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Proposed Residential Development, Land to West of Crease Drove, Crowland

Noise Assessment Report

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On behalf of
N Woodroffe & Sons

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1.0 INTRODUCTION

1.1 Blue Tree Acoustics has been appointed by N Woodroffe & Sons to carry out an assessment of the existing noise climate at a site for proposed residential development on Land to West of Crease Drove, Crowland.

1.2 The proposed development site comprises an open field situated to the west of Crease Drove on the southwestern fringe of Crowland.

1.3 Crease Drove borders the site to the east. To the east is a site containing commercial warehouse/storage premises, which we understand has recently been granted permission for residential development. To the north, the site is bordered by existing residential properties, mainly in the form of two-storey houses. Open fields border the site to the west. To the south are other open fields, and distant traffic on the A16 is just visible at approximately 900m distance from the centre of the site. There is a cluster of industrial premises situated further along Crease Drove, approximately 100m south of the development site at the nearest point.

1.4 The proposal is to build new residential housing on the site as indicated in the illustrative site plan in Figure 3.

1.5 The noise impact assessment has included:

i) Inspection of the site and surroundings.
ii) Noise monitoring surveys undertaken at locations on the site.
iii) Evaluation of the site in accordance with relevant planning policy guidance.
iv) Consideration of noise control measures required to maintain acceptable noise levels within the proposed bedrooms and living rooms in accordance with *British Standard 8233: 2014, 'Guidance on sound insulation and noise reduction for buildings'* (BS8233) and relevant local authority guidance.

2.0 EXISTING NOISE SOURCES

Road

2.1 The section of Crease Drove near the development site is a single track road, but is relatively busy with frequent passing vehicles, as it provides a route through to the nearby junction of James Road with the A16. The topography in the vicinity of the site is relatively flat and the distant A16 traffic is visible and audible, providing a continuous background sound level throughout the day and night. This road traffic is the primary noise source in the area, together with more intermittent local vehicle movements on Crease Drove.

2.2 We understand that the development proposals include widening of Crease Drove to improve vehicle access. Whilst this potentially will result in increased traffic passing the site, as stated above, this section of road is already used frequently, and an increase in traffic associated with the widening is not expected to result in a significant increase in traffic noise, i.e. a doubling in traffic flow past the site is needed to result in an increase of 3dB L_{Aeq}. Such a change in noise level is generally considered as being just noticeable, and therefore not of significant impact. Any such noise impact from proposals to widen Crease Drove should be reviewed once detailed traffic flow data is available.

Commercial Premises

2.3 The warehouse/storage premises to the east of the development site appeared to be either vacant or little used at the time of the site surveys. During our survey visits, one visiting car was observed to access one building for a short period only. We understand that permission has been granted for demolition of these buildings to facilitate redevelopment of the site for housing.

2.4 There are several industrial premises situated at short distance to the south of the site. The most significant of these in terms of noise generation is Crowland Cranes, which was observed to commence operations at around 0530 hours. This primarily comprised noise from mobile cranes manoeuvring within the yard, exiting the premises onto Crease Drove, and heading south, and then east, along Harvester Way. During daytime, i.e. after 0700 hours, some noise from machinery, possibly a spray-booth, at Crowland Cranes was faintly audible at the development site during lulls in traffic and passing vehicles (this noise appears to emanate from the buildings

to the south of the Crowland Cranes site and is therefore shielded by the intervening buildings). No significant noise emission was apparent from the other industrial buildings nearby. Commercial vehicles all appeared to enter/exit the Crowland Cranes site from the south via Crease Drove and Harvester Way.

2.5 We understand there to be consented residential development at a site approximately 300m southeast of the Crowland Cranes premises ,and an application for residential development is currently under consideration for the fields immediately to the east and southeast of Crowland Cranes. It is therefore assumed that the current level of noise impact from Crowland Cranes upon these sites, and also the nearby existing housing, is deemed acceptable by the Local Authority.

3.0 NEW NOISE SOURCES

3.1 The new development is primarily residential in nature and will introduce no significant long-term noise sources. There may be potential for noise generation from new M&E equipment, such as domestic ventilation systems. Such domestic systems do not typically generate significant noise levels and can usually be adequately addressed at the detailed design stage, or, if needed, by an appropriately worded planning condition.

3.2 Potentially, there will be noise produced at times during the construction of the development. However, this will be restricted to daytime hours only, and, if needed, can be controlled by an appropriately worded planning condition.

4.0 NOISE SURVEY

4.1 Noise monitoring was undertaken by Blue Tree Acoustics in order to determine the existing ambient noise climate at the site. Attended measurements were taken during representative daytime and nighttime survey periods.

4.2 Noise measurements were taken at nighttime on Wednesday 3rd February 2016 and in the early morning on Thursday 11th February 2016. The measurement locations are indicated in Figure 1.

4.3 Noise measurements were carried out using 1no Rion NA28 Type 1/Class 1 Integrating Sound Level Meter, 1no Rion NL32 Type 1/Class 1 Integrating Sound Level Meter, and 1no Svan SV971 Type 1/Class 1 Integrating Sound Level Meter. Each meter was within a valid period of laboratory calibration. Calibration checks were carried out both before and after the measurements, with no variance observed. A proprietary environmental windshield was fitted to the microphone in each case, and measurements were made with each meter mounted on a tripod at approximately 1.5m from ground level.

4.4 Weather conditions during the attended noise survey period were generally dry and calm, with wind speeds <5m/s.

4.5 The dominant noise at the development site was found to be from road traffic. Some noise from the Crowland Cranes site was faintly audible at times. The measurements also include some extraneous noise contribution from separate visits by Police and site security vehicles during the survey on Wednesday 3rd February 2016.

4.6 The measurement results are detailed in Appendix II, and are summarised in Tables 1 and 2 below to show the average noise levels recorded at the measurement positions on the development site.

