Noise Assessment for Proposed Mixed Use Development

Albert Road, Deal, Kent, CT14 9JQ

For Quinn Estates Ltd






Quality Management

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1 Introduction

1.1 The Acoustics Team at the Brighton office of RPS Planning and Development (RPS) has been appointed by Quinn Estates Ltd (QEL) to provide an environmental noise assessment to accompany a planning application for a mixed use development at Albert Road, Deal, Kent, CT14 9JQ which falls within the administrative area of Dover District Council (DDC). The proposed development includes 142 dwellings and an area of proposed retail development on the eastern boundary with Albert Road.

1.2 The assessment has been undertaken based upon appropriate information on the proposed development provided by SWWR and its project team. RPS is a member of the Association of Noise Consultants (ANC), the representative body for acoustics consultancies, having demonstrated the necessary professional and technical competence. The assessment has been undertaken with integrity, objectivity and honesty in accordance with the Code of Conduct of the Institute of Acoustics (IOA) and ethically, professionally and lawfully in accordance with the Code of Ethics of the ANC.

1.3 The technical content of this assessment has been provided by RPS personnel, all of whom are corporate (MIOA) or non-corporate, associate members (AMIOA) of the IOA (the UK's professional body for those working in acoustics, noise and vibration). Personnel and individual qualifications are provided within the Quality Management table at the start of this report and in Appendix A in accordance with the requirement of Section 12 of British Standard (BS) 4142:2014 'Methods for rating and assessing industrial and commercial sound' [1].This report has been peer reviewed within the RPS team to ensure that it is technically robust and meets the requirements of our Quality Management System.

2 Planning Policy and Guidance, Consultation and Relevant British Standards

National Planning Policy and Guidance on Noise

2.1 Appendix B provides a complete summary of the relevant guidance on national planning policy contained within the Noise Policy Statement for England (NPSE) [2], the National Planning Policy Framework (NPPF) [3] and published Planning Practice Guidance on Noise (PPG-N) [4]. These documents do not contain guidance in terms of numerical noise levels. Guidance is provided descriptively, which may be transposed to numerical noise levels for site-specific situations, using the methods contained within British Standards (BSs). However, there is no specific guidance on this.

2.2 The PPG-N provides further information on the adverse effects of noise and how it can be mitigated. For noise sensitive development, the PPG-N suggests that mitigation measures can include designing the development to reduce the impact of noise from the local environment by optimising the sound insulation provided by the building envelope through noise insulation. For this development, the requirements of national planning policy and guidance would be demonstrated by showing that a residential development could be designed to achieve the noise criteria contained with BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' [5] and that, following the guidance within BS 4142:2014, significant adverse impacts associated with proposed commercial aspect of the development are avoided.

Local Planning Policy and Guidance on Noise

2.3 The Dover District Local Development Framework Core Strategy Document (DDLDFCSD) (adopted February 2010) [6] sets out the overall ambitions and priorities for the District, a set of proposals, and a means for making sure that they are delivered. In terms of noise pollution, the DDLDFCSD refers to the now defunct (since 28th February 2013) South East Plan (SEP) [7]. Policy NRM10 from the SEP relates specifically to noise and development and states the following:

"POLICY NRM10: NOISE

Measures to address and reduce noise pollution will be developed at regional and local level through means such as:

i. locating new residential and other sensitive development away from existing sources of significant noise or away from planned new sources of noise

ii. traffic management and requiring sound attenuation measures in major transport schemes

iii. encouraging high levels of sound-proofing and screening as part of sustainable housing design and construction."

Consultation

2.4 On Monday 15th February 2016, Peter Barling (PB), Acoustics Consultant for RPS, contacted DDC by telephone and email to seek agreement on the proposed assessment methodology and criteria and spoke with Brian Gibson (BG), Senior Environmental Protection Officer with DDC.

2.5 The proposed noise and vibration assessment methodology, based on guidance contained within BS 8233:2014, 6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting' [8] and BS 4142:2014 was agreed via email confirmation. A copy of the email conversation is provided in Appendix B.

British Standards

British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'

2.6 BS 8233:2014 provides guideline values for internal ambient noise levels in spaces when they are unoccupied. A summary of the levels recommended in paragraph 7.7.1 of sub clause 7.7 and Table 4 of BS 8233:2014 for rooms used for resting, dining and sleeping is provided in Table 2.1 below. The guideline values in Table 2.1 are annual average values and do not have to be achieved in all circumstances.

2.7 The guidance in paragraph 7.7.1 of Section 7.7 of BS 8233:2014 applies to external noise as it affects the internal acoustic environment from sources without a specific character. The paragraph states, including the accompanying note:

"… Occupants are usually more tolerant of noise without a specific character than, for example, that from neighbours which can trigger complex emotional reactions. …"

"NOTE Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."

