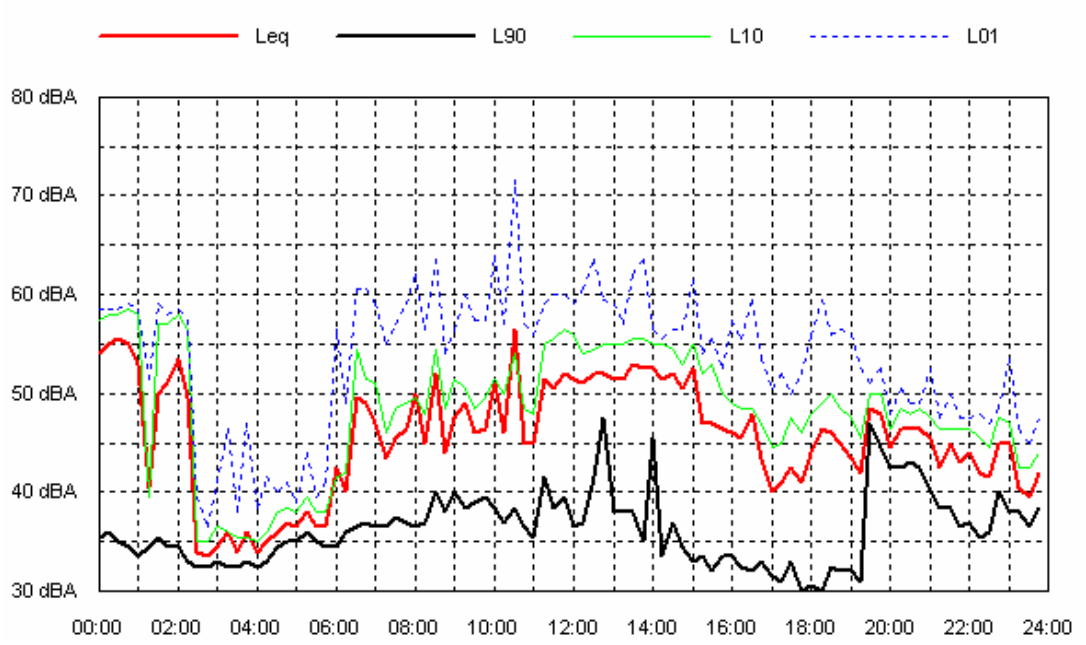

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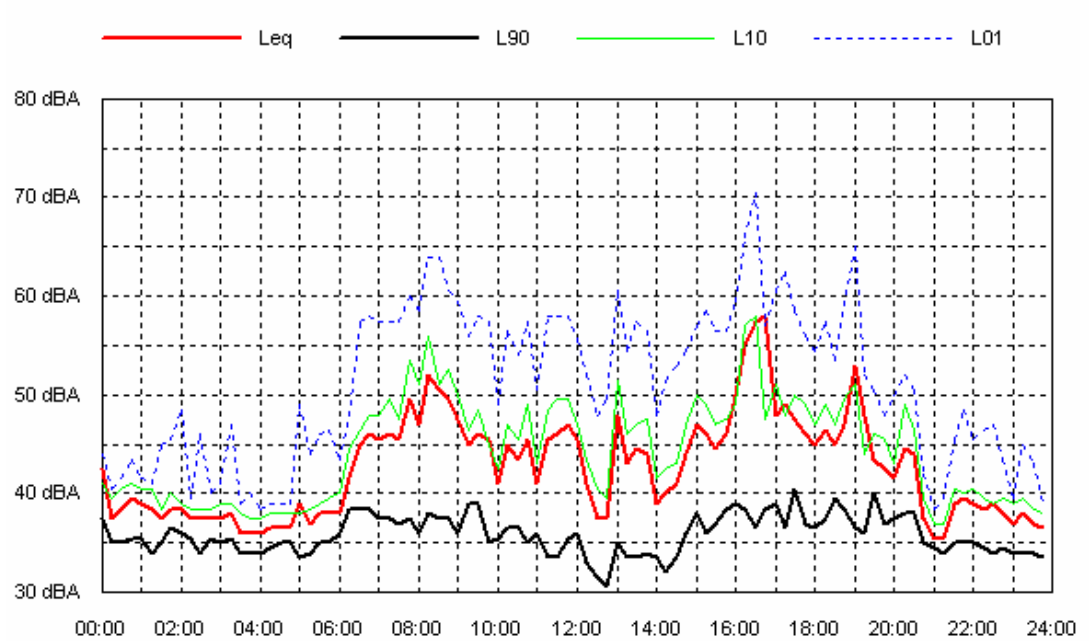

