



Noise Impact Assessment for a Residential Development

Land at Pont Adam Crescent, Ruabon, North Wales
for:

Castlemead Group Ltd.

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Noise Impact Assessment for a Residential Development

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For:	Castlemead Group Ltd.
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EXECUTIVE SUMMARY

Enzygo has been instructed by Castlemead Group Ltd., to prepare a noise assessment in support of an Outline Planning Application for a residential development on a site to the south of Pont Adam Crescent in Ruabon, near Wrexham, North Wales.

Within the scope of this assessment noise levels have been quantified at locations around the site in order to determine the existing ambient noise climate of the area. This has been considered and assessed against Welsh national guidance in order to establish the acceptability of the site for residential redevelopment. Further reference has also been made to British Standard (BS) noise assessment documentation where necessary and appropriate.

The noise surveys concluded the noise climate of the area to be dominated by infrastructure noise associated with both road traffic movements and train movements within the area. This was coupled with human activity noise from the surrounding residential uses.

Noise across the sites was found to predominately lie between PPG24 NEC "A" to NEC "B" during both the daytime and overnight periods, depending on the proximity to the main noise sources. However, with the implementation of the Outline indicative layout provision drawn up by Axis Architectural Design Ltd. the majority of the site is reduced to within NEC "A" with only a small number of garden areas to the south of the site being within NEC "B". As such it is demonstrated that with appropriate consideration given to layout and building specification/design, suitable internal and external noise levels could be achievable across the entire development site.

It is considered that based upon the assessments undertaken within the scope of this report, the assumptions made and subject to the implementation of appropriate acoustic design considerations within the detailed design of the site, enforced within appropriate planning conditions, there are no significant issues relating to noise impacts that should restrict the proposals from being granted outline planning permission.

Appropriate, example conditions for inclusion within the Outline planning permission to control noise are presented within this report.

1. INTRODUCTION

1.1. Project Introduction

Enzygo Environmental Consultants (Enzygo) have been commissioned by Castlemead Group Ltd. (Castlemead), to provide technical support to an Outline planning application for a residential development at a site to the south of Pont Adam Crescent in Ruabon, near to Wrexham in North Wales.

It is understood that the application is outline in nature with specific details to be resolved in reserved matters. As such, the specifics of the site, including number of buildings, layout of the development etc. have only been determined indicatively at this time.

The purpose of this noise assessment is to identify any potential impacts resulting from the existing noise climate of the area on the proposed development of the site, to assess whether these would be acceptable and, where appropriate recommend suitable mitigation strategies.

The assessment is informed by a noise measurement survey undertaken for a full 24hr period between the 28th February and 1st March 2014 at the site.

Details regarding the assessment methodology employed, together with the results of the survey undertaken, and the subsequent conclusions and recommendations drawn are presented within the following report.

1.2. Site Description

1.2.1. General Environment

The proposed development site lies to the south of Pont Adam Crescent at the south western extent of the town of Ruabon, approximately 7.5km to the south west of Wrexham, North Wales. The site lies within the administrative area of Wrexham County Borough Council and is centre at approximate grid ref SJ 29625 43638.

The existing site use is entirely open ground used for recreational purposes by the occupants of the houses to the north. The site is indicated approximately within the red square on Figure 1.1 below.

Figure 1-1: Site Location Plan



(Image Source: Imagery ©2014 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2014 Google)

The area immediately surrounding the site is predominately residential in nature with open spaces. The classifications of the areas surrounding the site, in each compass direction, are as follows:

- To the immediate north of the site is Pont Adam Crescent marking the south western extent of Ruabon. Beyond Pont Adam Crescent is a residential estate.
- To the immediate east lies a railway line with public open space and residential dwellings beyond. Again these residential dwellings form part of Ruabon. Approximately 700m to the east of the site lies the main route of the A483 but there are a significant number of residential dwellings/estates on the intervening ground;
- To the south of the site lies the A539, Llangollen Rd. with open space and residential properties beyond; and,
- To the west of the site is isolated residential dwellings and open farm land. Approximately 200m from the site is the Wynnstay Technology Park, with residential properties forming the northern extent of Cefn-Mawr beyond.

These features would affect the prevailing noise climate of the area.

1.2.2. Proposed Development

The proposal for the site is to redevelop the land for solely residential use. Whilst this is an Outline application an indicative layout has been prepared by Axis Architectural Services Ltd (Axis) on behalf of Castlemead, presented within drawing ref: CGL3/TML-03 dated March 2014.

It is noted that the layout designed by Axis, and presented below in Figure 1-2, is for consideration purposes only.

Figure 1-2: Outline Development Layout



1.3. Consultation

In the preparation of this report a consultation exercise has been undertaken with the local planning authority (LPA), Wrexham County Borough Council (WCBC). The consultation was initiated via telephone conversation, and subsequent e-mail transmission, with Paul Campini at WCBC on the 20th February 2014 detailing the noise monitoring and assessment methodologies proposed in the assessment of the site.

A response e-mail was received from Nick Minshall, also from WCBC, on the 20th February 2014 indicating that the LPA was happy with the methodologies proposed within the initial Enzygo email transmission. Mr Minshall also requested that consideration of the World Health Organisation guidelines should be made within the scope of the assessment.

For reference, the email transmissions sent to/ received from WCBC are appended to this document as Appendix A.

1.4. Noise Assessment Methodology

In order to consider and assess these potential impacts a number of elements of work have been completed. These are as detailed below:

- Consultation with the LPA to discuss and agree appropriate assessment methodologies;
- Completion of a noise survey to quantify the existing baseline and ambient noise climate of the area;
- Assessment and consideration of the suitability of the site for residential end use; and,
- Where necessary, consideration of suitable acoustic mitigation measures and strategies that could be employed within the detailed design of the site to control noise.

2. NOISE UNITS

2.1. Noise

Before presenting the results of the noise assessment, it is considered useful to provide some background information on noise, the units of measurement and perception of changing levels by people.

Noise is defined as unwanted sound. The range of audible sound is taken to be from 0 dB to 140dB. Examples of typical noise levels relating to everyday occurrences are presented within Table 2-1 below:

Table 2-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Traffic at kerb edge	70 – 85	Loud
Raised voice at 1 metre	80	Loud
Normal voice at 1 metre	60	Moderate
Residential area at night	40	Quiet

The frequency response of the human ear to noise is usually taken to be about 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level, it is more sensitive in the mid-frequency range than the lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurements.

For variable noise sources within an area an increase of 3 dB(A) would be considered to be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10 dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.

With regard to environmental noise levels (in the open air), these are rarely steady, but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These include:

2.1.1. L_{Aeq} Noise Level

This is the 'equivalent continuous A-weighted sound pressure level, in decibels', and is defined in British Standard BS7445 as the 'value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time'.

It is the unit most suitable for the description of general environmental noise.

2.1.2. L_{A90} Noise Level

The L_{A90} is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods.

It is often referred to as the 'background' noise level.

2.1.3. L_{Amax} Noise Level

The L_{Amax} is the maximum value of the A-weighted sound pressure level measured during the survey period. L_{Amax} can be quantified in two ways, $L_{Amax F}$ or Fast time response averaged over a 0.125 second time period or $L_{Amax S}$ or Slow time response averaged over a 1 second time period.

This typically relates to impulsive noises such as infrequent vehicle movements, emergency services sirens, shouting, bangs and impact noises etc.

3. STANDARDS AND GUIDANCE

Within the following section of the report detail will be presented relating to the guidance documents and assessment methodologies appropriate for noise associated with a use such as that proposed at the Pont Adam Crescent site.

As agreed with the LPA during the consultation the assessment of residential suitability would need to reference the following guidance.

3.1. Planning Guidance (Wales), Technical Advice Note (TAN) 11: Noise - October 1997

Whilst in England the NPPF has superseded the guidance contained within the PPG 24: Planning and Noise 1994, the sister document to TAN 11, this is not the case in Wales and TAN 11 is still the appropriate policy guidance for noise associated with residential development.

As such the guidance of TAN 11 will be used to form the basis of the residential suitability assessment at the site as outlined below. In general, the guidance contained within TAN 11 considers the following:

- Outlines the considerations, relating to noise, to be borne in mind when determining planning applications for both developments which will generate noise and those that will be noise sensitive;
- Introduces the Noise Exposure Category (NEC) method of determination for residential developments;
- Advises on the use of conditions and measures that could be implemented to minimise noise impacts.

The document TAN11 states the following within Annex A “Noise Exposure Categories for Dwellings” with respect to assessing the impact of noise on proposed residential developments;

“When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) (Table 1) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC”.

The Noise Exposure Categories (NEC) are subsequently defined as follows:

Table 3-1 – TAN 11 Noise Exposure Category (NEC) Definitions

Noise Exposure Category	Definition
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 desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
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.

The L_{Aeq} noise levels corresponding to the above noise exposure categories are as detailed within the table below:

Table 3-2 – TAN 11 NEC Noise level Bands

Noise Levels Corresponding to the Noise Exposure Categories for New Dwellings $L_{Aeq,T}$ dB, TAN 11				
Noise Source	Noise Exposure Category			
	A	B	C	D
Road Traffic 07:00 – 23:00	< 55	55 – 63	63 – 72	>72
23:00 – 07:00	< 45	45 – 57	57 – 66	>66
Rail Traffic 07:00 – 23:00	< 55	55 – 66	66 – 74	>74
23:00 – 07:00	< 45	45 – 59	59 – 66	>66
Air Traffic 07:00 – 23:00	< 57	57 – 66	66 – 72	>72
23:00 – 07:00	< 48	48 – 57	57 – 66	>66
Mixed Sources 07:00 – 23:00	< 55	55 – 63	63 – 72	>72
23:00 – 07:00	< 45	45 – 57	57 – 66	>66

As defined within Table 3-2 above, TAN 11 defines appropriate bandings for the NEC categories for both the daytime and night-time periods. Daytime is subsequently defined within the document as being between the hours of 07:00 and 23:00 with night-time being defined as the period 23:00 to 07:00.