Table 2.1: BS 8233:2014 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00 hours	23:00 to 07:00 hours
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

2.8 Note 7 of the following text states the following:

"NOTE 7 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."

2.9 In relation to external noise levels, the second paragraph of 7.7.3.2 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, it is also recognized 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."

British Standard 6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting'

2.10 The human body is an excellent detector of vibration, which can become perceptible at levels that are substantially lower than those required to cause even cosmetic building damage. The way in which people perceive vibration in buildings depends upon various factors, including the vibration duration, frequency, direction and activity.

2.11 Present knowledge indicates that how people inside a building respond to vibration from sources within and outwith the building, with the exception of blasting, is best evaluated with the Vibration Dose Value (VDV), as promoted through BS 6472-1:2008. VDV defines a relationship that yields a consistent assessment of intermittent, occasional and impulsive vibration, as well as continuous input, and correlates well with subjective response. The VDV is given by the fourth root of the time integral of the fourth power of the acceleration after it has been frequency weighted. BS 6472-1:2008 provides separate weighting curves related to human response for vibration in the vertical and the horizontal directions.

2.12 The VDV is evaluated at the point of entry to the subject. If direct measurement is not possible, for example, on a building that has not yet been built, then BS 6472-1:2008 states that it will be necessary to estimate the vibration environment to be expected within the building. Appendix C of BS 6472-1:2008 contains guidance on the estimation of building vibration response.

2.13 The VDVs associated with various probabilities of adverse comment within residential buildings are provided in Table 2.2. The criteria are presented as ranges due to the widely differing susceptibility to vibration evident among members of the population and also their differing expectations of the vibration environment. BS 6472-1:2008 states that adverse comment is not expected for VDVs below the ranges in Table 2.2.

Table 2.2: VDV Ranges Which Might Result in Various Probabilities of Adverse Comment

Place	Low probability of adverse comment[1] ($m/s^{1.75}$)	Adverse comment possible ($m/s^{1.75}$)	Adverse comment probable[2] ($m/s^{1.75}$)
Residential building (16 hour day)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings (8 hour night)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

1) Below these ranges adverse comment is not expected.
2) Above these ranges adverse comment is very likely.

British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound'

2.14 The foreword to BS 4142:2014 provides the following introduction for the assessment of human response to sound:

"Response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood."

2.15 BS 4142:2014 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the proposed development) at residential noise sensitive receptors (NSRs). The specific sound level (L_s) may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level' ($L_{Ar,Tr}$), whether or not a character correction is applied. The 'residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

2.16 The specific sound levels should be determined separately in terms of the $L_{Aeq,T}$ index over a period of T=1-hour during the daytime and T=15-minutes during the night-time. For the purposes of the Standard, daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours.

2.17 BS 4142:2014 states that measurement and assessment locations should be outdoors, where the microphone is at least 3.5 m from any reflecting surfaces other than the ground and, unless there is a specific reason to use an alternative height, at a height of between 1.2 m and 1.5 m above ground level. However, where it is necessary to make measurements above ground floor level, the measurement position, height and distance from reflecting surfaces should be reported, and ideally measurements should be made at a position 1 m from the façade of the relevant floor if it is not practical to make the measurements at least 3.5 m from the facade.

2.18 With regards to the rating correction, paragraph 9.2 of BS 4142:2014 states:

"Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention."

2.19 An initial estimate of the impact of the specific sound source is obtained by subtracting the measured background sound level ($L_{A90,T}$) from the L_s of the specific sound source. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.20 The significance of the effect of the noise in question should be determined on the basis of the initial estimate of impact significance from the BS 4142:2014 assessment and after having considered the context of the sound. It is necessary to consider all pertinent factors, including:

- the absolute level of the sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
    - facade insulation treatment;
    - ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
    - acoustic screening.

3 Baseline Conditions and Survey

Baseline Conditions

3.1 The proposed development site is located approximately 500 m north-west of Deal town centre and is predominately comprised of undeveloped, agricultural land. A plan of the proposed site is provided in Figure 1.

3.2 The area is suburban in nature with no large industrial sources of sound in the vicinity. It is considered that train movements on the railway located to the north-east of the site and road traffic movements on Albert Road will be the dominant sources of sound affecting the site. There are some commercial premises, such as a builder's merchant, located to the north of the site.

Long Term Surveys

Sound Level Survey

3.3 A long term baseline sound level survey was deployed on site to run from Tuesday 16th February 2016 to Monday 22nd February 2016 and was carried out to determine the existing levels of environmental noise affecting the proposed development. A plan showing the approximate location of the measurement position and site boundary is provided in Figure 1.

3.4 The long term sound level survey (SML1) was located towards the north-eastern part of the site, approximately 150 m from the north-east boundary and the railway line. This was in a location where the proposed dwellings will be closest to the railway line and Albert Road and where on-site environmental sound levels would be expected to be highest. This ensures that the collected survey data will allow for a robust assessment. During the time spent on site setting up the long term survey, the following sound sources were noted affecting the site: train movements on the railway; road traffic; aircraft passing overhead; people talking; and bird song.