Table 1: Averaged Daytime Free-field External Noise Levels

Location	Date	dB L_{Aeq}	dB L_{Amax}	dB L_{A10}	dB L_{A90}
1	03/02/16	49	68	47	38
	11/02/16	53	68	54	47
2	03/02/16	43	55	45	36
	11/02/16	49	58	50	45
3	03/02/16	51	70	51	40
	11/02/16	56	74	56	48

Table 2: Averaged Nighttime Free-field External Noise Levels

Location	Date	dB L_{Aeq}	dB L_{Amax}	dB L_{A10}	dB L_{A90}
1	03/02/16	45	59	43	34
	11/02/16	53	73	54	46
2	03/02/16	42	52	45	35
	11/02/16	50	62	52	45
3	03/02/16	47	58	47	35
	11/02/16	55	73	56	48

4.7 As can be seen from the tables, the magnitude of noise levels at the development site is modest during daytime, being <55dB L_{Aeq}. During late evening and early morning hours, noise levels are similarly modest at 45dB L_{Aeq}. At the end of the nighttime period, around 0500-0700 hours, it can be seen that noise levels increase to around 53dB L_{Aeq}. This is primarily attributed to increasing traffic noise from both Crease Drove and the distant A16. There is some minor contribution from operations commencing at Crowland Cranes, but this is only faintly audible and has minimal influence on the magnitude of noise levels at the development site. For example, the greatest measured noise level at Location 3 including crane movements was 59dB $L_{Aeq(15min)}$ at 0714

hours. Allowing for approximate distance of 120m from the measurement location to the nearest proposed new dwelling, the resultant noise level at the development site is 41dB $L_{Aeq(15min)}$. This is less than the ambient and background noise levels measured at the development site and therefore of minimal impact. In addition, the corresponding measurements taken at Locations 1 and 2 at this time do not indicate any notable increase in noise levels that could be attributable to influence from activities at Crowland Cranes.

4.8 As mentioned above, noise generation from Crowland Cranes appears to take place in areas to the south and east of the site, and therefore screened from the development site by the intervening buildings. As such, industrial noise emission is primarily towards the east and south, i.e. away from the development site as indicated by the greater noise levels measured at Location 3, and therefore of lesser impact upon development sites to the north.

5.0 NOISE ASSESSMENT

5.1 In March 2012, the National Planning Policy Framework came into force. This document replaces a great many planning guidance documents which previously informed the planning system in England. The new framework states that:

The planning system should contribute to and enhance the natural and local environment by:

- *protecting and enhancing valued landscapes, geological conservation interests and soils;*
- *recognising the wider benefits of ecosystem services;*
- *minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;*
- *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;*

  and

- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*

Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;[28]*

  and

- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

[27] *See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).*

[28] *Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.*

5.2 In addition, the Noise Policy Statement for England (NPSE) states:

Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

Noise Policy Aims

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

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

Guiding principles of sustainable development

Ensuring a Strong Healthy and Just Society – Meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity for all.

Using Sound Science Responsibly – Ensuring policy is developed and implemented on the basis of strong scientific evidence, whilst taking into account scientific uncertainty (through the precautionary principle) as well as public attitudes and values.

Living Within Environmental Limits – Respecting the limits of the planet's environment, resources and biodiversity – to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations.

Achieving a Sustainable Economy – Building a strong, stable and sustainable economy which provides prosperity and opportunities for all, and in which environmental and social costs fall on those who impose them (polluter pays), and efficient resource use is incentivised.

Promoting Good Governance – Actively promoting effective, participative systems of governance in all levels of society – engaging people's creativity, energy and diversity.

Source: Securing the future – delivering UK sustainable development strategy, HM Government, March 2005.

5.3 The Noise Policy Statement for England Explanatory note states that:

Noise is an inevitable consequence of a mature and vibrant society. For some the noise of city life provides a desirable sense of excitement and exhilaration, but for others noise is an unwanted intrusion that adversely impacts on their quality of life, affecting their health and well being.

The management of noise has developed over many years as the types and character of noise sources have altered and as people's attitude to noise has changed. The Noise Abatement Act came into law in 1960 and the Report from the Committee on the Problem of Noise was published in 1963 (the Wilson report). Since then, examples of noise management can be found in many areas including reducing noise at source; the use of the land use and transport planning systems, compensation measures, the statutory nuisance and licensing regimes and other related legislation.

Furthermore, the broad aim of noise management has been to separate noise sources from sensitive noise receivers and to 'minimise' noise. Of course, taken in isolation and to a literal extreme, noise minimisation would mean no noise at all. In reality, although it has not always been stated, the aim has tended to be to minimise noise as far as reasonably practical. This concept can be found in the Environmental Protection Act 1990, where, in some circumstances, there is a defence of 'best practicable means' in summary statutory nuisance proceedings.

By describing clear policy vision and aims the NPSE provides the necessary clarity and direction to enable decisions to be made regarding what is an acceptable noise burden to place on society.

The intention is that the NPSE should apply to all types of noise apart from noise in the workplace (occupational noise). For the purposes of the NPSE, "noise" includes:

- *"environmental noise" which includes noise from transportation sources;*
- *"neighbour noise" which includes noise from inside and outside people's homes;*

  And
- *"neighbourhood noise" which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.*

The application of the NPSE should mean that noise is properly taken into account at the appropriate time. In the past, the opportunity for the cost effective management of noise has often been missed because the noise implications of a particular policy, development or other activity have not been considered at an early enough stage.

In addition, the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications.

In the longer term, the Government hopes that existing policies could be reviewed (on a prioritised basis), and revised if necessary, so that the policies and any noise management measures being adopted accord with the vision, aims and principles of the NPSE.