Local planning authorities have the power under TAN 11 (Annex A, para A2) to increase NEC limits by up to 3dB(A) above the recommended levels where for example there is a clear need for the development.

With regard to night-time noise levels where individual noise events regularly exceed 82dB $L_{Amax(S)}$ several times in any one hour, the site should be considered to be within NEC “C” regardless of the $L_{Aeq,8h}$ except when the site is already within NEC “D”.

3.2. British Standard 8233: 2014 ‘Guidance on Sound Insulation and Noise Reduction for Buildings’

When internal noise levels are required to be considered TAN 11 recommends that suitable guidance can be found within BS8233: 1999. However, BS8233: 1999 has recently been superseded by a 2014 version of the same Standard, and as such the 2014 version has been referenced within the scope of this study.

This Standard provides guidance values within Section 7.7 relating to a range of design criteria levels for certain building types. Section 7.7.1 covers “*Dwelling Houses, flats and rooms in residential use (when unoccupied)*” and the appropriate values are presented within Table 3-3 below.

Table 3-3 - BS8233 Guidance Values

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

Note 7 to the above table within BS8233 details that “*Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved*”.

With regard to external noise levels the Standard states that “*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments*”. However the Standard recognises that these levels are not achievable in all situations and further states that “*In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited*”.

The internal values detailed within the scope of BS8233: 2014 generally accord well with the recommendations of the WHO guidance.

3.3. The World Health Organisation Guidelines for Community Noise

The World Health Organisation’s (WHO) ‘Guidelines for Community Noise’ report for external environmental noise levels states that;

“4.2.7 Annoyance responses

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10dB lower than during the day....”

For night-time noise sources the WHO guidelines recommend a night-time (23:00 – 07:00) 8hour noise level of 30dB L_{Aeq} inside bedrooms (for reasonably steady noise source) to avoid sleep disturbance.

For internal noise levels during the daytime and evening period it is suggested that a noise level of 35dB $L_{Aeq, 16hr}$ (07:00 – 23:00hrs) be achieved to avoid speech intelligibility and moderate annoyance.

A summary of the guideline internal noise levels, taken from Table 1 of the WHO guidelines, is presented below

Table 3-4: WHO Guideline Values

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (Hours)	$L_{Amax, fast}$ (dB)
Dwelling, Indoors	Speech Intelligibility & Moderate annoyance daytime & evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

3.4. World Health Organisation: Night Noise Guidelines for Europe (2009)

The 'Night Noise Guidelines for Europe' was published by the WHO in 2009 and works in association with the 2000 Guidelines for Community Noise.

The guidance also states that;

"Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night, outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night, outside}$ of 40dB should be the target of the night noise guidelines (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly."

The document accords well with the 'Good' internal design criteria as defined within BS8233 when windows are open for ventilation.

Whilst WCBC have asked for the assessment to reference the WHO guidelines we would note that to a degree these are out with the criteria of TAN 11, reference to both documents specifically resulting in a potentially confused conclusion as to residential suitability of the site. As such higher credence has been put on the criteria of TAN 11 this being the appropriate Welsh policy document.

4. NOISE MONITORING SURVEY

This section of the report describes the specifics of the noise survey undertaken in connection with the study.

4.1. Survey Details

In order to determine the existing noise climate of the area, a noise monitoring survey was undertaken at 4no (four) locations within the site area. The survey was undertaken for the 24hr period between the 28th February and 1st March 2014, and was considered to be representative of the typical noise climate of the area.

The survey was undertaken at the following noise monitoring locations which were broadly discussed and agreed with WCBC during the consultation phase. There may be some slight variation in the locations used from that discussed with the LPA, this is purely as a function of access/site parameters.

Table 4-1: Noise Monitoring Locations

Location Reference Location	Grid Ref (NGR)	Description
24hr Long Term Survey Location		
ML01 (Red Balloon)	SJ 29646 43612	At the southern extent of the site on the eastern site boundary
Rotational 24hr survey locations		
ML02 (Blue Balloon)	SJ 29704 43644	At the northern end of the site at the eastern site boundary
ML03 (Blue Balloon)	SJ 29558 43692	At the north west corner of the site adjacent to Pont Adam Crescent
ML04 (Blue Balloon)	SJ 29717 43697	At the north east corner of the site adjacent to Pont Adam Crescent

The noise monitoring locations are presented graphically within Figure 4-1 below.

Figure 4-1: Noise Monitoring Location Plan



(Image Source: Imagery ©2014 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2014 Google)

The noise monitoring survey was undertaken throughout a full 24 hour period by a combination of short term rotational and long term static samples. These are detailed within Table 4-2 below.

Table 4-2: Noise Monitoring Periods

Location	Period	Duration (hh:mm:ss)	Times
ML01	Long Term Survey	24:00:00	10:00 - 28 th February 2014 to 10:00 - 1 st March 2014
ML02	Daytime	04:54:00	11:20 – 11:54 - 28 th February 2014 13:28 – 14:08 - 28 th February 2014 15:26 – 16:04 - 28 th February 2014 17:46 – 18:21 - 28 th February 2014 20:06 – 20:41 - 28 th February 2014 21:54 – 22:58 - 28 th February 2014 07:58 – 08:46 - 1 st March 2014
	Overnight	02:48:00	01:20 – 03:26 - 1 st March 2014 05:55 – 06:37 - 1 st March 2014
ML03	Daytime	04:23:00	10:01 – 10:39 - 28 th February 2014 11:59 – 12:28 - 28 th February 2014 14:08 – 14:45 - 28 th February 2014 16:10 – 16:44 - 28 th February 2014 18:26 – 19:00 - 28 th February 2014 20:46 – 21:18 - 28 th February 2014 07:00 – 07:25 - 1 st March 2014 08:51 – 09:25 - 1 st March 2014
	Overnight	02:29:00	23:05 – 00:10 - 28 th Feb/1 st Mar 2014 04:07 – 05:14 - 1 st March 2014 06:43 – 07:00 - 1 st March 2014
ML04	Daytime	04:21:00	10:43 – 11:18 - 28 th February 2014 12:51 – 13:26 - 28 th February 2014 14:48 – 15:24 - 28 th February 2014 16:51 – 17:28 - 28 th February 2014 19:14 – 19:47 - 28 th February 2014 21:21 – 21:52 - 28 th February 2014 07:29 – 07:56 - 1 st March 2014 09:27 – 10:00 - 1 st March 2014
	Overnight	02:12:00	00:14 – 01:19 - 1 st March 2014 03:30 – 04:02 - 1 st March 2014 05:18 – 05:53 - 1 st March 2014

4.2. Weather

Daytime Period – Friday 28th February 2014

The weather during the daytime period of the 28th February was noted to be mild with an ambient air temperature of between 5°C and 7°C. Wind speeds were noted to be low with no discernible directional component, and no precipitation fell. Cloud cover was noted to be low between 10 and 30% coverage.

The road surfaces within the area were noted to be dry.

Overnight Period – Saturday 1st March 2014

The weather during the overnight period of the 1st March was noted to be cool with an ambient air temperature of around 3°C during the early part of the survey dropping towards 1°C towards the early morning. Wind speeds were noted to be low with no discernible directional component and no precipitation fell. Cloud cover was noted to be low between 10 and 30% coverage.

The road surfaces within the area were noted to be dry.

Daytime Period – Saturday 1st March 2014

The ambient air temperature during the daytime period of the 1st March (after 07:00) increased toward 4°C. Wind speeds were noted to remain low and cloud cover was noted to be low, recorded at 10%. No precipitation fell during the survey period.

The road surfaces within the area were noted to be dry.

4.3. Monitoring Equipment

The monitoring was undertaken in line with the guidance set out within BS7445: 1991, with the sound level meters programmed to monitor over 15 minute intervals during the daytime and 5 minutes intervals during the overnight. The equipment used was set to record the following statistical parameters:

L_{eq} in dB

L_{10} in dB

L_{90} in dB

L_{max} in dB

The following noise monitoring equipment was used in order to undertake the survey work in the vicinity of the site.

Table 4-3: Noise Monitoring Equipment

Equipment	Manufacturer	Type	Serial Number
Sound Level Meter	01dB	Black Solo	65396
Sound Level Meter	01dB	Black Solo	65445
Calibrator	Cirrus	CR:515	59522

The following set-up parameters were used on the sound level meters during all of the noise measurements undertaken:

Time Weighting: Fast

Frequency Weighting: "A"

The sound level meters used within this assessment were locally calibrated using an electronic calibrator prior to commencement and upon completion of the surveys, no significant drift in calibration was observed. Formal instrumentation calibration documentation for the equipment used is available on request.

5. NOISE SURVEY RESULTS

This section of the report summarises the results of the noise monitoring survey undertaken within the scope of this assessment. The full monitoring dataset is presented in Appendix B of this report.

5.1. Noise Monitoring Survey Results

Presented within Table 5-1 below is a summary of the daytime and overnight noise levels monitored at the locations detailed within Section 4.