3.5 Sound level measurements were made using a 'Class 1' Rion NL-52 sound level meter (SLM) in accordance with BS 4142:2014. The SLM was calibrated before and checked at the end of the survey with a Rion NC-74 calibrator with no significant drift occurring. Long term survey data were logged of the fast A-weighted sound pressure level in 100 ms periods ($L_{pA,100ms}$).

3.6 Data for weather conditions over the survey period were obtained from a nearby amateur weather station[1]. During the survey period, measured wind speeds ranged between 0 and 5 m/s and there were some periods of rainfall; however these do not appear to have affected the measured sound levels and, consequently, no data have been removed as a result.

3.7 A summary of the measured data are provided in Table 3.1 below, numbers are presented to zero decimal places reflecting best practice. Further details are provided in Appendix D.

[1] http://wow.metoffice.gov.uk/graphdata?requestedAction=REQUEST&siteID=913916001

Table 3.1: Summary of Long Term Baseline Sound Level Data

Location	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Energetical Average $L_{Aeq,16h}$ (dB)	Representative $L_{A90,1h}$ (dB)	Energetical Average $L_{Aeq,8h}$ (dB)	Representative $L_{A90,15min}$ (dB)
SML1	53	44	47	35

3.8 Daytime and night-time representative background sound levels have been determined through a modal analysis of the baseline survey data. The $L_{pA,100ms}$ raw survey data has been processed to provide both the $L_{A90,1h}$ and the $L_{A90,15m}$ background sound level data. From these data, the percentage distribution of the daytime $L_{A90,1h}$ and the night-time $L_{A90,15m}$ have been plotted on histograms, which are provided as Figure 2 and Figure 3.

3.9 With reference to Figure 2, analysis of the daytime 1-hour background sound level data at SML1, shows a prominent peak at 44 dB $L_{A90,1h}$, representing data from all seven days surveyed and over 20% of the total $L_{A90,1h}$ survey data (62% of the daytime survey data is at 44 dB $L_{A90,1hr}$ or higher). On this basis, 44 dB $L_{A90,1hr}$ is considered to be representative of the daytime background sound level at SML1.

3.10 With reference to Figure 3, analysis of the night-time 15-minute background sound level data at SML1 shows a slight peak at 35 dB $L_{A90,15m}$, representing data from all six of the nights surveyed and 11% of the total $L_{A90,15min}$ survey data (53% of the night-time survey data is at 35 dB $L_{A90,15min}$ or higher). There is also a relatively high occurrence of 33 and 34 dB $L_{A90,15m}$; however both these account for less of the overall data and from only five of the nights surveyed; therefore, on this basis, a value of 35 dB $L_{A90,15m}$ is considered to be more representative of the night-time background sound level at SML1.

Vibration Level Survey

3.11 A long term baseline vibration level survey was deployed and set up on Tuesday 16th February 2016 and ran until the morning of Friday 19th February 2016. A plan showing the approximate location of the measurement position is provided in Figure 1.

3.12 The long term vibration level survey (VML1) was located towards the north-eastern part of the site, approximately 30 m from the north-east boundary and the railway line. This was in a location where the proposed dwellings will be closest to the railway line and where on-site vibration levels would be expected to be highest. This ensures that the collected survey data will allow for a robust assessment.

3.13 Vibration level measurements were made using a Svantek 958 vibration level meter (VLM) with a Dytran 3233AT tri-axial accelerometer. Survey data were logged of the 5-minute $VDV_{b/d,5min}$ for each of the three axis.

3.14 A summary of the measured data, with numbers presented to one decimal place, is provided in Table 3.2 below. Further details are provided in Appendix D.

Table 3.2: Summary of Long Term Baseline Vibration Level Data

Period	Start	Duration (hrs)	$VDV_{b/d,day,night}$ ($m/s^{1.75}$)		
			x-axis (horizontal)	y-axis (horizontal)	z-axis (vertical)
Daytime (07:00 - 23:00)	17/02/2016	16	0.1	0.1	0.0
	18/02/2016	16	0.1	0.1	0.0
Night-time (23:00 - 07:00)	16/02/2016	8	0.0	0.0	0.0[3]
	17/02/2016	8	0.1[1]	0.1[2]	0.0[4]
	18/02/2016	8	0.0	0.0	0.0[5]

Notes:
1. 0.06 to two decimal places.
2. 0.06 to two decimal places.
3. 0.02 to two decimal places.
4. 0.03 to two decimal places.
5. 0.01 to two decimal places.

4 Assessment

Residential Suitability Assessment

Internal Sound Level Assessment

4.1 With reference to paragraph G.1 of BS 8233:2014, an estimate of the internal sound levels within typical dwellings may be determined on the basis of the sound reduction provided by the windows. On the basis of the results of research contained within Report NANR 116 [9], a window that is partially open to provide background ventilation provides approximately 15 dB $D_{A,road}$ of attenuation to road traffic noise.