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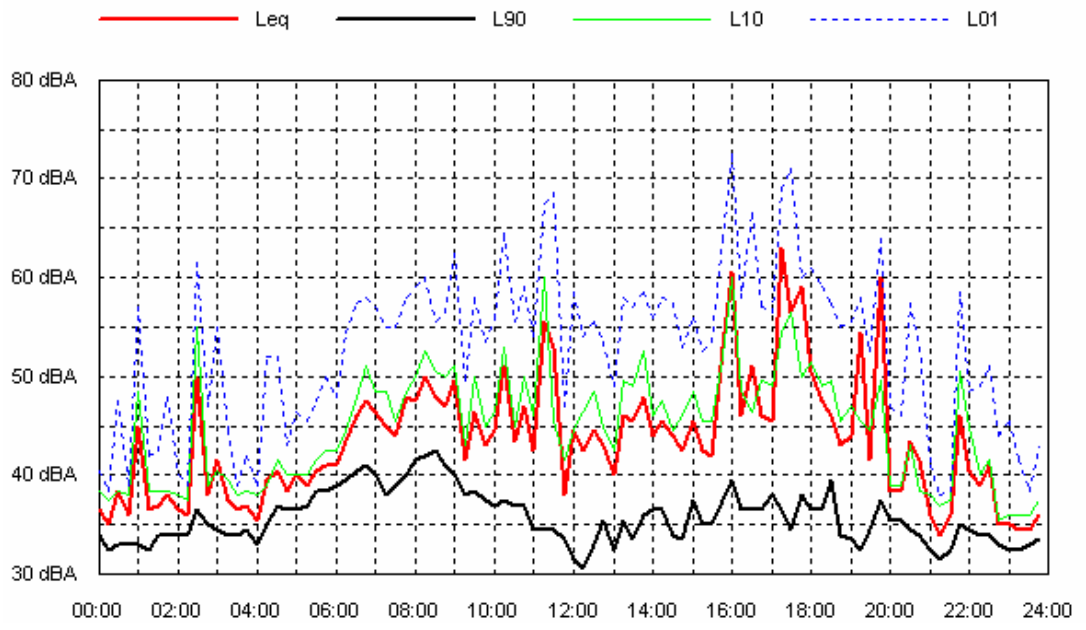

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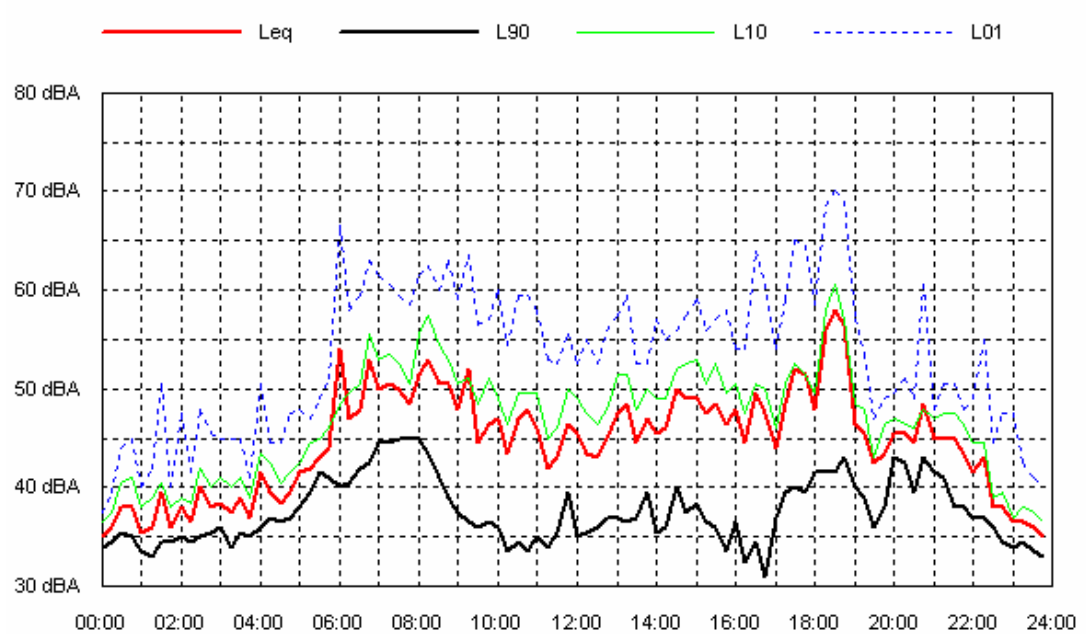