- The daytime data is presented as the averaged 15 minute levels over the daytime period of 07:00 to 23:00.
- The overnight data is presented as the averaged 5 minute levels over the overnight period of 23:00 to 07:00.

Table 5-1: Measured Noise Level Data

Location	Period	Duration (hh:mm:ss)	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
ML01	Daytime	16:00:00	58.2	85.3	48.7	60.4
	Overnight	08:00:00	50.5	76.3	35.8	52.5
ML02	Daytime	04:54:00	53.4	76.8	45.7	54.3
	Overnight	02:48:00	47.2	71.3	37.0	49.4
ML03	Daytime	04:23:00	49.5	72.1	45.6	50.5
	Overnight	02:29:00	49.0	72.3	40.7	50.1
ML04	Daytime	04:21:00	51.8	75.9	45.4	52.9
	Overnight	02:12:00	46.9	74.2	36.5	49.1

5.2. Subjective field notes

The noise monitoring survey was attended by competently trained and experienced field technicians in order to subjectively quantify the existing noise climate of the area.

The noise climate during the daytime period was noted to be dominated by infrastructure noise, notably road traffic and train movements (on the adjacent railway lines). This was coupled with general human activity noise in the area from the residential estate including children playing, natural noises including birds and periodic overhead aircraft. Generally the noise climate of the area was described as “typical of a residential setting”.

During the overnight period the main noise source was described as road traffic noise emanating from the A539/A483 and railway noise.

6. NOISE IMPACT ASSESSMENT

In this section of the report, the potential noise impacts on the residential development of the site have been assessed in accordance with the relevant criteria of the guidance as summarised in Section 3.

Consideration of residential suitability has been undertaken in line with the Noise Exposure Category (NEC) methodology of TAN 11, as agreed with WCBC within the consultation phase.

This assessment shows that the measured noise levels at the monitoring locations would fall into the noise exposure categories (NEC), as shown in Table 6-1 and

Table 6-2 below. Analysis of the subjective field notes concluded that traffic and train movements on the surrounding transport network are the dominant noise sources of the area. Therefore the site will be assessed under the PPG24 “Road Traffic” banding classifications as this is slightly more onerous than the “Rail Traffic” bands.

6.1. Residential Noise Assessment – Overnight Period

Within TAN 11, Note 2 to Table 2 of Annex A, states that “sites where individual noise events regularly exceed $82\text{dB}_{L_{Amax}}$ (5 time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D)”.

Analysis of the data presented within Appendix B details the 82dB criterion is not exceeded at any of the locations during the overnight period, as such the NEC banding concluded from the L_{Aeq} noise levels is not subject to any change.

Table 6-1 – TAN 11 Overnight Noise Assessment (23:00 – 07:00)

Location	Free Field Noise Level $L_{Aeq,T}$	TAN 11 Noise Source Assessment Category	TAN 11 Noise Exposure Category (NEC)
ML01	50.5	Road Traffic	NEC “B”
ML02	47.2	Road Traffic	NEC “B”
ML03	49.0	Road Traffic	NEC “B”
ML04	46.8	Road Traffic	NEC “B”

TAN 11 concludes the following with regard to these bandings:

NEC “B” is defined as a situation where: “conditions should be imposed to ensure a commensurate level of protection against noise”.

The data monitored around the perimeter of the development site has been used to construct a 3-D noise model of the site. The noise levels monitored within the vicinity of the site (ML01 to ML04) have been utilised to give an estimation of the propagation of noise as it decays across the site. Due to the dominance of road and rail traffic noise in the area the measured noise levels have been corrected to line source levels representative of the A539, the railway and to a lesser degree Pont Adam Crescent. Levels have been corrected separately for both the daytime and night-time periods.

This information was input into a scaled, 3D noise model constructed within the commercially available SoundPLAN 7.3 software. The propagation of noise from the assumed sources has been undertaken following the methodologies contained within both BS5228 and ISO9613.

The tolerance between the measured night-time levels at locations ML01 to ML04 and the model output at these same positions was noted to be within +/- 1.3dB and as such the noise model is considered to provide a robust representation of the noise propagation across the site.

The results of this modelling exercise for the night-time period is contained within Figure 6-1 below. For clarity the coloured scale has been amended to reflect the TAN 11 bandings for “Road Traffic” sources.

Figure 6-1: Night-time Noise Contours (TAN 11 “Road Traffic” night-time period NEC bandings)



(Image Source: Imagery ©2014 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2014 Google)

It is noted that based upon the predicted propagation of noise across the development site the closest aspect of the site to the A539 could be within NEC “C” as detailed by the orange contour on Figure 6-1. NEC “C” relates to noise climates where TAN 11 would consider that *“conditions should be imposed to ensure a commensurate level of protection against noise”* and as such mitigation should be used in this area as discussed in Section 7.0 of this report.

In order to consider the impacts on the noise propagation characteristics across the site that the implementation of the development may cause, the Axis Outline layout (Figure 1-2) has been input into the noise model, with the output presented within Figure 6-2 below:

Figure 6-2: Night-time Noise Contours (TAN 11 NEC bandings) – Axis Outline Layout



(Image Source: Imagery ©2014 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2014 Google)

Implementation of the Axis layout details that the noise climate of the site would change as a result of screening provision from the peripheral sources, with large areas reducing to NEC "A". However, we would note that during the overnight period internal criteria would be more appropriate for the consideration of residential suitability as detailed within Section 6.3.

It is noted that the area of the site identified as NEC "C" (orange contour) relates to the parking area and access road for the properties nearby. This would not be used as external garden space or classified as sensitive in nature.

6.2. Residential Noise Assessment – Daytime Period

TAN 11 also requires that daytime (07:00 – 23:00) levels be considered within the scope of any residential suitability assessment.

Table 6-2 below presents the results of the assessment of the measured daytime noise levels at each location against the "Road Traffic" NEC banding criteria of TAN 11.

Table 6-2 – TAN 11 Daytime Noise Assessment (07:00 – 23:00)

Location	Free Field Noise Level $L_{Aeq,T}$	TAN 11 Noise Source Assessment Category	TAN 11 Noise Exposure Category (NEC)
ML01	58.2	Road Traffic	NEC "B"
ML02	53.4	Road Traffic	NEC "A"
ML03	49.5	Road Traffic	NEC "A"
ML04	51.8	Road Traffic	NEC "A"

TAN 11 concludes the following with regard to these bandings:

NEC "A" correlates to situations where *"noise need not be a determining factor in granting planning permission"*.

NEC "B" is defined as a situation where: *"conditions should be imposed to ensure a commensurate level of protection against noise"*.

As undertaken for the overnight period the data monitored around the perimeter of the development site has also been used to estimate noise propagation across the site during the daytime. Again road and rail traffic noise dominated the measured noise levels and as such the measured levels have been corrected to line source levels representative of the A539, the railway and to a lesser degree Pont Adam Crescent.

The tolerance between the measured daytime levels at locations ML01 to ML04 and the model output at these same positions was noted to be within +/- 1.7dB and as such the noise model is considered to provide a robust representation of the noise propagation across the site.

The results of this modelling exercise for the daytime period is contained within Figure 6-3 below, with the coloured scale amended to reflect the TAN 11 daytime bandings for "Road Traffic" sources.

Figure 6-3: Daytime Noise Contours (TAN 11 "Road Traffic" daytime period NEC bandings)



(Image Source: Imagery ©2014 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2014 Google)

As with the overnight period, based upon the predicted propagation of noise across the development site the closest aspect of the site to the A539 could be within NEC "C" during the daytime period also, as detailed by the orange contour on Figure 6-3. NEC "C" relates to noise climates where TAN 11 would consider that *"conditions should be imposed to ensure a*

commensurate level of protection against noise” and as such mitigation should be used in this area as discussed in Section 7.0 of this report.

As with the overnight assessment the Axis Outline layout (Figure 1-2) has been input into the noise model, with the output presented within Figure 6-4 below:

Figure 6-4: Daytime Noise Contours (TAN 11 NEC bandings) – Axis Outline Layout



(Image Source: Imagery ©2014 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2014 Google)

With reference to Figure 6-4 it can be seen that the majority of the external living spaces across the site would be within TAN 11 NEC “A”. Certain of the garden spaces at the southern end of the site are detailed to be within NEC “A/B” where they occur in close proximity to the A539.

It is again noted that the area of the site identified as NEC “C” (orange contour) relates to the parking area and access road for the properties nearby. This would not be used as external garden space or classified as sensitive in nature.

However, to accomplish this certain of the garden fences around the perimeter of the site would need to be replaced with acoustic grade fencing of between 2.0 to 2.5m in height.

6.3. Internal Noise Assessment

As well as assessing the external noise climate, as presented in Sections 6.1 and 6.2 above, it is also deemed appropriate within the scope of this report to consider the potential internal noise levels of the proposed residential dwellings. This is considered particularly pertinent during the overnight period during which people will be within dwellings attempting to go to sleep or sleeping rather than external to the property. As a result of the TAN 11 classifications of the site, adequate protection for the internal noise climate within new residential dwellings is paramount.

As summarised in Table 3-3 of this report the ‘reasonable’ internal noise criteria for residential developments within BS8233 are 40 dB $L_{Aeq, 16 \text{ hours}}$ (daytime) for resting/sleeping in living rooms and

35 dB $L_{Aeq, 8\text{-hours}}$ (night-time) for resting/sleeping in bedrooms. Therefore, as a minimum any sound insulation proposed within the design of the dwellings should ensure that internal noise levels are brought down to meet these criteria for both the daytime and overnight periods.