4.2 With reference to Table 3.1, external sound levels are such that partially open windows will not provide sufficient attenuation and therefore another method of ventilation will be required. Notwithstanding this, there is no reason why windows should not be openable, at the residents' discretion, in order to provide rapid natural ventilation as long as the openable windows, when closed, provide the required attenuation. It should also be noted that these requirements are for habitable rooms only i.e. kitchens (unless part of a lounge/diner/living room), bathrooms, hallways, landings, utility rooms etc. have no specific requirements with respect to internal noise levels.

4.3 The specific façade design requirement (wall, glazing and ventilation system) will depend on the specific layout and orientation of the buildings; room size; and wall and roof design etc. Consequently, facade specifications cannot be provided because such details have not been finalised. However, an estimation of the sound level difference across a 'standard' façade design[2], which includes trickle ventilators, for a typical dwelling room type and size is around 25 dB $D_{2m,n}$. On this basis, appropriate acoustic environments within living rooms and bedrooms will be achieved with a standard façade specification in areas of the site where the external environmental sound level is no greater than 60 dB $L_{Aeq,16h}$ and 55 dB $L_{Aeq,16h}$ during the daytime and night-time respectively.

4.4 As detailed in Table 3.1, external environmental sound levels on site are 53 dB $L_{Aeq,16h}$ and 47 dB $L_{Aeq,8h}$ during the daytime and night-time respectively. Therefore, from an acoustic perspective, dwellings provided with a standard façade will ensure that internal sound levels meet the criteria within BS 8233:2014. Table 4.1 below provides a summary of the measured external level and the resultant internal sound levels.

[2] 'Brick and block' external wall; '6-12-6 insulated glass units'; and 0.04 m^2 trickle ventilator.

Table 4.1: External Sound Levels and Resultant Internal Sound Levels

Period	External Sound Level (dB $L_{Aeq,T}$)	Sound Level Difference Across Façade (dB $D_{2m,n}$)	Resultant Internal Sound Level (dB $L_{Aeq,T}$)
07:00 - 23:00	53	25[1]	28
23:00 - 07:00	47	25[1]	22
Notes: 1 Based on a standard façade design for a typical residential room size.			

External Sound Level Assessment

4.5 With reference the design criteria for gardens and external amenity areas contained within BS 8233:2014, which are reproduced in paragraph 2.9 of this report, desirable external noise levels in gardens (i.e. up to 50 dB $L_{Aeq,T}$) will be achieved throughout the entirety of the site.

4.6 Measured sound levels within the areas allocated for dwellings closest to the railway line towards the east of the site do exceed 50 dB $L_{Aeq,16h}$ by +3 dB; however this was measured in a free field location with no screening between the survey location and the railway. In reality, gardens will be provided with local fencing which will offer some acoustic screening such that the sound level within the gardens would be lower, and would likely below 50 dB $L_{Aeq,16h.}$

4.7 On this basis, noise levels within external amenity areas, should be acceptable throughout the proposed development, in accordance with the guidance contained within BS 8233:2014.

Vibration Dose Value Assessment

4.8 The vibration criteria contained within BS 6472-1:2008 are set in terms of the VDVs 'at the point of entry to the subject', i.e. evaluated on the floors of the building. Attenuation occurs due to mass-loading provided by buildings and amplification occurs due to floor resonance. These effects are highly variable and depend upon site, source and project specific vibration characteristics, ground conditions, foundation types, building and floor constructions. Table 4.2 below provides a summary of the likely effects of mass-loading and floor resonance, and the resultant maximum external vibration level such that the vibration level at the point of entry does not result in a 'Low probability of adverse comment' with respect to BS 6472-1:2008. Further details are provided Appendix C.

Table 4.2: Vibration Assessment Criteria

		Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Internal Vibration Assessment Criteria[1]	$VDV_{d/b,day/night}$ ($m/s^{1.75}$)	0.2	0.1
Transfer Functions	Mass Loading	0.6	0.6
	Floor Resonance	4.0	4.0
External Horizontal Vibration Assessment Criteria[2]	$VDV_{d,day/night}$ ($m/s^{1.75}$)	0.3	0.2
External Vertical Vibration Assessment Criteria[3]	$VDV_{b,day/night}$ ($m/s^{1.75}$)	0.1	0.0[4]

Notes:
1. This is the level above which there would be a 'Low probability of adverse comment' and below which 'adverse comment is not expected' with respect to BS 6472-1:2008.
2. This is the corresponding maximum external horizontal (x and y-axis) vibration level above which there would be a 'Low probability of adverse comment' and below which 'adverse comment is not expected'.
3. This is the corresponding maximum external vertical (z-axis) vibration level above which there would be a 'Low probability of adverse comment' and below which 'adverse comment is not expected'.
4. 0.04 to two decimal places.