Noise management is a complex issue and at times requires complex solutions. Unlike air quality, there are currently no European or national noise limits which have to be met, although there can be specific local limits for specific developments. Furthermore, sound only becomes noise (often defined as 'unwanted sound') when it exists in the wrong place or at the wrong time such that it causes or contributes to some harmful or otherwise unwanted effect, like annoyance or sleep disturbance. Unlike many other pollutants, noise pollution depends not just on the physical aspects of the sound itself, but also the human reaction to it. Consequently, the NPSE provides a clear description of desired outcome from the noise management of a particular situation.

The guiding principles of Government policy on sustainable development should be used to assist in its implementation. The development of further principles specifically to underpin implementation of noise management policy will be kept under review as experience is gained from the application of the NPSE.

There are several key phrases within the NPSE vision and these are discussed below.

Health and quality of life

The World Health Organisation defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, and recognises the enjoyment of the highest attainable standard of health as one of the fundamental rights of every human being.

It can be argued that quality of life contributes to our standard of health. However, in the NPSE it has been decided to make a distinction between 'quality of life' which is a subjective measure that refers to people's emotional, social and physical well being and 'health' which refers to physical and mental well being.

It is recognised that noise exposure can cause annoyance and sleep disturbance both of which impact on quality of life. It is also agreed by many experts that annoyance and sleep disturbance can give rise to adverse health effects. The distinction that has been made between 'quality of life' effects and 'health' effects recognises that there is emerging evidence that long term exposure to some types of transport noise can additionally cause an increased risk of direct health effects. The Government intends to keep research on the health effects of long term exposure to noise under review in accordance with the principles of the NPSE.

Promote good health and good quality of life

This statement expresses the long term desired policy outcome, but in the use of 'promote' and 'good' recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations.

Effective management of noise

This concept confirms that the policy applies to all types of 'noise' (environmental, neighbour and neighbourhood) and that the solution could be more than simply minimising the noise.

Within the context of Government policy on sustainable development

Sustainable development is a core principle underpinning all government policy. For the UK Government the goal of sustainable development is being pursued in an integrated way through a sustainable, innovative and productive economy that delivers high levels of employment and a just society that promotes social inclusion, sustainable communities and personal wellbeing. The goal is pursued in ways that protect and enhance the physical and natural environment, and that use resources and energy as efficiently as possible.

There is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focussing solely on the noise impact without taking into account other related factors.

There are several key phrases within the NPSE aims and these are discussed below.

"Significant adverse" and "adverse"

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL . No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL . Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL . Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different

for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

The first aim of the Noise Policy Statement for England

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

The second aim of the Noise Policy Statement for England

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

5.4 Unfortunately, the above guidance gives no objective, tangible standards or criteria which enable planning decisions to be made. In the absence of such guidance, quantification of noise impact in terms of guidance such as BS8233, which present noise limits and criteria based on World Health Organisation recommendations, can be considered as appropriately assessing the potential noise impact with regard to toxicology concepts and hence in line with the principles of the NPPF and NPSE. Therefore, if a site meets the recommendations of BS8233 and any associated local authority noise requirements, it can be considered as being below the level

where there is no detectable adverse effect on health and quality of life due to noise, and this meets the NOEL (No Observed Effect Level) set out in the NPSE.

5.5 In order to protect potential future residents against the impact of noise, the guidance given in *British Standard 8233: 2014, 'Guidance on sound insulation and noise reduction for buildings'* (BS8233) should be considered. The table below sets out the range of levels recommended in BS8233 for residential accommodation.

Table 3: BS8233 Guidance Criteria

Activity	Location	0700 to 2300hrs	2300 to 0700hrs
Resting	Living rooms	35 dB $L_{Aeq\ (16\ hour)}$	-
Dining	Dining room/area	40 dB $L_{Aeq\ (16\ hour)}$	-
Sleeping (daytime resting)	Bedrooms	35 dB $L_{Aeq\ (16\ hour)}$	30 dB $L_{Aeq\ (8\ hour)}$

5.6 BS8233:2014 does not stipulate any criteria for maximum noise levels within rooms in terms of dB L_{Amax}, but does state that, "*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values."*

5.7 It is noted that BS8233:2014 also states 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 5dB and reasonable internal conditions still achieved.

5.8 The levels shown above are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern (for example, on a road serving a port with high levels of traffic at certain times of the night), an appropriate alternative period (e.g. 1 hour) may be used, but the level should be selected to ensure consistency with the levels recommended in the table. These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

5.9 BS8233 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. BS8233 also recognises that these guideline values are not achievable in all circumstances where development might be desirable. 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.

5.10 The criteria adopted in this report are set out in Table 3 above and represent the current requirements set out in BS8233.

5.11 The following noise mitigation section is based on achieving the above indoor noise level criteria to ensure a suitable level of protection for the future occupants of the development. Noise ingress calculations have been carried out in accordance with BS8233:2014.

6.0 NOISE MITIGATION MEASURES

6.1 There are a variety of proportionate and reasonable techniques that could be introduced to mitigate the effects of noise, such as:

- **Engineering:** reduction of noise at source (e.g. use of quiet machinery and working methods), containment of generated noise, and protection of noise-sensitive buildings (e.g. by sound insulation and/or screening them by purpose-built barriers);
- **Layout:** adequate distance between source and noise-sensitive building; screening by natural barriers, other buildings or non-critical rooms in a building;
- **Administrative:** limiting operating time of source, restricting activities on site, specifying an acceptable noise limit.

6.2 An indicative layout for the proposed development is presented in Figure 3. The potential dwelling locations most exposed to traffic noise will be those along the southern site boundary, with a view toward the A16. The plots situated in the northern and western sections of the development site will benefit from acoustic screening and scattering of the A16 traffic noise provided by the intervening plots situated near the southern site boundary.