Figure 6-5 below presents details of the predicted overnight façade noise levels across the site based upon the measured free field noise levels. The predictions of the façade levels were taken from the noise model as detailed within Section 6.1 and are as a result of the existing noise climate of the area. The coloured scale used in Figure 6-5 is described and defined within the following section.

Figure 6-5: Night-time façade noise levels – Axis Outline Layout

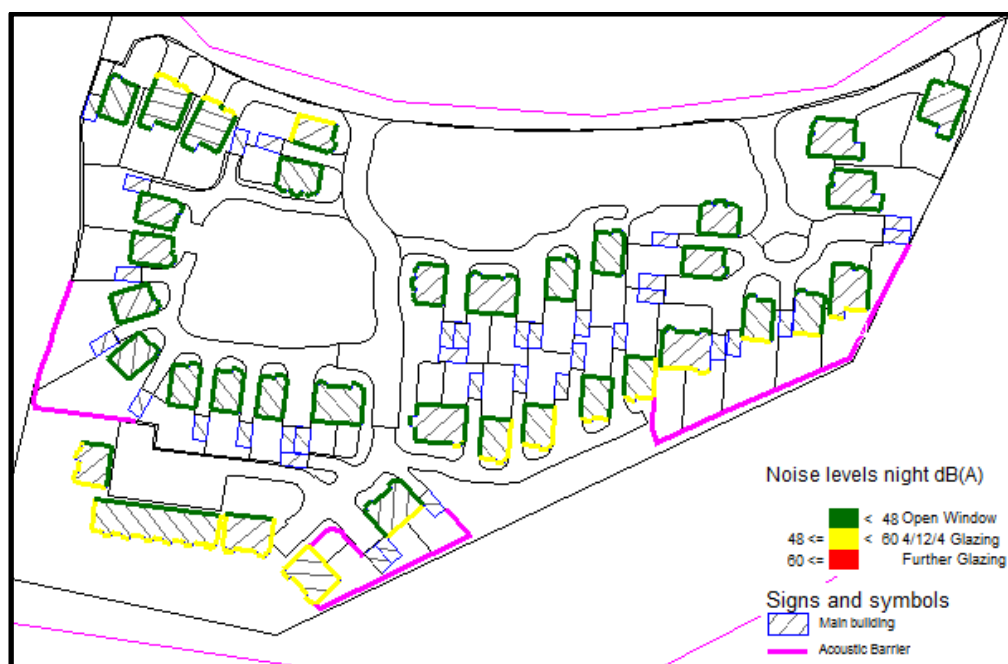
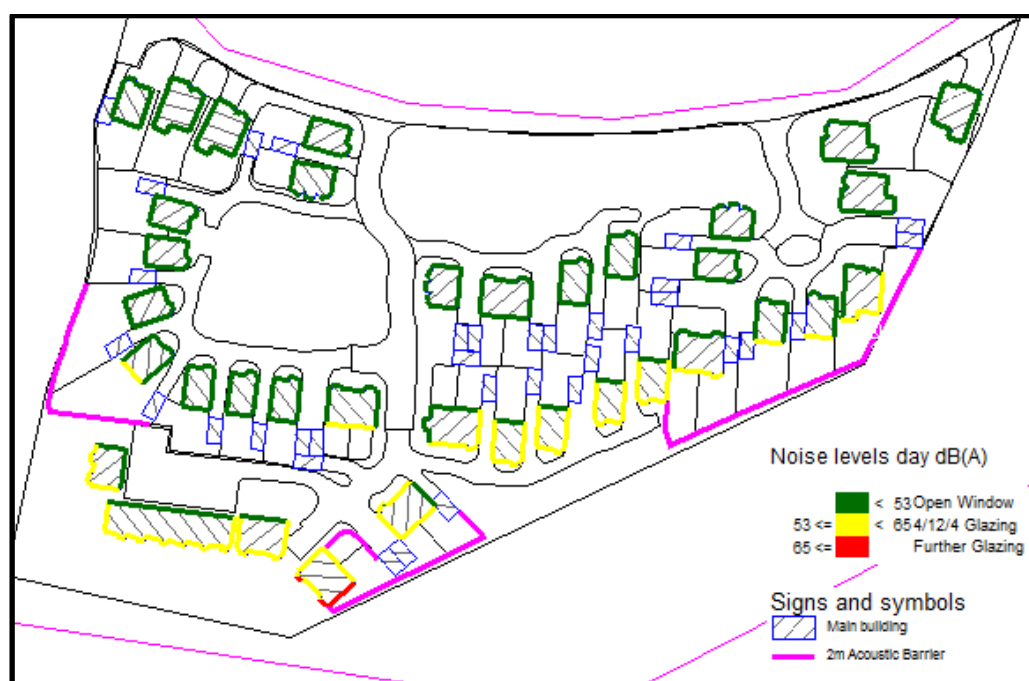


Figure 6-6 details the façade noise levels predicted for the daytime period on the same basis.

Figure 6-6: Daytime façade noise levels – Axis Outline Layout



The coloured scales presented on the Figures (6-5 and 6-6) have been derived in order to provide information to developers relating to the required construction detail of each façade, specifically with regard to glazing and ventilation provision. The rationale behind each selected scale value and colour is detailed within

Table 6-3 below.

Table 6-3 – Figures 6-5 and 6-6 Coloured Scale Derivation

Scale Colour	Façade Value	Rationale
Daytime Period (Figure 6-6)		
Green	< 53 dB(A)	These façades would require standard 4/12/4 thermal double glazed units and no alternative ventilation provision. This is based upon achieving an internal L_{Aeq} of 40dB(A) (BS8233 “reasonable” criteria) and assuming a façade correction of -13dB(A) for a partially open window for ventilation
Yellow	53<dB(A)>65	These façades would require standard 4/12/4 thermal double glazed units and alternative ventilation provision. This is based upon achieving an internal L_{Aeq} of 40dB(A) (BS8233 “reasonable” criteria) and assuming a façade correction of -25dB(A)*(1). This would require that windows remain closed to achieve the required level of acoustic protection; as such alternative forms of ventilation would be a requirement.
Red	> 65dB(A)	These façades would require enhanced double glazed units and alternative ventilation provision if glazing is included in the facade. Based upon the level of attenuation required (greater than 25dB(A)) facades in this band would require to be considered on an individual basis. if glazing provision is necessary. Without glazing standard blockwork would be acceptable
Night-time Period (Figure 6-5)		
Green	< 48 dB(A)	These façades would require standard 4/12/4 thermal double glazed units and no alternative ventilation provision. This is based upon achieving an internal L_{Aeq} of 35dB(A) (BS8233 “reasonable” criteria) and assuming a façade correction of -13dB(A) for a partially open window for ventilation
Yellow	48<dB(A)>60	These façades would require standard 4/12/4 thermal double glazed units and alternative ventilation provision. This is based upon achieving an internal L_{Aeq} of 35dB(A) (BS8233 “reasonable” criteria) and assuming a façade correction of -25dB(A)*(1). This would require that windows remain closed to achieve the required level of acoustic protection; as such alternative forms of ventilation would be a requirement.
Red	> 60dB(A)	These façades would require enhanced double glazed units and alternative ventilation provision if glazing is included in the facade. Based upon the level of attenuation required (greater than 25dB(A)) facades in this band would require to be considered on an individual basis if glazing provision is necessary. Without glazing standard blockwork would be acceptable.

***(1) The façade attenuation of 25dB(A) is based upon a standard 4/12/4 double glazing as specified by Pilkington Glass.**

The information presented on Figures 6-5 and 6-6 is based upon the modelled L_{Aeq} values and as such considers the “general” noise climate of the development site. However, during the overnight period it is also appropriate to consider L_{Amax} levels and how these would impact upon the amenity of the bedrooms and the required glazing provision. As such further consideration of glazing specifications is required in order to ensure that L_{Amax} levels in the area are also controlled to an acceptable degree. The criteria of BS8233 details that L_{Amax} levels should not breach 45dB(A) within bedrooms during the overnight period.

Table 6-4 below details the level of attenuation required on the noisier façades of the development to control L_{Amax} levels.

Table 6-4 – Required Attenuation Levels - L_{Amax}

Location	Period	Corrected Façade Noise Level (dB L_{Amax}) *(1)	Internal Noise Criteria (dB L_{Aeq})	Attenuation required (dB(A))
ML01	Overnight	79.3	45 L_{Amax}	- 34.3
ML02		74.3		- 29.3
ML03		75.3		- 30.3
ML04		77.2		- 32.2

***(1) Calculations based upon corrected façade noise levels by the addition of a +3dB façade correction.**

Therefore, based upon both the L_{Aeq} and L_{Amax} levels across the site it is concluded that the following glazing requirements would be necessary. The colour coding within Table 6-5 below relates to the colour coded façades as presented on Figures 6-5 and 6-6.

Table 6-5 – Glazing Specifications

Façade Colour ref. Figures 6-5 to 6-6	Appropriate Glazing Specification (R_{TRA})	
	Daytime Living areas	Night-time - Bedrooms
Green	4/12/4 Thermal Double Glazing	4/12/4 Thermal Double Glazing
Yellow	4/12/4 Thermal Double Glazing and alternative ventilation	Between 4/12/4 and 10/12/6.4 _{PVB} Thermal Double Glazing and alternative ventilation
Red	Only one façade concludes this rating and is at the southern end overlooking the A539. It is a gable end wall and therefore unlikely to have windows. A block wall construction of “110mm Brick-100mm Cavity-100mm Dense Block-12.5mm Blaster Board” gives an R_w in the region of 59dB (R_{TRA} 51dB)	

It is important to note that the information presented within Table 6-5 above assumes an absolute worst case of the entire room façade being constructed of the glazed element. In reality the window element would typically occupy a much smaller area of the façade than the block-work element (composite façade) which could perform to an approximate R_{TRA} value of 51dB₁. Indeed a standard 4/12/4 thermal double glazed unit set in a standard brick/block wall would offer in the region of 33dB(A) attenuation from road traffic noise.