4.9 With reference to Table 4.2 above and Table 3.2 external daytime VDVs at VML1 do not exceed 0.3 $ms^{-1.75}$ $VDV_{d,day}$ or 0.1 $ms^{-1.75}$ $ms^{-1.75}$ $VDV_{b,day}$ in either the horizontal and vertical directions respectively and are therefore of a level where adverse comment would not be expected.

4.10 With reference to Table 4.2 above and Table 3.2 external night-time VDVs at VML1 do not exceed 0.1 $ms^{-1.75}$ $VDV_{d,night}$ or 0.04 $ms^{-1.75}$ $ms^{-1.75}$ $VDV_{b,night}$ in either the horizontal and vertical directions respectively and are therefore of a level where adverse comment would not be expected.

4.11 On this basis, vibration levels within proposed dwellings should be acceptable throughout the proposed development in accordance with the guidance contained within BS 6472-1:2008.

Commercial Noise Assessment

4.12 Part of the proposed development includes a new 370 m^2 retail unit towards the eastern boundary of the site.

4.13 With reference to the consultation process undertaken with DDC, detailed in paragraphs, BG SEP at DDC has provided the following statement with regards to assessing the noise impact associated with the retail unit.

"Services for the proposed supermarket should be subject to a BS 4142 assessment and mitigation put in place if required.

A scheme should be provided showing that, when operating, the design and installation of new items of fixed plant shall be such that the cumulative noise level $L_{Aeq,Tr}$ arising from the proposed plant, measured or predicted at 1 metre from the facade of the nearest noise sensitive premises, shall be a rating level 5 dB(A) below the background noise level $L_{Af90,Tbg}$.

Times of deliveries to the supermarket may need to be limited, depending on design and siting of the delivery yard."

It has been assumed that the '*cumulative noise level $L_{Aeq,Tr}$ arising from the proposed plant'* is referring to the overall rating level ($L_{Ar,Tr}$).

4.14 A this stage, an operator for the retail unit has not been confirmed and details regarding the hours of operation, timing and number of deliveries, and any items of mechanical plant that may be installed, are unknown. Therefore whilst a numeric BS 4142:2014 assessment cannot be carried out at this stage, by ensuring an appropriate design, timing of and location of the unloading of deliveries, and through selection of mechanical plant, it will be possible to ensure that the

cumulative sound level, 1 m from the facades of NSRs, does not exceed a level 5 dB below the background sound level. Appropriate design measures that may need to be employed would include the following:

- limiting deliveries to less noise sensitive periods, i.e. during daytime hours when background levels are higher;
- locating the unloading of deliveries in area where screening between the unloading and NSRs is maximised;
- selecting quieter items of mechanical plant; and
- locating items of mechanical plant away from NSRs, and if necessary within enclosures.

4.15 As details regarding the retail unit are unknown at this stage, particularly hours of opening/operation and timing of deliveries, it is not possible to confirm appropriate background sound levels for the period of operation over a day. However, at this stage it has been assumed that the retail unit will operate throughout the daytime period (07:00 to 23:00 hours). As detailed in Table 3.1, the representative daytime background sound level is 44 dB $L_{A90,1h}$ and, therefore, at 1 m from facades of proposed or existing NSRs, the rating level, during the daytime, due to activities associated with the retail unit should not exceed 39 dB $L_{Ar,Tr}$. Night-time (23:00 to 07:00 hours) operations and activities are likely to be very dependent on the exact operator of the site, and the times the site is operational are very uncertain at this stage, so it is not possible at this stage to determine a similar criteria for the night-time.

5 Summary and Conclusions

5.1 The Acoustics Team at the Brighton office of RPS Planning and Development (RPS) has been appointed by Quinn Estates Ltd (QEL) to provide an environmental noise assessment to accompany a planning application for a mixed use development at Albert Road, Deal, Kent, CT14 9JQ which falls within the administrative area of Dover District Council (DDC). The proposed development includes 142 dwellings and an area of proposed retail development on the eastern boundary with Albert Road.

5.2 Glazing and ventilation requirements for the proposed development have been determined that will achieve the recommended internal noise levels within living rooms and bedrooms contained within British Standard (BS) 8233:2014 'Guidance on sound insulation and noise reduction for buildings'. Appropriate internal noise levels throughout the entire development will be achieved with a standard façade specification. Noise levels within gardens and external amenity areas will also be acceptable throughout the proposed development in accordance with the guidance contained within BS 8233:2014.