6.3 The existing daytime noise levels are around 53dB L_{Aeq}, and therefore below the desirable 55dB L_{Aeq} upper guideline value in BS8233:2014 for noise levels in gardens. To help reduce potential for noise disturbance from traffic or other noise sources to the south, provision of a suitable acoustic barrier is advisable to reduce noise levels in gardens along the southern site boundary. This can be achieved by provision of a close-boarded timber fence of minimum 1.8m height to gardens along this boundary, as indicated in Figure 3. Alternatively, an earth bund to the required height, or combination of bund and fencing, can be used to provide a suitable acoustic barrier, as indicated in the illustrative plan in Figure 3.

6.4 It may also be prudent to provide 1.8m acoustic fencing to any garden areas in new plots positioned along the eastern site boundary in order to provide protection form potential increase in traffic flow associated with widening of Crease Drove.

6.5 Acoustic fencing should be constructed of solid, weather-treated timber (or ply) of minimum 18mm thickness. All joints should be tight-butted with timber cover strips or tongue and groove boards to ensure that there are no air gaps in the structure or between the base of the fence and the ground beneath. Alternatively, if desired, acoustic barriers can be created from almost any

solid material that can be made impermeable to air; for example, the barrier could be constructed from masonry, concrete, plastic, timber panels etc.

Dwelling Protection

6.6 The design of the building envelope of the new dwellings can incorporate suitable sound insulation to satisfy the internal noise criteria set out above. Noise ingress calculations have been carried out in accordance with BS8233:2014 in order to determine appropriate sound insulation measures to satisfy the acoustic criteria set out above. Based on the noise ingress calculations, the following sound insulation measures are recommended. As there are no detailed plans available at this stage, calculations are based on standard room and window sizes.

6.7 All new housing should be of masonry construction, e.g. external walls comprising insulated cavity with block-work inner leaf and external brick leaf. If any lightweight framed sections of outer wall are proposed within the dwellings, these should be designed to achieve acoustic performance comparable to a masonry construction; typically, this will require inclusion of suitable mass layers within the wall build-up.

6.8 Roof constructions should be tiled, with ceilings to rooms below comprising a minimum of 1no layer of solid gypsum-based board (total minimum mass per unit area 10kg/m^2), overlaid with minimum 100mm insulation wool. Any proposed rooms in the roofspace should be designed to have suitable internal linings to achieve the required sound insulation, e.g. equivalent to the external masonry wall.

6.9 Noise levels at the site are relatively modest, and therefore special measures for enhanced acoustic glazing are not necessary. The noise ingress calculations show that typical double glazing is expected to provide suitable sound insulation. Calculations have been based on sound reduction provided by a typical standard configuration of 4mm glass/minimum 12mm cavity/6mm glass, as shown in the table below. Systems with thicker glass and/or greater cavity depth will provide greater sound insulation, and therefore will also be suitable.

Table 4: Glazing Minimum Octave Band Sound Reduction Indices

Glazing Configuration	Octave Band Minimum Sound Reduction Indices (dB)						
	63	125	250	500	1k	2k	4k
4mm glass/12mm airgap/6mm glass Typically 33dB R_w	18	23	22	27	38	40	41

6.10 For acoustically rated windows, the required acoustic performance should be attained by the glazing system as a whole, including frames, seals, opening lights, etc.

6.11 Standard passive trickle ventilation is suitable to meet the internal noise criteria in most habitable rooms. To help reduce potential for noise disturbance from traffic or other noise sources to the south, it is recommended that enhanced acoustic performance to ventilators be provided to south-facing bedrooms as indicated in Figure 3. Calculations indicate a minimum ventilator sound insulation performance of 36dB $D_{n,e,w}$ should be suitable. Similarly, enhanced vents could be considered for bedrooms in new plots on the eastern boundary overlooking Crease Drove in order to provide enhanced protection from potential increase in traffic flow associated with widening of the road. Ground floor living rooms and dining rooms on these elevations may be provided with standard window trickle ventilators. Alternatively, to avoid penetrations of the external building façade, a ducted ventilation system (e.g. whole house type) could be implemented, or it may be possible to design a continuous running MEV/MVHR fan system with no requirement for ventilation openings in window frames or external walls into habitable rooms on building elevations directly exposed to noise sources. It should also be ensured that internally generated noise from new mechanical services are designed to be suitably quiet within the new dwellings. CIBSE guidance suggests Noise Rating (NR) of NR25 is appropriate for bedrooms, and NR30 for living rooms. These criteria can be considered appropriate for the proposed development and separate to the BS8233 targets stipulated above for external noise sources.

6.12 Glazing and ventilators to non-habitable rooms or spaces do not require special acoustic measures, and these spaces may have standard trickle ventilation. For the purposes of noise assessment, separate kitchens, bathrooms, WCs, etc., are considered as non-habitable spaces.

6.13 The specifications given above are suitable recommendations and should be verified during the detailed building design. Equivalent acoustic performance may be achieved by other materials or products, but acoustic performance data for all proposed systems should be checked by a

competent acoustic consultant in order to ensure adequate acoustic performance will be achieved. We understand there is potential for other plots of land to the south to be developed for residential use and it may be the case that provision of enhanced acoustic measures may become unnecessary, depending on the extent of development undertaken to the south.

6.14 It should be acknowledged that careful design and close attention to detail, along with high standards of site supervision and workmanship are essential in achieving the required acoustic performance, particularly in relation to controlling flanking sound transmission paths, air gaps, and use of suitable materials. Therefore, effective work management plans will be needed to ensure all contractors and tradesmen are aware of the acoustic performance requirements and details to ensure works are implemented to the necessary standard.

6.15 All recommendations given above are for acoustic purposes only. Any other requirements such as structural, thermal, fire safety, etc., should be checked by suitably qualified specialists.

7.0 SUMMARY AND CONCLUSIONS

7.1 A noise assessment has been carried out on behalf of N Woodroffe & Sons for the proposed residential development of Land to West of Crease Drove, Crowland.

7.2 The assessment has included measurements of the prevailing ambient noise levels at the development site during daytime and nighttime.

7.3 Noise from local passing traffic and distant traffic was found to be the dominant noise source at the site during the day and night.