It is therefore noted that the calculations undertaken within the scope of this report are simple and preliminary in nature and are supplied for information purposes so as to demonstrate that suitable

¹ External face 110mm Block/100mm cavity/100mm dense block/12.5mm plaster board (internal)

internal levels can be achieved with the appropriate façade and glazing specification. As such there is a distinct possibility, depending upon the final design of the building and the percentage area of block work to glazing, that glazing specifications below those presented within Table 6-5 may be suitable for use.

Within the scope of the detailed design of the site additional, more detailed, acoustic calculations should be undertaken based upon the exact specifics of the buildings. Specifics regarding the actual glazing specification, and any requirement for acoustic ventilation, could then be more accurately concluded, this aspect of the development could be covered within an appropriately worded condition within the planning permission document.

6.4. Acoustic Ventilation Systems

As a result of the level of attenuation required to be achieved by certain façades of the development, alternative means of ventilation would be required in order that the windows do not need to be opened for this purpose.

This could be by means of one of the following methods:

- localised acoustic trickle ventilation (type acoustic ventilator as specified in the Noise Insulation Regulations); or,
- by means of a whole building system via internal duct work venting onto a quieter façade/the roof of the building.

Should the final development scheme include a whole building system the associated duct work, and any fans, would require being adequately treated and silenced so as to prevent mechanical noise becoming an issue within any of the connected rooms. This would be controlled and mitigated within the full, final design for the development.

6.5. General Comments

All of the attenuation values presented within the scope of this assessment assume that windows and ventilation systems would be acoustically sealed and fitted with workmanship of a good quality. Poorly fitting windows and build quality can decrease sound insulation performance significantly.

It should also be noted that the glazing specifications provided above are for acoustic purposes only and, therefore, any structural, safety or other issues will require to be addressed separately.

7. CONCLUSION

A noise assessment has been completed for submission to WCBC in support of an outline application for a residential development at land to the south of Pont Adam Crescent, Ruabon. However, as the scheme is Outline at this stage details relating to number of properties, layout etc. is in flux but an indicative layout has been provided in order to demonstrate how the development could be designed with environmental and operational constraints in mind.

A noise survey has been completed to quantify the existing noise climate of the area which was noted to be dominated by a mixture of traffic and train noise. Other noise sources prevalent included human activity, natural noises and aircraft noise overhead.

The noise monitoring detailed that the external noise environment, during both the daytime and overnight periods, would be categorised in line with the TAN 11 Noise Exposure Categories as between NEC "A" and "B". However, with the implementation of the proposed indicative layout this reduces to the site predominantly being within NEC "A", with only limited garden spaces being within NEC "B".

Given the categorisations detailed above, specific acoustic mitigation measures would be a requirement of any development at the site in order to achieve an appropriate noise climate within sensitive external areas. Furthermore, consideration of internal noise has also been undertaken with the conclusion that detailed façade consideration would also be a necessity across the site to achieve appropriate internal criteria.

As such, based upon the existing noise climate it is considered that noise mitigation is a key, central feature of this development. To that end, a number of recommendations have been included within Section 8 of this report as guidance to inform the detailed design process.

This acoustic mitigation could be controlled by an appropriately worded planning condition included within any planning permission for residential development at the site, to ensure appropriate consideration is given within the detailed design process. An example condition is provided within Section 8 of this report for guidance.

7.1. General Conclusion

Overall it is concluded that with appropriate consideration of acoustic mitigation across the development site there are no significant issues relating to noise impacts associated with the proposed development of the Pont Adam Crescent site that could not be controlled by the implementation of appropriate acoustic mitigation strategies, enforced by an appropriate planning condition.

As such noise should not be classified as a material factor that would preclude the development from being granted Outline planning permission for residential end use.

8. RECOMMENDATIONS

The assessments undertaken within the scope of this report are to inform an Outline Planning application for residential development at a site off Pont Adam Crescent, Ruabon. As a function of the Outline nature of the application the specifics would be addressed within Reserved Matters.

The assessments undertaken within the scope of this report indicate that in principle, the existing noise climate of the area is conducive for the proposed residential development of the site but would necessitate acoustic consideration within the detailed design stage.

Based upon the assessments undertaken within the scope of this report the following recommendations are made in order to ensure that the residential amenity of the site is acceptable. The following design measures should therefore be investigated, and where appropriate implemented, within the detailed design of the site as a means of mitigating noise:

- Consideration within the site layout design such to utilise the mass of the dwelling structures to shield external living areas from direct line of sight to the surrounding noise sources. This is specifically relevant with regard to the A539 elevation of the site which could necessitate apartment blocks or continuous town houses to screen noise into the site. The Axis layout proposed within Figure 1-2 is a good example of how the layout could be used to control noise;
- Positioning of dwellings such to overlook or front onto noise sources such as the A539. This would position non-noise sensitive car parking areas directly adjacent to the main noise sources and sensitive rear garden areas would be afforded significant screening by the dwelling buildings themselves. Again this has been demonstrated within the Axis design layout (Figure 1-2);
- The use of continuous brick walls and/or well-built impervious close boarded fencing (min surface density of approximately 10Kg/m²) around peripheral rear garden areas. The exact specifics of the height and location of these fences would require to be confirmed within the detailed design;
- Consideration of internal building layouts to, where possible, place noise sensitive rooms (bedrooms, lounges, studies) on façades away from the peripheral noise sources and use less sensitive rooms (kitchens, hallways, utility rooms) on these façades; and,
- The use of glazing specification and façade construction detail as a means of achieving appropriate internal noise climates within the residential dwellings.

Due to the outline nature of the application, it is considered appropriate to control the noise at the site through the detailed design process by the use of an appropriately worded planning condition. An example of such a condition is presented below:

Residential Suitability

"Prior to the commencement of any construction activities on site associated with the residential provision, a detailed acoustic assessment should be supplied to, and approved by, the local planning authority. The assessment shall examine noise levels incident on the proposed residential aspect of the development, consider the specifics of the development and where appropriate specify a scheme of sound insulation and/or noise reduction measures to ensure appropriate noise levels are achieved both internally and externally to the proposed dwellings.

The assessment would require to be signed off by the LPA and the findings of such incorporated within the scheme constructed.

Reason: For the protection of future amenity at the site"

REFERENCES

Planning Guidance (Wales), Technical Advice Note (TAN) 11: Noise - October 1997

British Standards Institution. British Standard 8233: 'Guidance on Sound Insulation and Noise Reduction for Buildings', 2014

British Standards Institution. British Standard 7445-2: Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use', 1991.

The World Health Organisation Guidelines for Community Noise, 2000

World Health Organisation: Night Noise Guidelines for Europe, 2009

APPENDIX A – CONSULTATION DOCUMENTATION

Peter Tallantyre

From: Nick Minshall <xxxx.xxxxxxxx@xxxxxxx.xxx.xx>
Sent: 20 February 2014 17:01
To: Peter Tallantyre
Subject: Land South of Pont Adam Crescent, Ruabon, Wrexham - Noise Assessment

Hello Pete

Further to our telephone conversation regarding the proposed development of the above site, I confirm that the Environmental Protection Section of Wrexham CBC would expect a planning application to include an appropriate TAN 11 noise survey to determine the noise exposure categories of proposed residential properties. The report should include recommendations for noise mitigation measures as appropriate in order to ensure compliance with the relevant WHO noise guidelines.

Regards Nick

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Peter Tallantyre

From: Paul Campini <xxxx.xxxxxxx@xxxxxxx.xxx.xx>
Sent: 20 February 2014 16:20
To: Peter Tallantyre
Subject: RE: Land South of Pont Adam Crescent, Ruabon, Wrexham - Noise Assessment

Hi Pete

Confirming receipt of the email and I'll forward it on to one of my colleagues when I've spoken to them.

Regards

Paul

From: Peter Tallantyre [mailto:xxxxx.xxxxxxx@xxxx.xxx]
Sent: 20 February 2014 16:17
To: Paul Campini
Cc: Mark Harrison
Subject: Land South of Pont Adam Crescent, Ruabon, Wrexham - Noise Assessment

Hi Paul, many thanks for your time to talk this afternoon. As discussed please find detailed below the specifics of what we are doing, where and what we would like to achieve in consulting with you. We would be grateful if you could forward this e-mail on to the appropriate officer who looks after noise in this area such that we can hope to agree an appropriate scope and methodology for the surveys required.

Proposed Scheme: We are still awaiting the specific details of the layouts and densities etc.. but the scheme is for a purely residential development at a site to the south of Pont Adam Crescent in Ruabon near Wrexham. The site is centred at approximately grid reference SJ 29636 43640 and is as detailed within the red square on the map below:



We have been requested to undertake a noise assessment of the proposed scheme to conclude residential suitability. From our consideration of commercial mapping and aerial photography it is apparent that there are two main sources of noise in the area that would probably govern the noise climate of the site, namely the A539 to the south (immediately on the southern site boundary) and the railway line to the east (approximately 30/40m from the eastern site boundary). Noise surveys and assessments should therefore consider noise associated with these features as well as other sources present in the ambient climate.