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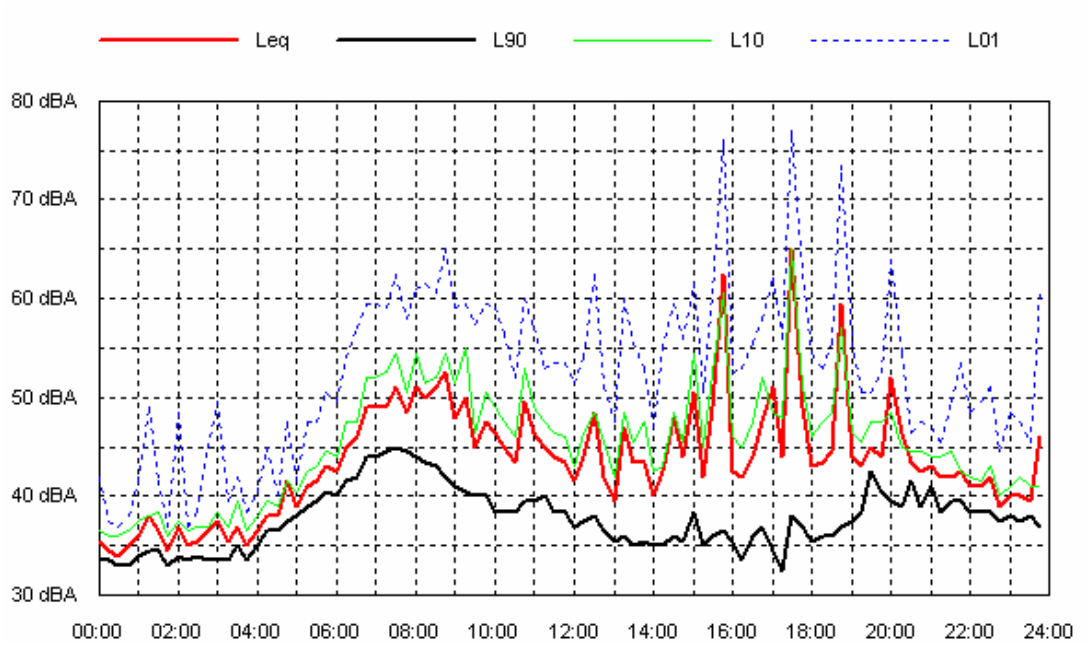

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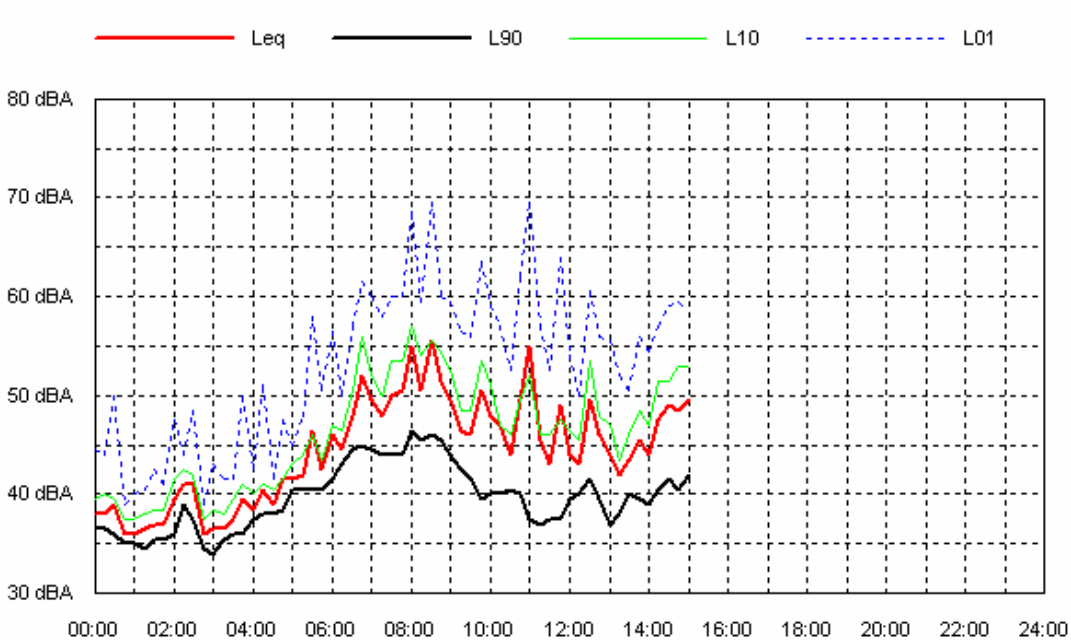