7.4 Outline noise control measures have been recommended in order to meet suitable noise level criteria for the proposed residential development.

7.5 The site can be considered suitable for residential development in planning and noise terms, as acceptable noise levels in accordance with BS8233 can be achieved following the design and implementation of suitable noise mitigation measures.

7.6 In addition, the assessment has been undertaken in accordance with the National Planning Policy Framework (NPPF) and the Noise Policy Statement for England (NPSE). Appropriate noise assessment and design targets for internal noise levels have been used to quantify noise impact and determine suitability for residential development with due regard to effects on health and quality of life as set out in the NPSE. On this basis, we consider that the noise assessment methodology and conclusions meet the principles set out in the NPPF and NPSE.

FIGURE 1 – SITE AERIAL VIEW & APPROXIMATE NOISE MONITORING LOCATIONS

FIGURE 2 – RED LINE PLAN

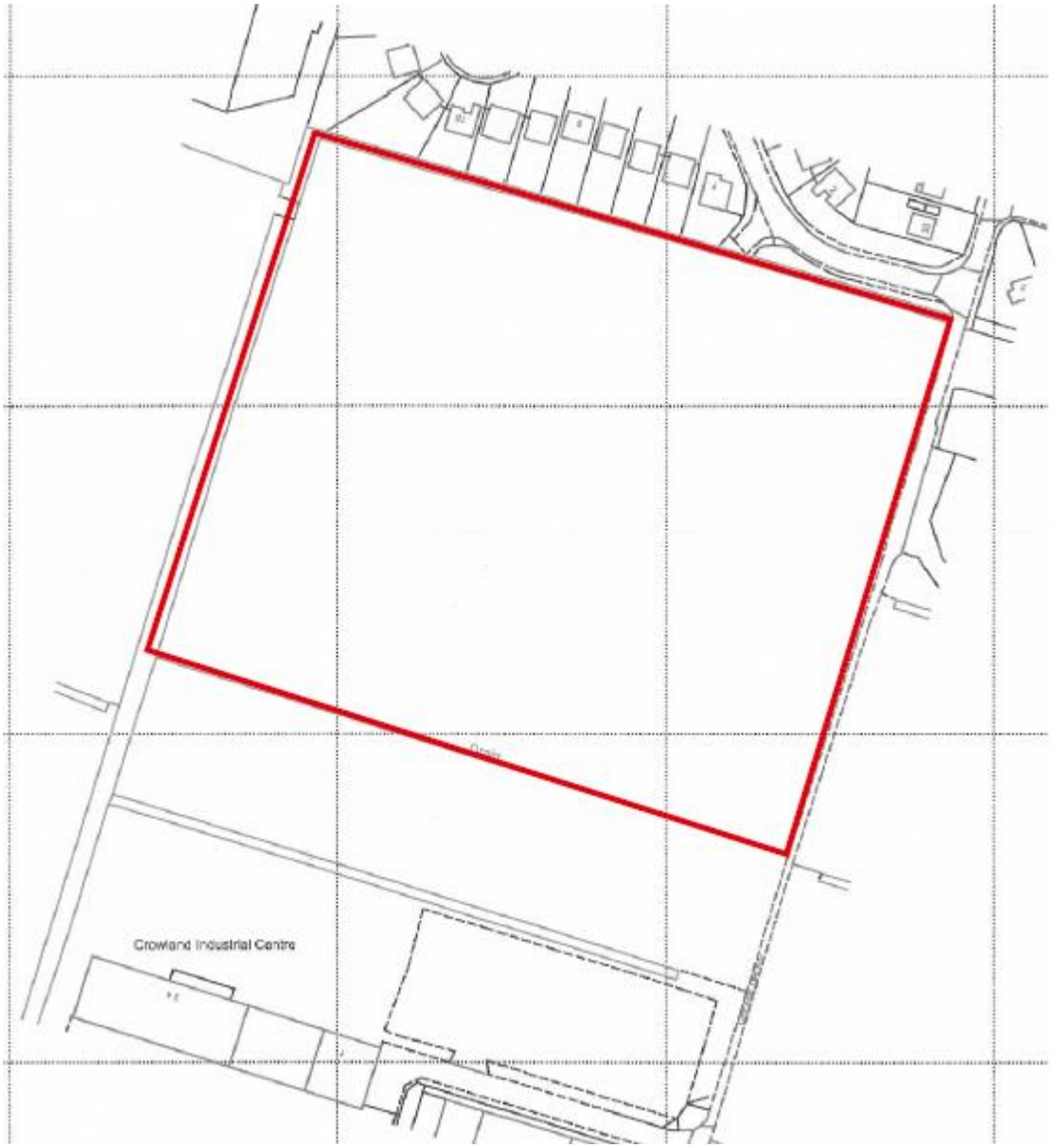

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FIGURE 3 – ILLUSTRATIVE SITE LAYOUT

Key:

Acoustic ventilators to bedrooms

Acoustic barrier fence to gardens

APPENDIX I – NOISE UNITS AND INDICES

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of pressure in air. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. Due to the wide range of pressure variations detectable by the ear, a logarithmic scale is used to convert the values into manageable numbers. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

b) Frequency and Hertz (Hz)

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequencies are often written as kilohertz (kHz), where 1kHz = 1000Hz.

Young people with normal hearing can hear frequencies in the range 20Hz to 20kHz. However, the upper frequency limit gradually reduces as a person gets older.

As the ear hears some frequencies better than others, the A-weighting scale is used to mimic human hearing. A-weighing applies a correction to the sound level at a given frequency depending on how well the ear hears that frequency.

c) Glossary of Terms

In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

L_{Aeq} This is the A-weighted equivalent continuous sound level which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period.

L_{Amax} This is the maximum A-weighted sound level that was recorded during the monitoring period.