As such we would propose to undertake the following assessment at the site and would appreciate your thoughts on our scope and methodology.

Monitoring Locations

In order to quantify the noise climate of the area, such to allow residential suitability to be concluded, we would propose to undertake monitoring at the following locations by a mixture of 24hr and shorter term monitoring stations (as discussed further below).



We would propose to undertake the surveys as detailed below over a full 24hr period as soon as the weather permits.

- Red Balloon: 1No. 24hr permanent monitoring station at location ML01, access and equipment safety permitting. The equipment would be set to record continually for the 24hr period.
- Blue Balloons: Rotational monitoring around the remaining monitoring locations. The survey would be undertaken such that noise would be quantified in 30/60minute blocks at each location rotating continuously for a full 24hr period. This would mean that all surveys were attended allowing notes on the prevailing noise climate and weather conditions to be made. Whilst two locations are presented on the drawing and deemed sufficient this method could be employed for up to 6 locations without significant loss of resolution on the data monitored at each location – so additional locations can be added.

All monitoring would be undertaken with appropriately calibrated Type 1 SLM equipment and would be attended by a competent Enzygo field technician. The equipment would be locally calibrated before and after each survey. Long term equipment can only be left if a safe, secure position is found and as such we cannot confirm this until we arrive on site. Any changes to the scheme proposed above would be advised within the noise impact assessment report unless it was considered significant enough to warrant separate contact.

Assessment Methodology

Residential suitability at the site would be concluded based upon the measured ambient noise climate of the area and referencing the Standards and Methodologies as detailed below:

- The NEC assessment bandings of Technical Advice Note (Wales) TAN11. We appreciate that in England the NPPF effectively superseded the guidance of PPG24 (English equivalent of TAN11), however, from my understanding the NPPF does not apply in Wales and as such we would still consider the TAN11 NEC banding scheme to have merit and provide a good consideration of residential suitability when considered in association with other guidance.
- BS8233 and WHO Guidelines for the consideration of internal noise levels and suitability

From the information we have we would not consider industrial noise to be a significant feature of the noise climate of the area – if a feature at all. However, should industrial noise be considered a potential issue at the site once we have more information on the baseline/ambient noise climate of the area we would assess this in line with the methodology of BS4142. However, from the info we have we would not consider this an issue in this area.

The noise impact assessment would be supplied in a report format supporting the main application. The document would contain information relating to the site, the development proposed, the methodologies used to assess noise, the results of the assessment and details of noise mitigation necessary at the site to make development possible.

We hope that the proposed methodology is acceptable to yourselves and look forward to the opportunity to discuss any aspect of our proposal with you to agree an appropriate methodology to take forward into the assessment and application. We would therefore be appreciative of hearing from you regarding our proposed scope and methodology, or requesting any further information that you may require. We are keen to progress the surveys as soon as the weather permits (as a result of the time of year and the prevailing weather conditions) and as such would appreciate any feedback that you may have as soon as you are able such that it can be incorporated into the study.

Kind regards, and thanks for your consideration of our proposals, Pete

Pete Tallantyre
Technical Director (Acoustics)



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APPENDIX B – NOISE MONITORING DATA

Location ML01
 Periods 15m Day, 5m night
 Start 28/02/2014 10:00
 End 01/03/2014 10:00
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
28/02/2014 10:00	64.1	44.3	85.3	49.2	60.7
28/02/2014 10:15	57.2	43.7	66.4	49.2	60.6
28/02/2014 10:30	57.3	45.9	70.2	49.3	60.7
28/02/2014 10:45	57.5	43.9	71.7	49.8	60.4
28/02/2014 11:00	57.1	46.5	66.4	49.7	60.3
28/02/2014 11:15	56.7	47.0	63.7	49.5	60.0
28/02/2014 11:30	57.7	45.2	65.3	50.3	60.7
28/02/2014 11:45	58.2	44.7	75.4	48.9	60.1
28/02/2014 12:00	58.4	45.6	77.2	50.0	60.9
28/02/2014 12:15	57.3	46.7	68.9	49.8	60.4
28/02/2014 12:30	56.7	45.1	63.2	49.0	60.2
28/02/2014 12:45	58.5	45.7	74.0	49.8	60.7
28/02/2014 13:00	57.7	44.9	68.3	49.5	60.7
28/02/2014 13:15	57.9	47.1	67.0	50.0	61.0
28/02/2014 13:30	57.0	46.4	67.2	49.5	60.2
28/02/2014 13:45	58.6	47.2	74.8	50.1	61.0
28/02/2014 14:00	56.9	46.3	66.5	49.3	59.9
28/02/2014 14:15	56.6	45.1	65.8	48.5	60.0
28/02/2014 14:30	58.4	46.3	73.3	50.2	60.8
28/02/2014 14:45	58.9	46.4	74.4	50.8	61.0
28/02/2014 15:00	57.7	45.9	72.1	50.3	60.6
28/02/2014 15:15	57.2	46.9	64.5	49.7	60.4
28/02/2014 15:30	56.9	46.3	65.6	49.2	59.9
28/02/2014 15:45	58.0	45.4	74.9	49.1	60.4
28/02/2014 16:00	57.4	45.3	72.9	50.1	60.2
28/02/2014 16:15	58.3	46.5	64.2	51.0	61.0
28/02/2014 16:30	58.7	47.6	67.2	51.1	61.6
28/02/2014 16:45	60.8	48.3	79.0	51.5	61.7
28/02/2014 17:00	58.7	47.6	64.3	52.6	61.3
28/02/2014 17:15	59.2	45.1	72.8	50.7	61.6
28/02/2014 17:30	58.4	46.9	72.6	52.2	60.9
28/02/2014 17:45	58.4	47.4	65.7	50.9	61.6
28/02/2014 18:00	59.6	46.6	75.7	51.4	62.0
28/02/2014 18:15	57.8	45.1	64.4	49.5	61.1
28/02/2014 18:30	58.0	46.0	64.7	50.3	60.9
28/02/2014 18:45	59.2	48.3	73.2	51.6	61.6
28/02/2014 19:00	57.9	47.5	65.6	50.8	60.9
28/02/2014 19:15	64.5	46.2	80.8	49.7	61.5
28/02/2014 19:30	58.1	44.1	76.1	48.7	60.4
28/02/2014 19:45	57.2	40.3	71.9	48.7	60.1
28/02/2014 20:00	56.0	40.5	72.0	46.2	59.1
28/02/2014 20:15	55.7	43.6	64.5	47.5	59.4

28/02/2014 20:30	56.4	40.9	71.6	47.1	60.1
28/02/2014 20:45	57.4	39.2	74.2	46.0	59.8
28/02/2014 21:00	55.5	40.5	65.1	45.8	59.6
28/02/2014 21:15	61.8	40.4	81.1	44.6	59.7
28/02/2014 21:30	54.7	41.3	71.9	44.8	58.7
28/02/2014 21:45	54.3	41.7	70.6	45.1	57.9
28/02/2014 22:00	58.7	42.2	77.3	46.3	59.1
28/02/2014 22:15	54.2	39.1	64.9	45.2	58.4
28/02/2014 22:30	53.1	38.1	65.5	42.7	56.9
28/02/2014 22:45	58.0	34.8	77.5	40.8	58.2
28/02/2014 23:00	50.8	36.8	61.1	40.5	55.5
28/02/2014 23:05	51.0	37.4	61.4	40.6	56.0
28/02/2014 23:10	52.1	36.5	62.4	37.8	56.8
28/02/2014 23:15	52.9	34.5	63.9	37.6	57.8
28/02/2014 23:20	52.9	31.8	62.2	37.4	57.8
28/02/2014 23:25	50.0	30.9	62.8	34.8	53.8
28/02/2014 23:30	53.3	35.4	65.3	40.3	57.5
28/02/2014 23:35	50.4	38.1	62.9	40.9	55.6
28/02/2014 23:40	54.0	40.2	64.2	43.1	59.1
28/02/2014 23:45	53.3	40.5	62.4	43.4	57.9
28/02/2014 23:50	54.6	37.8	62.1	43.3	58.4
28/02/2014 23:55	52.4	37.7	63.7	41.0	56.4
01/03/2014 00:00	54.0	38.8	63.5	41.2	58.8
01/03/2014 00:05	54.2	34.7	67.3	39.9	58.4
01/03/2014 00:10	49.4	35.8	61.3	39.3	53.7
01/03/2014 00:15	50.0	34.0	61.3	36.1	54.1
01/03/2014 00:20	50.2	35.5	61.1	39.8	54.2
01/03/2014 00:25	49.1	34.3	62.6	39.3	53.1
01/03/2014 00:30	53.1	36.9	67.4	40.6	56.7
01/03/2014 00:35	47.8	36.5	61.2	39.6	49.4
01/03/2014 00:40	50.0	34.4	64.0	36.5	54.0
01/03/2014 00:45	51.2	30.9	63.1	34.5	55.5
01/03/2014 00:50	50.3	30.9	61.4	35.6	55.5
01/03/2014 00:55	49.3	33.7	63.8	37.7	53.0
01/03/2014 01:00	50.4	34.7	63.0	38.9	54.4
01/03/2014 01:05	50.0	30.4	62.5	32.8	54.2
01/03/2014 01:10	48.0	30.7	61.0	34.7	52.4
01/03/2014 01:15	48.9	31.2	60.2	35.3	53.5
01/03/2014 01:20	47.8	28.7	66.1	30.5	51.2
01/03/2014 01:25	48.5	33.3	61.2	38.7	50.5
01/03/2014 01:30	45.2	28.1	59.5	30.2	47.1
01/03/2014 01:35	46.9	29.1	65.4	30.4	48.1
01/03/2014 01:40	46.2	28.1	62.9	29.7	45.3
01/03/2014 01:45	46.2	25.1	63.6	26.6	46.7
01/03/2014 01:50	49.9	27.4	61.6	29.5	55.2
01/03/2014 01:55	46.0	27.7	62.6	29.8	48.5
01/03/2014 02:00	45.0	28.1	62.4	29.8	47.1
01/03/2014 02:05	41.6	28.6	62.9	29.6	41.7
01/03/2014 02:10	49.2	30.4	62.5	34.4	53.4
01/03/2014 02:15	47.4	26.9	62.7	29.4	46.2