Location D : 27 Greenway

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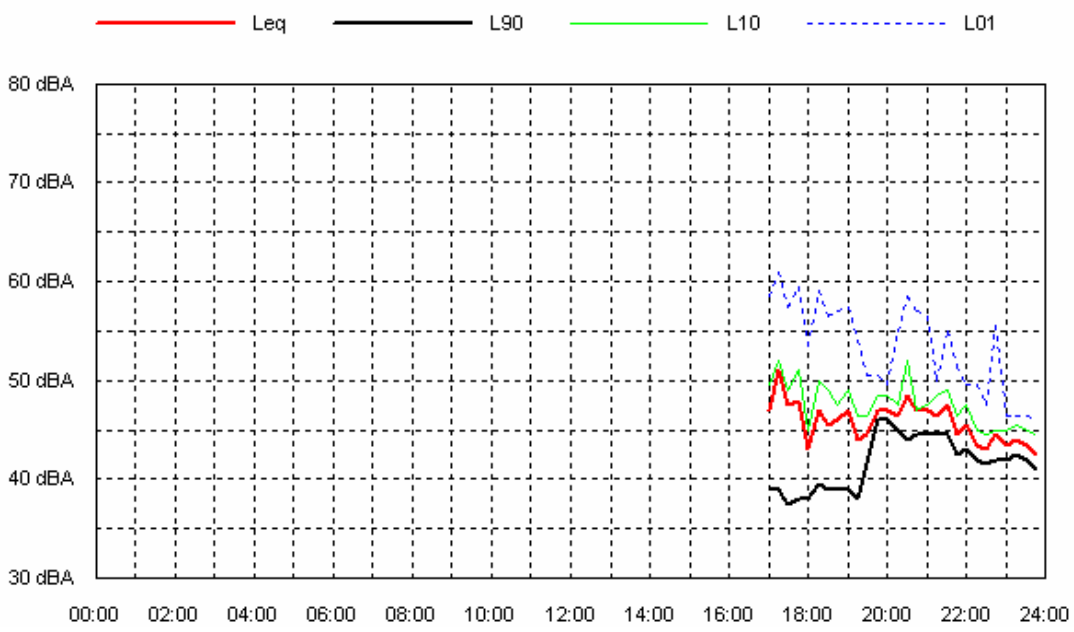