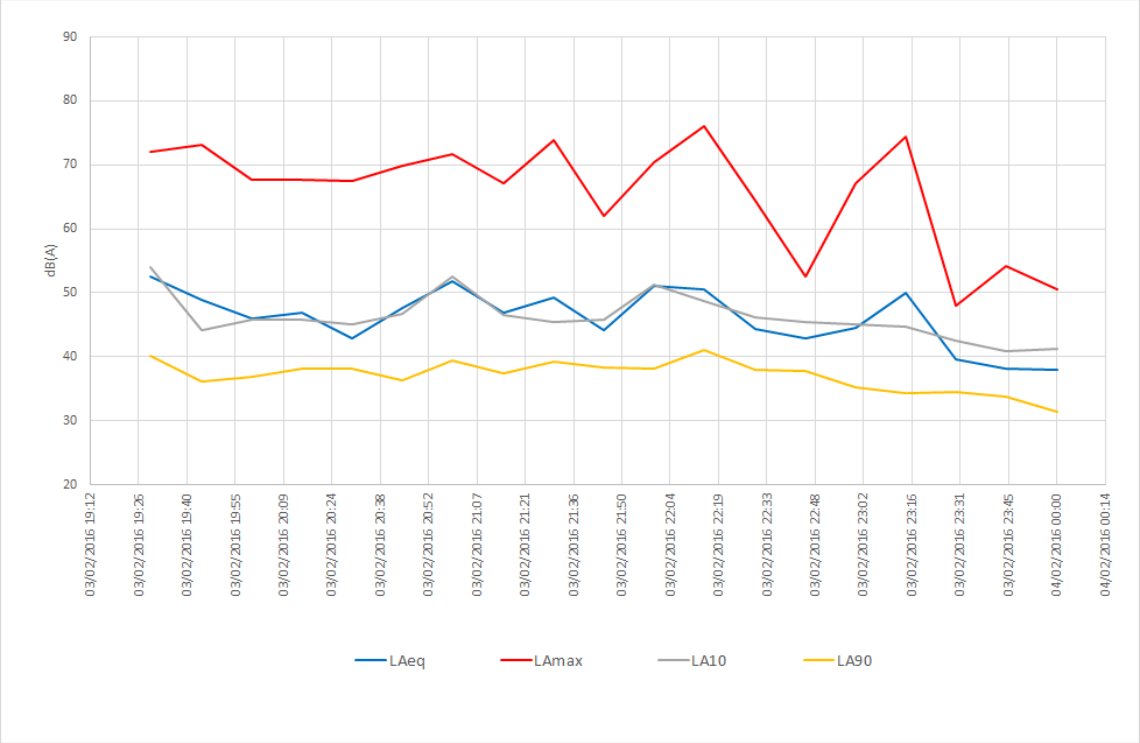
L_{A90} This is the A-weighted sound level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

L_{A10} This is the A-weighted sound level exceeded for 10% of the time period and is often used in the assessment of road traffic noise.

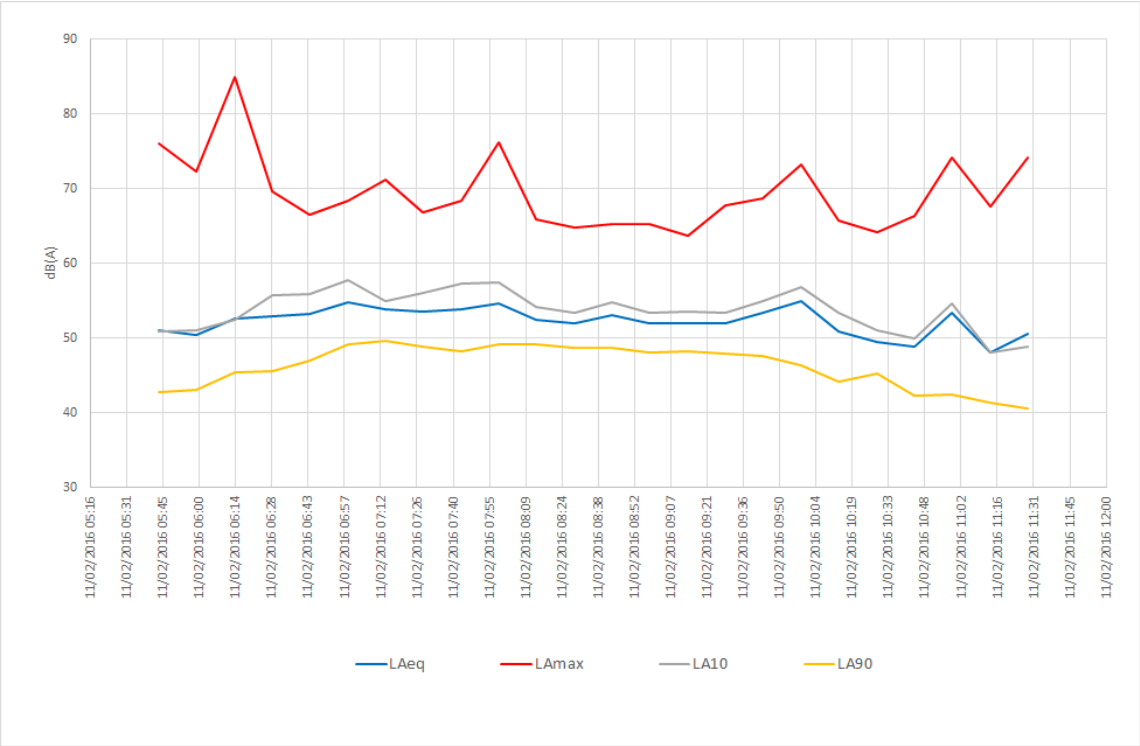
APPENDIX II – NOISE SURVEY DATA

Location 1 – Off Crease Drove

03/02/2016 - Rion NA28 Type 1/Class 1 Integrating Sound Level Meter
Series of 15 minute measurements