01/03/2014 02:20	45.9	27.6	61.0	30.2	46.2
01/03/2014 02:25	47.5	32.4	64.0	34.1	48.1
01/03/2014 02:30	45.4	30.3	61.6	32.1	46.3
01/03/2014 02:35	48.1	27.7	62.9	30.7	49.8
01/03/2014 02:40	44.6	26.5	63.0	27.1	45.3
01/03/2014 02:45	48.0	30.2	60.6	34.3	51.8
01/03/2014 02:50	43.8	29.6	60.9	31.7	43.4
01/03/2014 02:55	45.6	29.9	61.0	32.0	48.1
01/03/2014 03:00	45.3	29.4	63.2	31.1	46.7
01/03/2014 03:05	42.3	28.4	54.2	30.9	46.6
01/03/2014 03:10	44.2	28.7	59.7	31.6	45.2
01/03/2014 03:15	40.9	29.3	59.7	30.1	40.4
01/03/2014 03:20	45.8	29.9	63.8	30.9	45.2
01/03/2014 03:25	47.6	29.3	60.5	31.3	51.7
01/03/2014 03:30	49.3	30.0	61.1	32.6	53.7
01/03/2014 03:35	48.2	30.3	61.8	33.7	50.8
01/03/2014 03:40	48.1	29.0	61.7	31.1	51.3
01/03/2014 03:45	49.9	32.6	63.7	35.4	53.1
01/03/2014 03:50	44.8	33.0	57.8	35.5	47.7
01/03/2014 03:55	41.5	28.3	59.5	29.7	41.2
01/03/2014 04:00	43.6	29.0	58.2	30.1	48.3
01/03/2014 04:05	46.5	28.6	62.4	30.2	49.9
01/03/2014 04:10	47.1	32.4	63.3	35.1	47.9
01/03/2014 04:15	46.3	30.2	59.7	34.1	49.3
01/03/2014 04:20	45.4	32.4	60.3	35.0	45.6
01/03/2014 04:25	45.7	32.4	59.6	33.7	48.2
01/03/2014 04:30	42.7	29.9	60.4	31.1	43.5
01/03/2014 04:35	44.9	29.5	62.1	33.2	44.8
01/03/2014 04:40	49.3	30.5	61.6	33.6	52.4
01/03/2014 04:45	48.7	31.8	61.3	34.6	51.0
01/03/2014 04:50	39.3	30.5	48.3	33.1	43.2
01/03/2014 04:55	45.5	32.3	60.6	35.4	47.6
01/03/2014 05:00	46.9	33.8	60.7	36.3	48.9
01/03/2014 05:05	50.1	32.9	62.3	36.9	54.4
01/03/2014 05:10	48.3	35.6	61.6	40.1	50.0
01/03/2014 05:15	47.6	36.6	61.2	38.2	50.2
01/03/2014 05:20	48.9	37.6	61.5	39.8	51.5
01/03/2014 05:25	50.1	36.9	62.7	41.2	53.0
01/03/2014 05:30	53.4	39.3	63.6	41.9	58.1
01/03/2014 05:35	52.1	38.1	65.5	42.0	56.4
01/03/2014 05:40	48.5	38.8	62.1	41.5	49.5
01/03/2014 05:45	52.0	39.3	63.4	42.0	56.3
01/03/2014 05:50	56.5	37.0	76.3	40.3	50.0
01/03/2014 05:55	48.0	35.7	62.0	37.5	50.6
01/03/2014 06:00	53.0	37.9	63.1	40.6	58.1
01/03/2014 06:05	54.9	41.2	64.8	45.6	58.6
01/03/2014 06:10	51.9	41.3	62.6	44.7	55.8
01/03/2014 06:15	54.6	41.5	65.6	45.7	58.7
01/03/2014 06:20	52.9	44.3	62.4	47.0	56.5
01/03/2014 06:25	53.2	40.3	64.2	43.1	57.8

01/03/2014 06:30	53.4	41.3	65.6	45.0	56.3
01/03/2014 06:35	52.5	38.5	63.9	42.9	56.4
01/03/2014 06:40	55.4	42.7	67.4	45.7	59.6
01/03/2014 06:45	56.8	44.8	73.0	48.0	58.5
01/03/2014 06:50	55.5	43.6	63.5	47.3	59.6
01/03/2014 06:55	52.8	42.5	62.1	45.6	56.5
01/03/2014 07:00	53.9	42.4	63.9	46.2	58.0
01/03/2014 07:15	54.4	43.1	65.9	47.2	58.2
01/03/2014 07:30	54.7	40.1	64.5	44.2	58.7
01/03/2014 07:45	59.3	44.2	76.5	49.1	61.0
01/03/2014 08:00	56.4	42.1	65.3	48.9	60.2
01/03/2014 08:15	55.8	43.7	65.0	47.3	59.6
01/03/2014 08:30	57.2	46.4	73.4	49.1	60.5
01/03/2014 08:45	58.4	40.0	75.5	48.7	60.8
01/03/2014 09:00	56.7	44.1	66.5	48.1	60.3
01/03/2014 09:15	57.5	45.4	65.9	48.9	61.1
01/03/2014 09:30	57.8	46.7	65.7	50.7	60.8
01/03/2014 09:45	59.5	48.1	73.9	52.2	61.8

Location ML02
 Periods 15m Day, 5m Night
 Start 28/02/2014
 End 01/03/2014
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
28/02/2014 11:20	51.1	42.2	67.6	45.5	53.3
28/02/2014 11:35	50.9	41.8	58.0	45.4	53.8
28/02/2014 11:50	50.9	42.6	55.2	46.3	53.5
28/02/2014 13:28	51.7	42.8	70.5	46.1	53.8
28/02/2014 13:43	55.3	44.6	74.7	47.5	54.8
28/02/2014 13:58	52.6	43.5	61.4	46.6	54.9
28/02/2014 15:26	51.1	43.5	66.4	45.8	53.5
28/02/2014 15:41	54.5	42.9	75.0	45.7	54.4
28/02/2014 15:56	53.0	44.1	67.8	46.7	54.3
28/02/2014 17:46	53.1	44.6	67.6	47.4	55.3
28/02/2014 18:01	55.8	43.4	75.8	47.1	55.5
28/02/2014 18:16	52.6	44.3	58.4	46.8	55.4
28/02/2014 20:05	51.4	41.2	69.6	45.2	53.9
28/02/2014 20:20	51.4	41.8	66.3	45.0	54.3
28/02/2014 20:35	51.9	42.7	59.1	44.3	55.5
28/02/2014 21:54	56.2	39.9	76.5	44.9	53.9
28/02/2014 22:09	54.0	41.1	74.7	43.2	52.7
28/02/2014 22:24	49.1	36.8	59.6	42.2	52.4
28/02/2014 22:39	57.9	35.6	76.8	40.2	53.5
28/02/2014 22:54	47.4	36.6	60.4	39.7	50.9
01/03/2014 01:20	49.2	30.4	71.3	33.8	49.6
01/03/2014 01:25	43.5	30.2	51.2	37.1	47.1
01/03/2014 01:30	40.6	27.5	51.7	29.2	44.9
01/03/2014 01:35	43.8	28.7	57.5	30.1	46.8
01/03/2014 01:40	43.3	27.3	58.9	29.0	43.8
01/03/2014 01:45	49.2	24.4	64.8	25.6	52.3
01/03/2014 01:50	42.4	25.7	52.5	29.0	47.7
01/03/2014 01:55	40.7	26.8	55.2	28.7	44.4
01/03/2014 02:00	38.9	27.4	52.9	28.5	42.3
01/03/2014 02:05	38.8	27.2	54.5	30.1	40.0
01/03/2014 02:10	43.7	28.7	54.7	30.8	48.8
01/03/2014 02:15	44.2	27.3	55.5	29.2	49.6
01/03/2014 02:20	42.6	27.6	56.0	29.9	45.8
01/03/2014 02:25	38.3	30.9	46.7	32.2	41.8
01/03/2014 02:30	42.2	31.4	55.4	32.6	44.5
01/03/2014 02:35	41.0	26.9	54.5	28.0	44.0
01/03/2014 02:40	43.6	26.3	57.1	27.4	47.0