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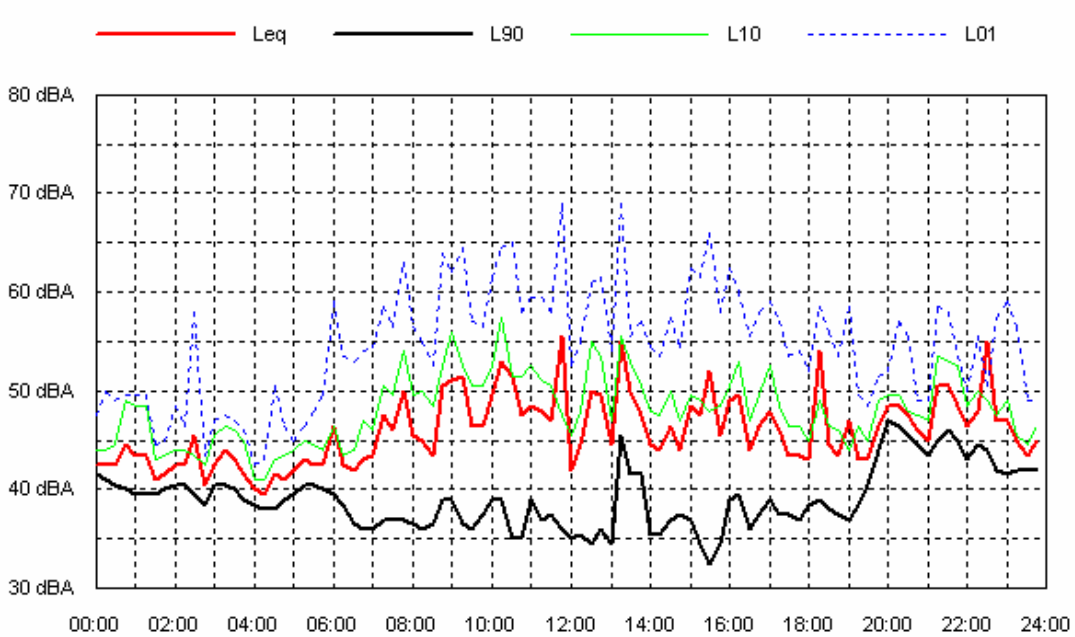

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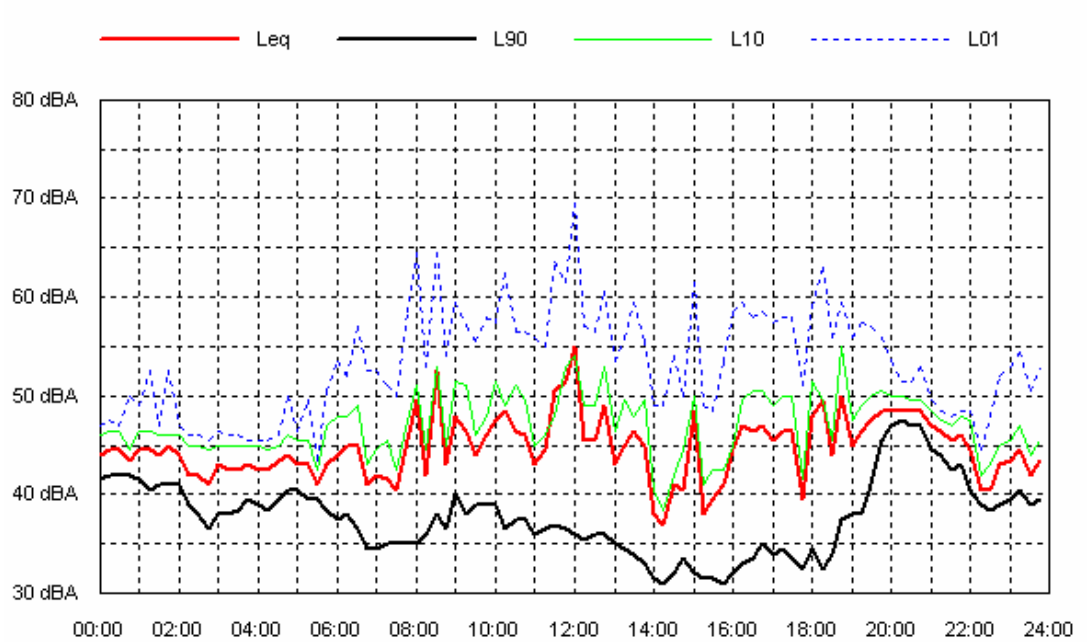