5.3 Vibration levels on site are such that, at the point of entry within proposed dwellings, the Vibration Dose Values (VDVs) are of a level where adverse comment is not expected, following the guidance contained within BS 6472-1:2008 ‘Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting’

5.4 A this stage, an operator for the retail unit has not been confirmed and details regarding the hours of operation, timing and number of deliveries, and any items of mechanical plant that may be installed, are unknown. Therefore, whilst a BS 4142:2014 ‘Methods for rating and assessing industrial and commercial sound’ assessment cannot be carried out, through appropriate design it will be possible to ensure that the cumulative sound level from activities associated with the retail unit, 1 m from the facades of existing or proposed noise sensitive receptors (NSRs), does not exceed a level 5 dB below the background sound level.

5.5 The proposed development has been demonstrated to be in compliance with the requirements of national and local planning policy and guidance (contained within the Noise Policy Statement for England, National Planning Policy Framework and Planning Practice Guidance on noise and the Dover District Local Development Framework Core Strategy Document). The proposed residential development can be designed to achieve the noise and vibration criteria contained within BS 8233:2014 and BS 6472-1:2008 respectively, and the retail unit would not result in adverse impacts at NSRs. On this basis, there are no reasons, with regards to noise or vibration, why planning permission should not be granted for the proposed development.

References

1 British Standards Institution. British Standard 4142:2014. Methods for rating and assessing industrial and commercial sound.

2 Department for Environment, Food and Rural Affairs. Noise Policy Statement for England. Defra. 2010.

3 Department for Communities and Local Government. National Planning Policy Framework: HMSO. March 2012.

4 Department for Communities and Local Government. National Planning Practice Guidance.

5 British Standards Institution. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings. 2014.

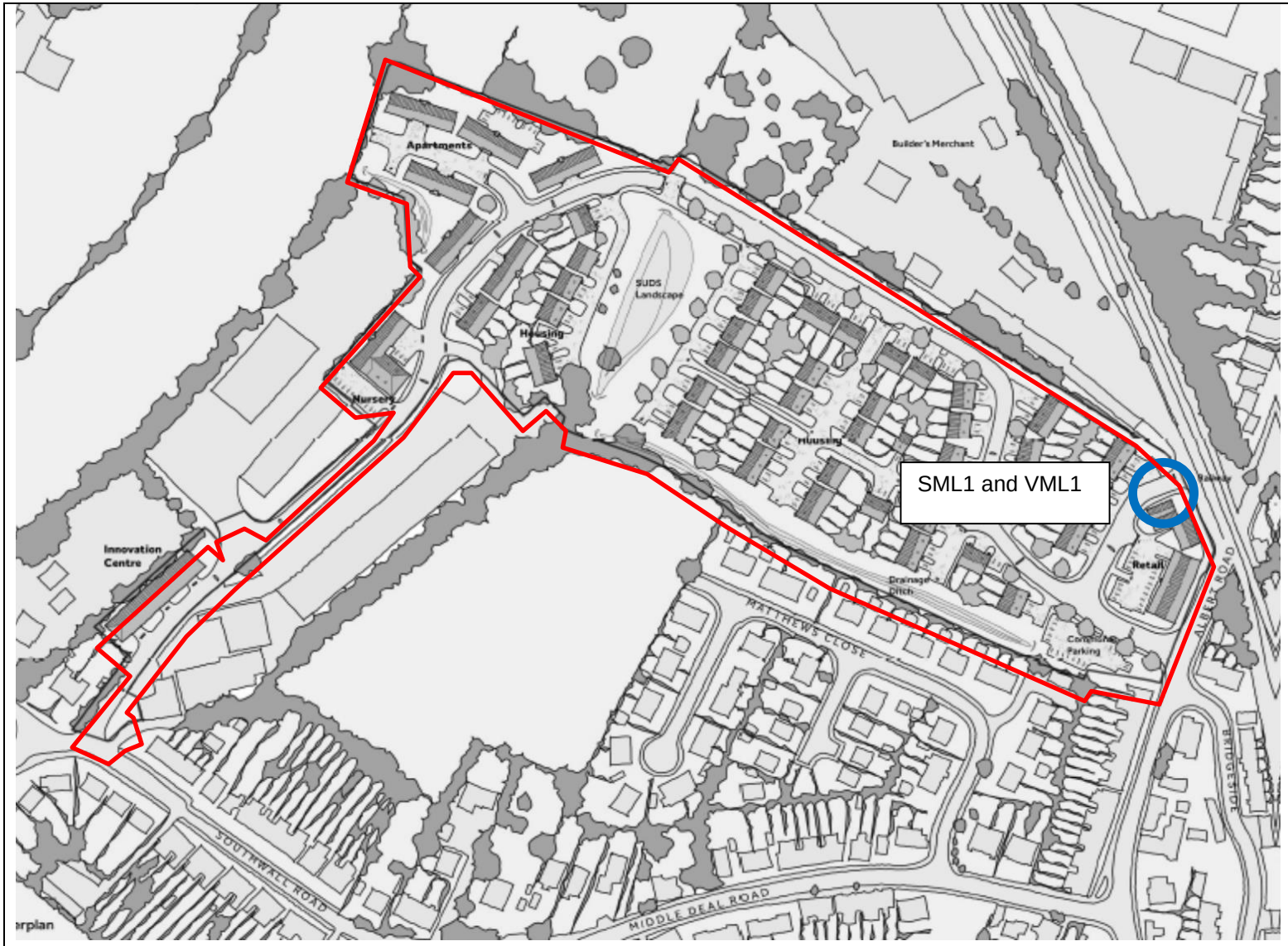
6 Dover District Council. Dover District Local Development Framework Core Strategy Document. February 2010.