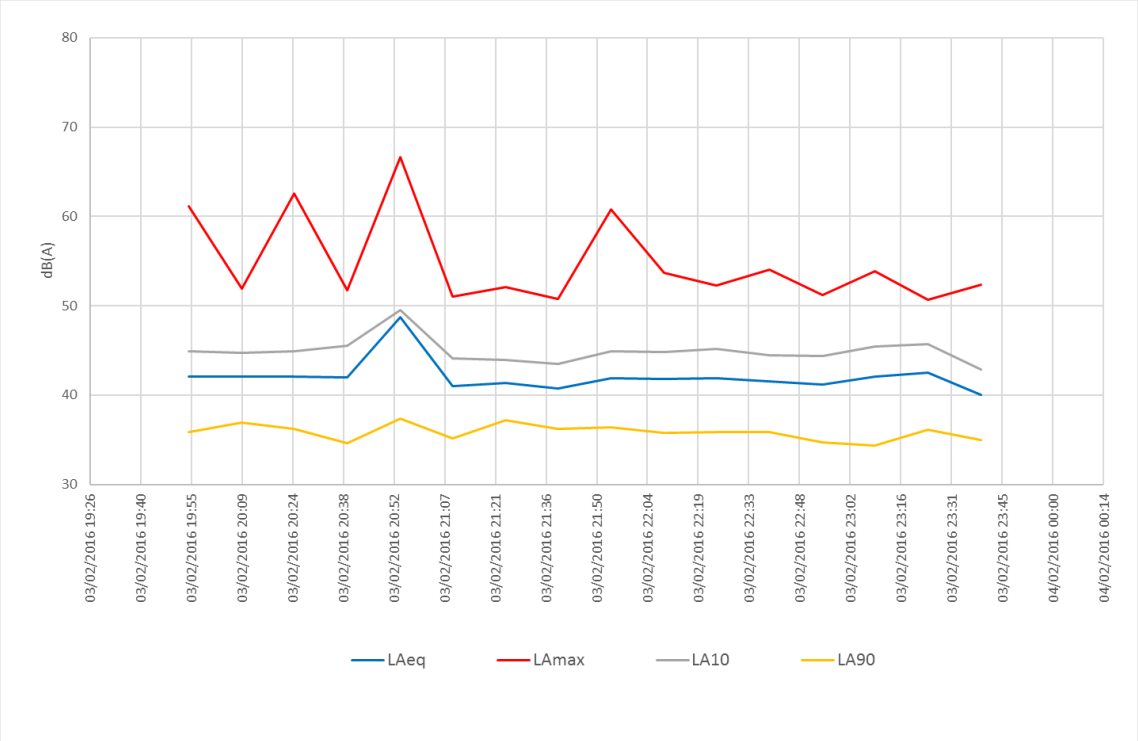


11/02/2016 - Rion NL32 Type 1/Class 1 Integrating Sound Level Meter
Series of 15 minute measurements



Location 2 – Southern Site Boundary

03/02/2016 – Svan SV971 Type1/Class 1 Integrating Sound Level Meter
Series of 15 minute measurements



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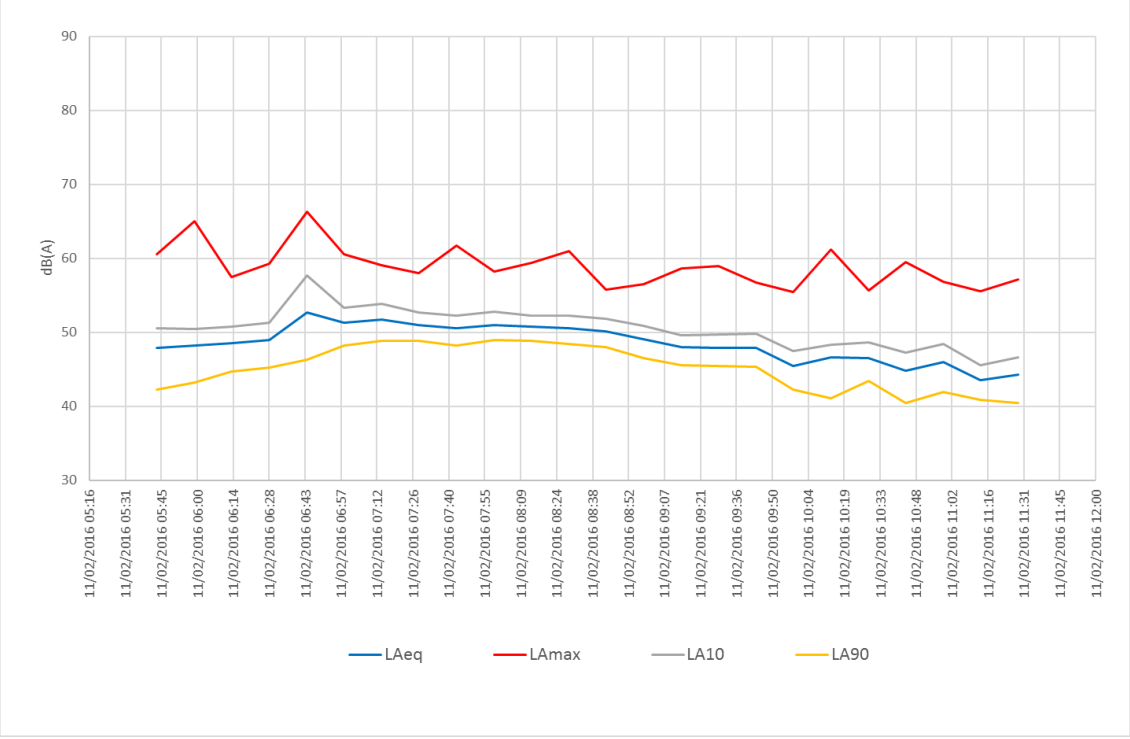
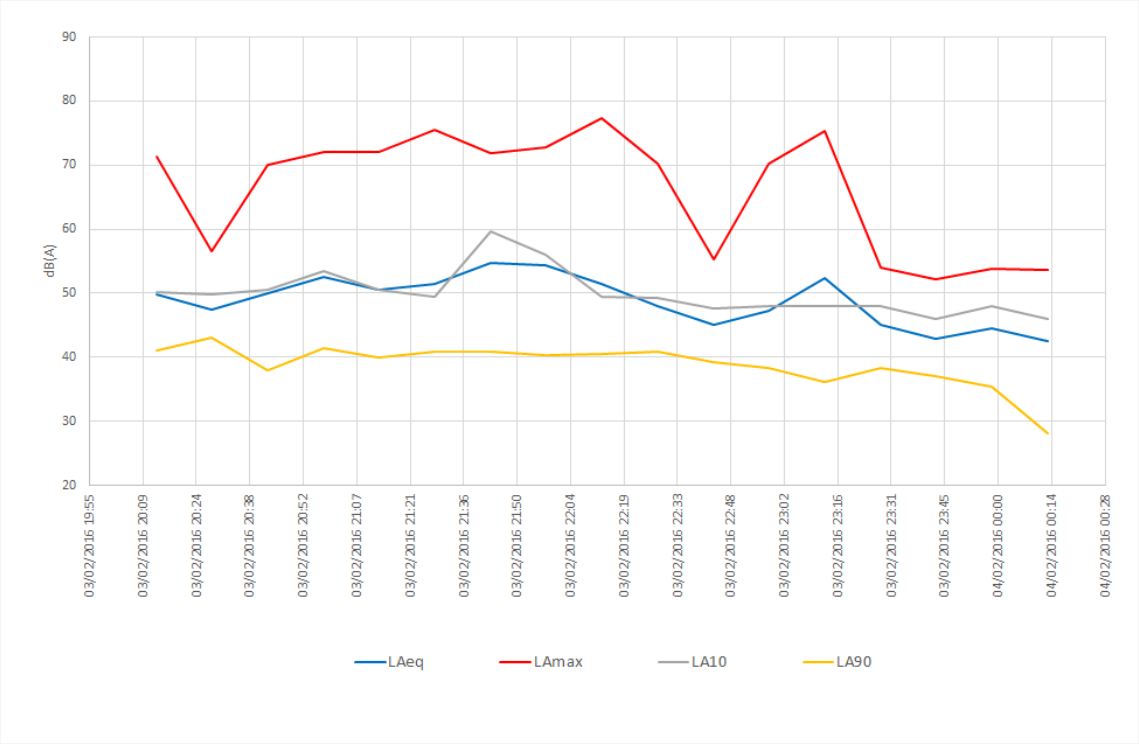
Series of 15 minute measurements