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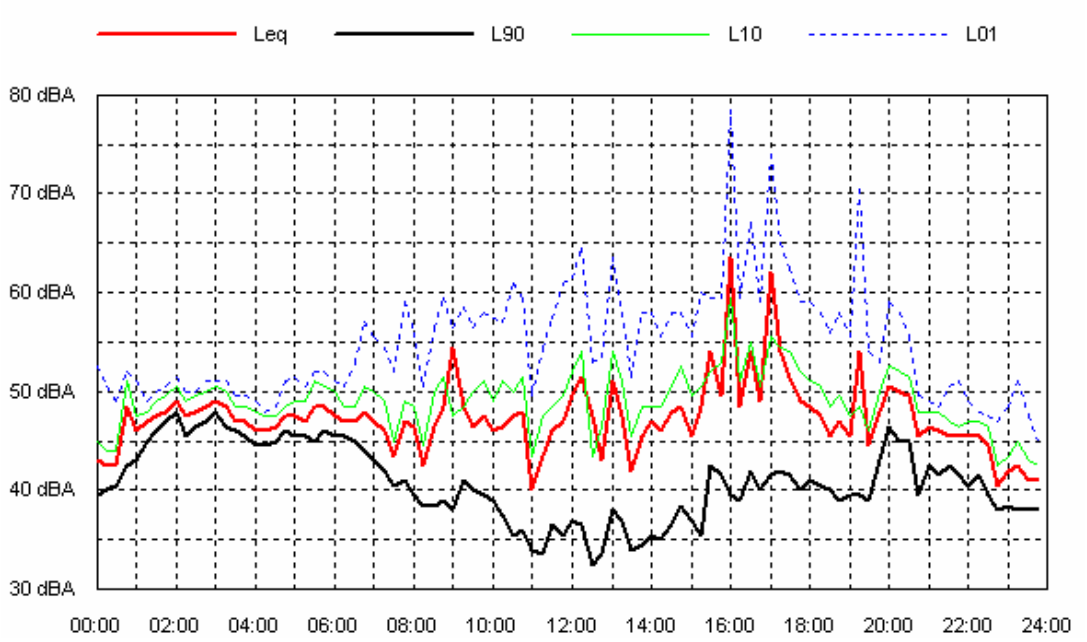

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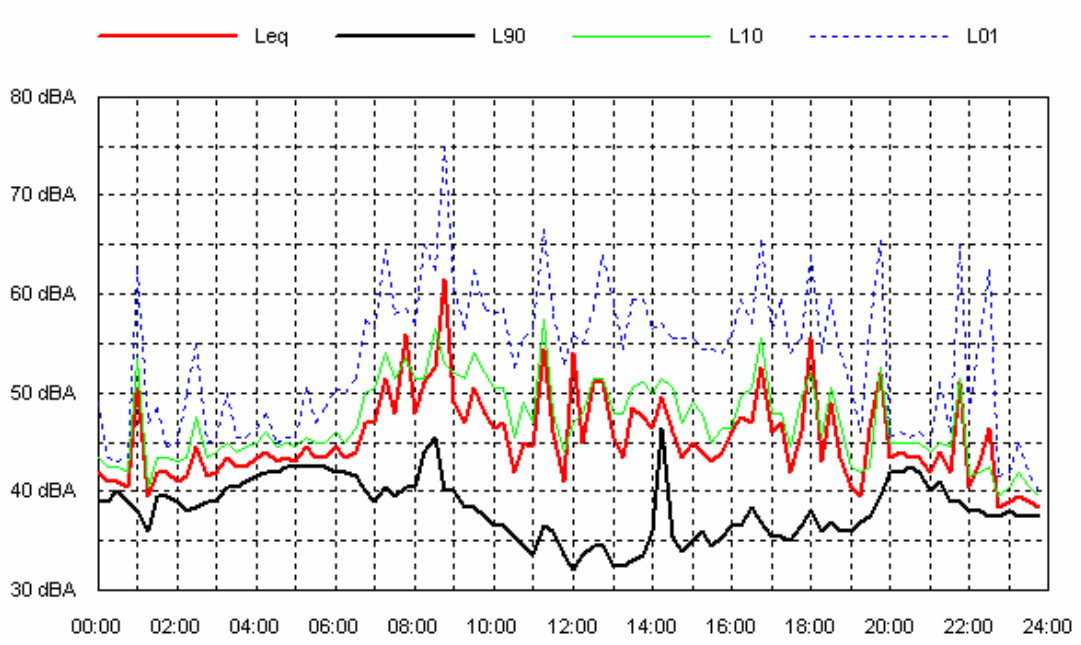