7 Government Office for the South East. The South East Plan. Regional Spatial Strategy for the South East of England. May 2009.

8 British Standards Institution. British Standard 6472-1:2008. Guide to evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting.

9 Defra Report NANR116. Open/Closed Window Research – Sound Insulation through Ventilated Domestic open Windows. The Building Performance Centre, School of the Built Environment, Napier University. 2007.

Figures



Monitoring Location

Site Boundary

Notes
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Client: Quinn Estates Ltd	
Project: Albert Road, Deal, Kent, CT14 9JQ	
Job Ref: JAE 8278	
File location:	
Date: 03/16	**Rev: 0**
Drawn: PB	**Checked:**

Figure 1: Site and Baseline Survey Locations

NOT TO SCALE

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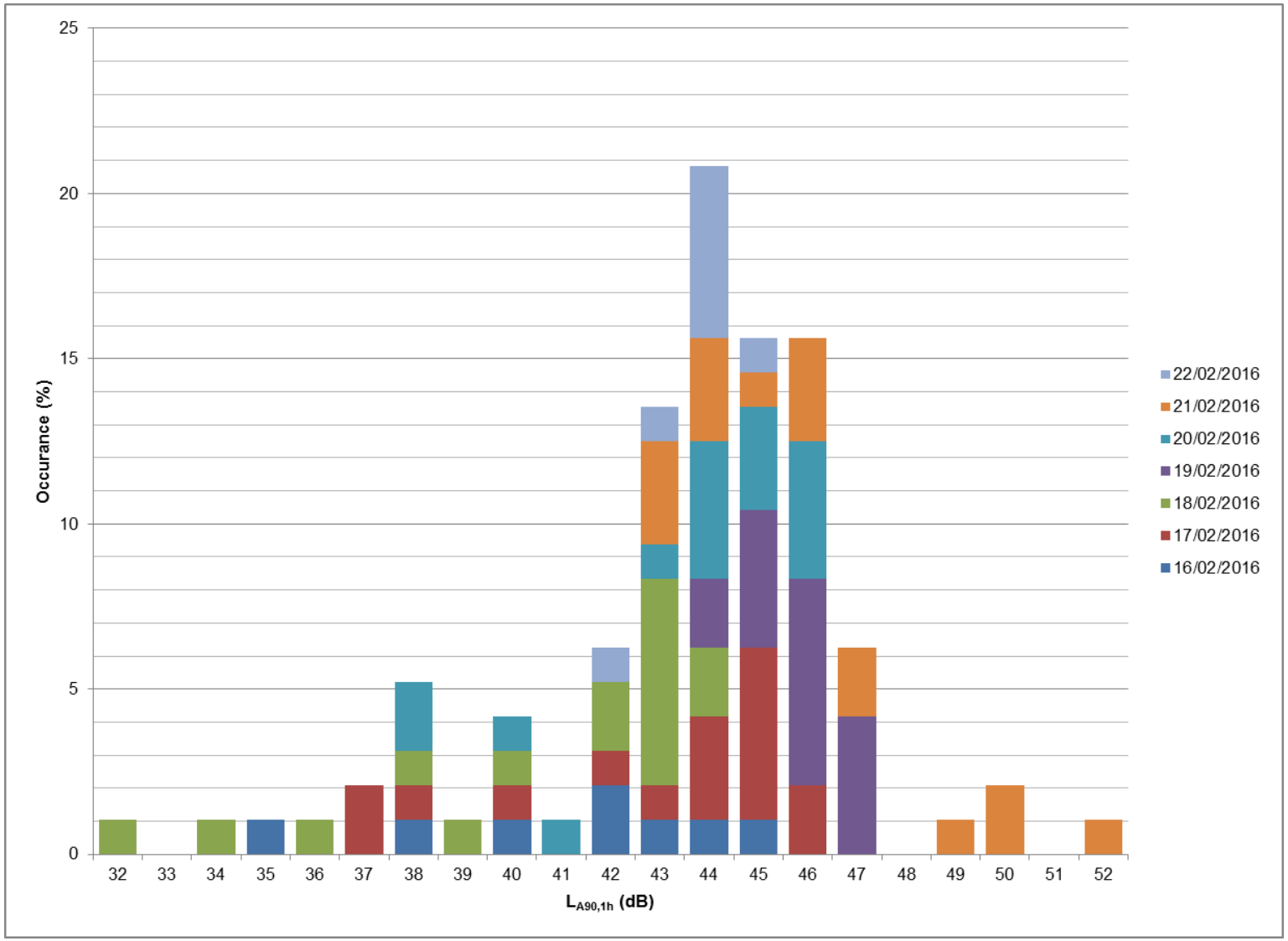