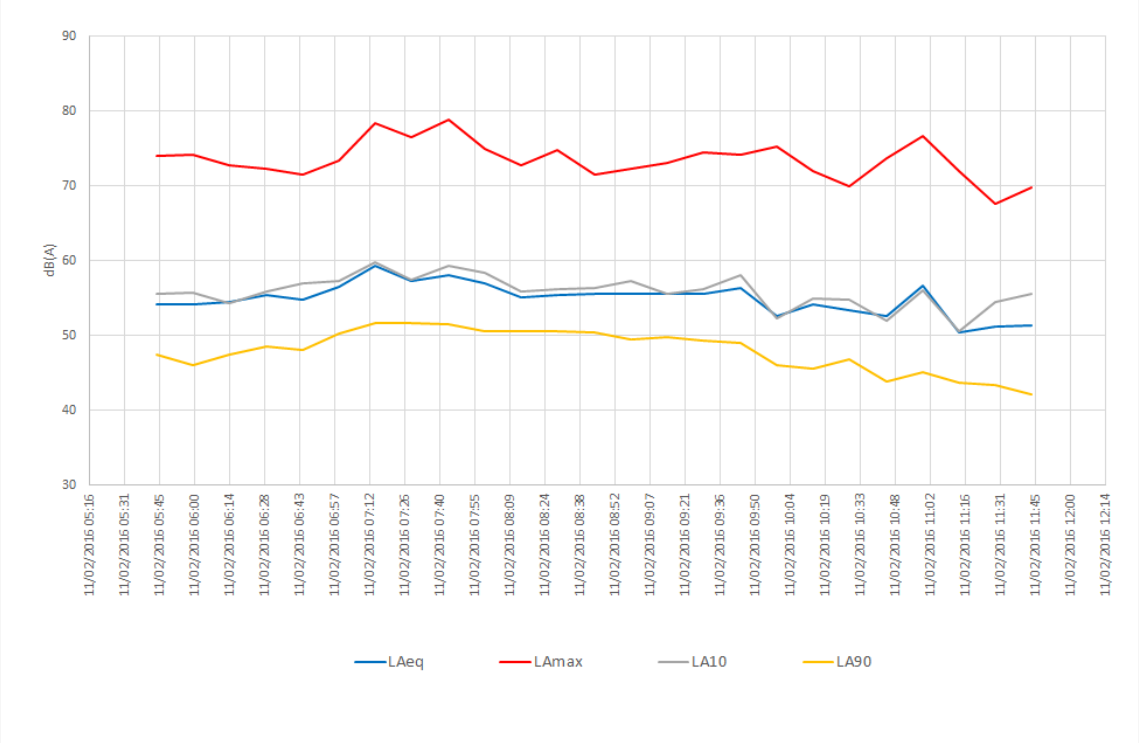


Location 3 – Off Crease Drove, near Crowland Cranes premises

03/02/2016 - Rion NL32 Type 1/Class 1 Integrating Sound Level Meter
Series of 15 minute measurements



11/02/2016 - Rion NA28 Type 1/Class 1 Integrating Sound Level Meter
Series of 15 minute measurements



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