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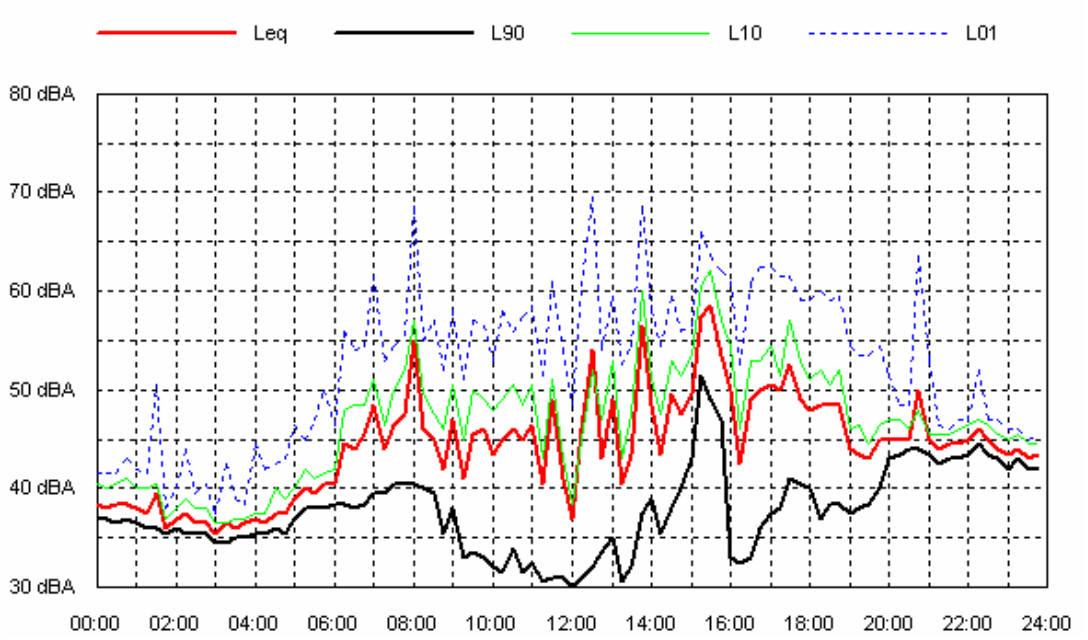

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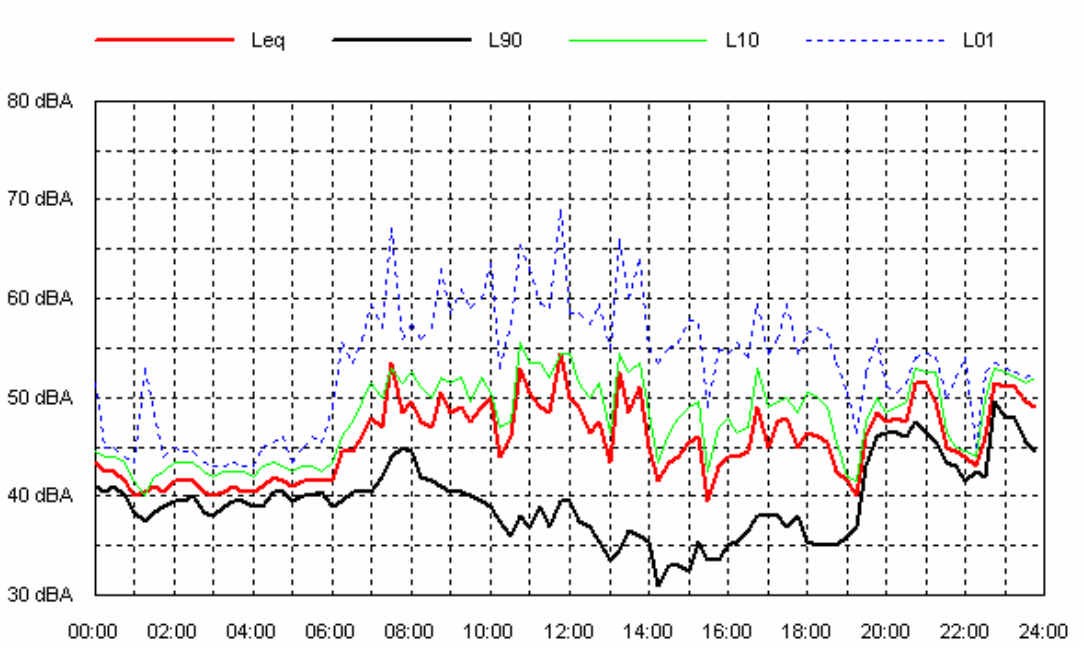