01/03/2014 02:45	41.8	29.8	54.7	31.7	44.4
01/03/2014 02:50	41.0	30.1	54.4	31.9	44.3
01/03/2014 02:55	39.7	29.5	53.5	31.0	42.7
01/03/2014 03:00	41.6	30.0	55.7	32.5	44.0
01/03/2014 03:05	37.3	28.4	46.9	30.4	41.3
01/03/2014 03:10	39.1	27.8	52.5	30.2	40.4
01/03/2014 03:15	39.0	28.6	52.0	30.1	41.2
01/03/2014 03:20	43.0	32.5	57.6	33.1	46.6
01/03/2014 03:25	49.4	35.8	56.6	36.1	56.4
01/03/2014 05:55	49.5	34.4	67.4	37.9	49.0
01/03/2014 06:00	45.5	39.3	55.9	41.0	47.1
01/03/2014 06:05	47.4	41.3	55.4	42.9	50.6
01/03/2014 06:10	48.8	41.3	57.8	44.5	51.6
01/03/2014 06:15	48.8	41.5	58.0	43.9	51.6
01/03/2014 06:20	52.3	43.2	62.8	45.3	56.3
01/03/2014 06:25	49.5	39.3	57.1	43.1	53.0
01/03/2014 06:30	48.8	39.6	58.1	43.4	51.5
01/03/2014 06:35	48.9	38.2	60.2	41.9	51.8
01/03/2014 07:57	53.5	42.8	73.1	47.1	55.1
01/03/2014 08:12	51.6	42.8	58.6	45.7	55.0
01/03/2014 08:27	54.4	44.4	71.2	47.7	56.5
01/03/2014 08:42	54.0	43.8	68.0	46.9	55.4

Location ML03
 Periods 15m Day, 5m Night
 Start 28/02/2014
 End 28/02/2014
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
28/02/2014 10:01	48.4	41.3	68.5	43.4	47.3
28/02/2014 10:16	46.6	39.6	56.2	43.3	48.3
28/02/2014 10:31	46.0	41.8	62.2	43.2	47.4
28/02/2014 11:59	48.8	42.4	72.1	44.3	48.0
28/02/2014 12:14	47.3	41.8	57.0	44.8	48.6
28/02/2014 12:29	46.4	42.4	56.1	44.1	47.8
28/02/2014 14:08	47.8	43.1	68.3	45.2	48.5
28/02/2014 14:23	48.8	43.8	60.3	45.8	50.3
28/02/2014 14:38	54.4	44.4	67.7	46.3	58.3
28/02/2014 16:10	48.5	43.6	71.0	45.5	48.8
28/02/2014 16:25	48.1	43.9	61.0	45.8	49.3
28/02/2014 16:40	48.6	45.5	58.7	46.3	49.4
28/02/2014 18:26	49.2	44.7	66.7	46.2	50.6
28/02/2014 18:41	51.0	46.2	55.1	48.5	52.5
28/02/2014 18:56	50.3	45.5	59.7	47.2	52.3
28/02/2014 20:46	50.9	40.9	70.3	45.1	52.7
28/02/2014 21:01	49.7	41.6	56.6	44.9	52.3
28/02/2014 21:16	50.5	45.1	56.3	47.1	51.9
28/02/2014 23:05	49.7	38.1	70.5	41.5	47.1
28/02/2014 23:10	46.3	38.5	53.1	40.6	49.1
28/02/2014 23:15	46.6	37.6	52.1	40.7	49.0
28/02/2014 23:20	46.7	33.9	53.8	40.0	49.5
28/02/2014 23:25	45.2	33.0	53.5	36.2	48.8
28/02/2014 23:30	47.3	39.4	53.3	42.5	49.3
28/02/2014 23:35	45.4	37.7	54.5	39.5	48.6
28/02/2014 23:40	49.3	37.7	56.9	43.0	52.7
28/02/2014 23:45	48.5	38.8	54.8	42.3	51.1
28/02/2014 23:50	48.6	40.4	55.6	43.3	51.2
28/02/2014 23:55	48.3	39.0	55.6	41.9	51.7
01/03/2014 00:00	51.0	38.5	59.5	41.9	55.0
01/03/2014 00:05	49.7	36.1	60.1	41.2	53.6
01/03/2014 00:10	53.4	46.6	60.4	47.3	57.0
01/03/2014 04:07	50.3	34.3	70.2	37.3	45.7
01/03/2014 04:12	41.0	31.1	51.5	34.0	44.0
01/03/2014 04:17	41.1	33.8	51.4	35.2	43.2
01/03/2014 04:22	41.4	31.7	49.9	34.0	44.3

01/03/2014 04:27	41.2	30.2	49.2	32.0	45.1
01/03/2014 04:32	41.2	30.5	50.2	34.2	44.3
01/03/2014 04:37	41.9	31.4	50.3	33.4	45.7
01/03/2014 04:42	45.0	33.1	56.1	35.2	48.0
01/03/2014 04:47	43.1	32.8	52.9	35.4	46.6
01/03/2014 04:52	40.1	31.1	51.4	32.9	43.9
01/03/2014 04:57	42.6	34.3	54.0	36.7	45.6
01/03/2014 05:02	45.7	34.7	53.7	38.2	49.4
01/03/2014 05:07	45.0	34.6	54.0	39.5	48.2
01/03/2014 05:12	50.6	41.6	67.5	42.6	47.9
01/03/2014 06:42	54.6	47.0	72.3	48.3	53.8
01/03/2014 06:47	50.4	44.4	57.5	46.4	52.6
01/03/2014 06:52	49.8	43.9	56.1	45.9	52.2
01/03/2014 06:57	49.3	44.6	54.5	46.3	51.2
01/03/2014 07:02	51.0	44.0	57.5	47.4	53.3
01/03/2014 08:51	50.4	43.0	71.9	45.9	50.6
01/03/2014 09:06	48.9	44.7	54.1	46.5	50.7
01/03/2014 09:21	49.5	44.2	59.2	46.7	50.3

Location ML04
 Periods 15m Day, 5m Night
 Start 28/02/2014
 End 28/02/2014
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
28/02/2014 10:43	51.4	39.3	75.9	44.1	52.6
28/02/2014 10:58	50.6	40.3	62.0	44.5	53.6
28/02/2014 11:13	49.5	41.8	65.8	44.0	50.3
28/02/2014 12:51	49.9	40.4	68.7	44.5	51.4
28/02/2014 13:06	49.5	42.6	57.3	45.2	52.1
28/02/2014 13:21	48.0	42.3	59.6	44.6	50.0
28/02/2014 14:49	50.9	42.9	72.0	45.9	51.9
28/02/2014 15:04	49.2	42.0	58.6	44.7	51.3
28/02/2014 15:19	49.8	43.2	59.2	45.8	51.8
28/02/2014 16:51	53.0	42.8	71.9	46.6	53.2
28/02/2014 17:06	52.7	44.2	63.7	47.4	54.2
28/02/2014 17:21	51.1	42.7	57.1	47.0	53.4
28/02/2014 19:14	57.2	42.5	72.9	46.0	53.5
28/02/2014 19:29	51.8	42.4	67.4	45.3	52.9
28/02/2014 19:44	51.2	38.2	65.3	44.9	53.0
28/02/2014 19:59	51.0	39.0	63.5	42.2	53.9
28/02/2014 21:21	49.3	38.2	70.3	42.6	51.3
28/02/2014 21:36	49.0	38.9	61.7	43.1	51.9
28/02/2014 21:51	48.1	41.5	55.8	42.7	51.5
01/03/2014 00:14	47.6	34.5	64.9	36.6	49.2
01/03/2014 00:19	44.9	33.7	52.7	38.5	48.5
01/03/2014 00:24	44.6	35.9	54.5	38.7	47.7
01/03/2014 00:29	45.2	31.9	59.1	36.7	48.4
01/03/2014 00:34	47.5	36.0	66.2	37.2	48.4
01/03/2014 00:39	45.2	34.4	56.9	36.8	48.2
01/03/2014 00:44	47.1	30.1	54.9	34.0	51.2
01/03/2014 00:49	46.0	30.3	54.2	35.7	50.3
01/03/2014 00:54	45.1	32.3	54.7	36.8	49.1
01/03/2014 00:59	46.0	33.2	58.3	37.5	49.8
01/03/2014 01:04	46.2	29.3	55.7	32.5	50.8
01/03/2014 01:09	44.3	30.5	53.0	33.3	48.7
01/03/2014 01:14	45.3	30.8	55.3	33.0	49.4
01/03/2014 01:19	47.9	39.9	51.6	39.8	51.5
01/03/2014 03:29	48.9	35.6	68.2	42.1	49.6
01/03/2014 03:34	43.4	30.3	52.1	33.3	46.4
01/03/2014 03:39	41.7	28.2	53.2	29.4	47.0

01/03/2014 03:44	44.2	29.6	54.5	32.9	48.1
01/03/2014 03:49	41.5	32.3	51.2	35.7	45.3
01/03/2014 03:54	41.9	29.7	51.4	33.3	44.7
01/03/2014 03:59	46.8	42.0	55.8	42.5	49.9
01/03/2014 05:18	52.1	38.3	74.2	40.2	49.7
01/03/2014 05:23	46.2	39.4	55.2	41.4	48.8
01/03/2014 05:28	48.5	38.0	55.3	40.4	52.1
01/03/2014 05:33	46.6	38.6	52.7	41.3	49.9
01/03/2014 05:38	45.8	37.7	55.5	40.2	49.1
01/03/2014 05:43	46.4	36.2	55.1	40.2	50.8
01/03/2014 05:48	52.1	38.9	66.3	41.9	52.1
01/03/2014 07:29	51.0	39.3	67.3	45.0	53.4
01/03/2014 07:44	53.5	44.1	68.3	47.1	54.9
01/03/2014 09:27	53.0	43.0	70.7	48.2	55.1
01/03/2014 09:42	53.5	44.9	64.6	48.2	55.9
01/03/2014 09:57	52.7	46.7	61.9	48.8	54.8



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