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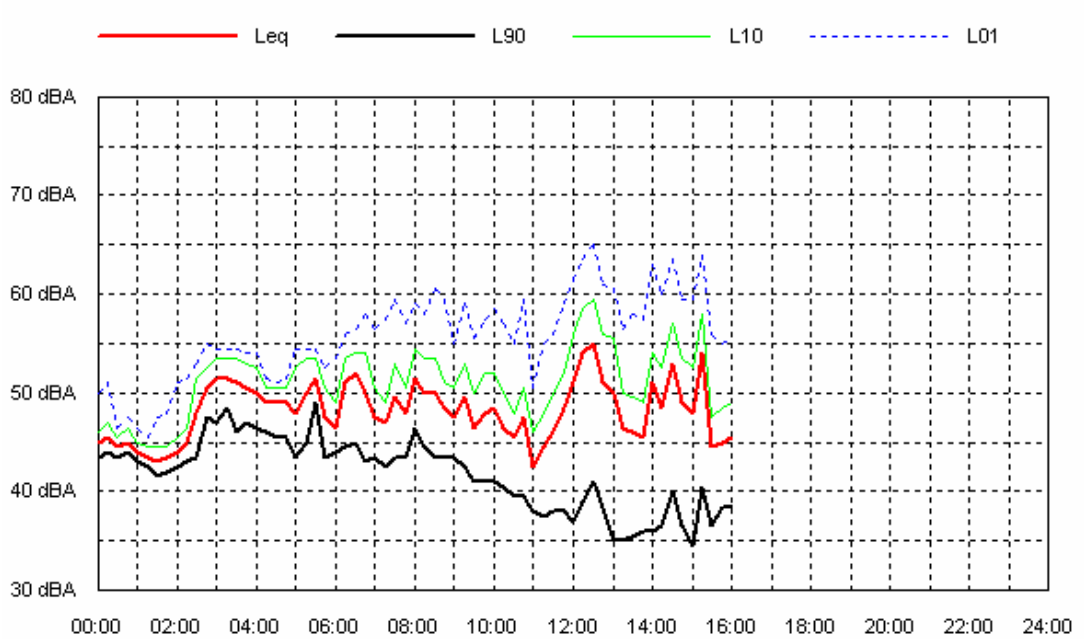


APPENDIX C

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

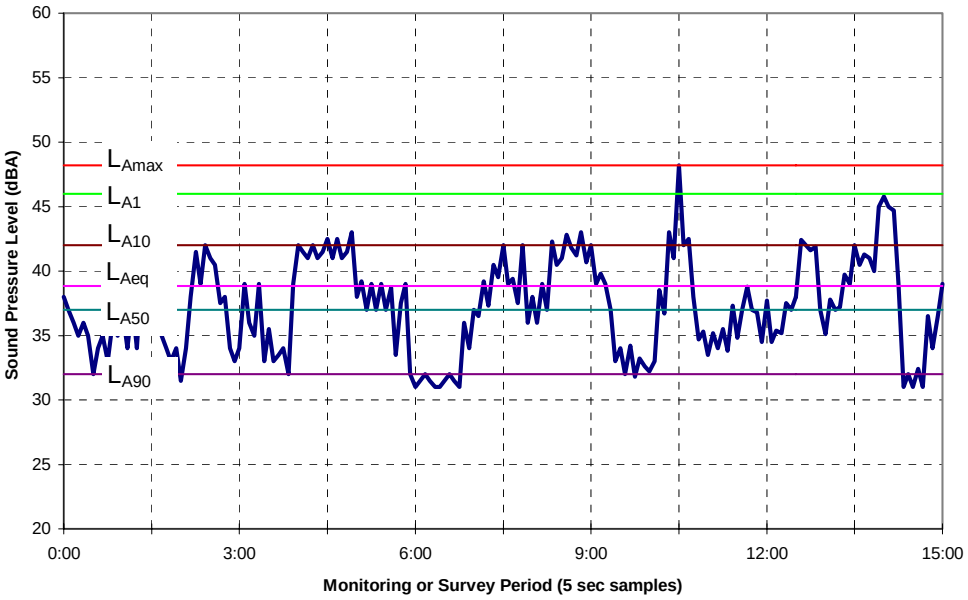
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period **–** daytime, evening and night time.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)