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Project: Albert Road, Deal, Kent, CT14 9JQ

Job Ref: JAE 8278

File location:

Date: 03/16	**Rev: 0**
Drawn: PB	**Checked:**

Figure 2: Daytime $L_{A90,1h}$ Histogram

NOT TO SCALE

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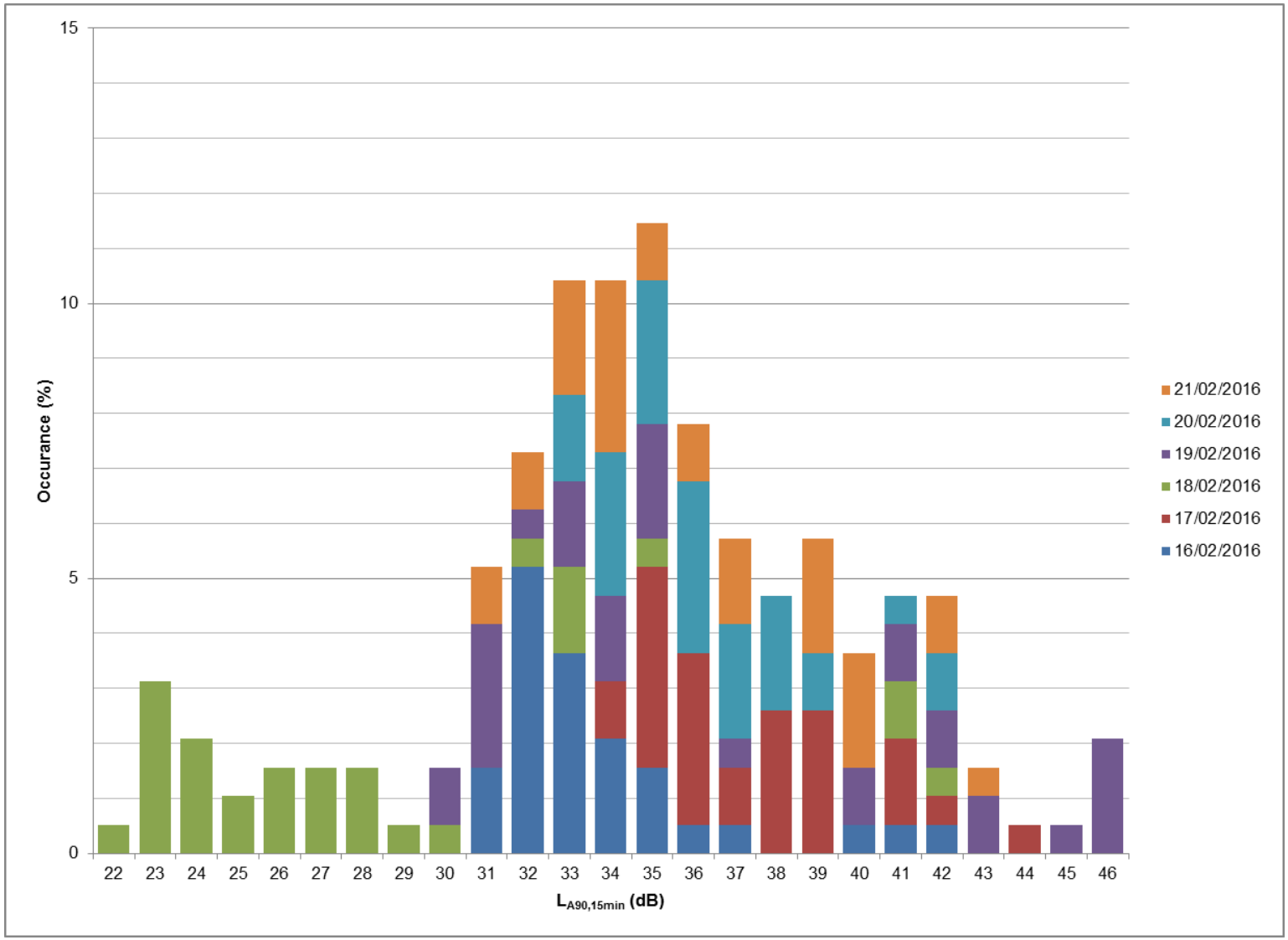

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Job Ref: JAE 8278

File location:

Date: 03/16	**Rev: 0**
Drawn: PB	**Checked:**

Figure 3: Night-time $L_{A90,15m}$ Histogram

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Appendices

Appendix A: Personnel and Individual Qualifications

Phil Evans – Senior Director Acoustics

BSc (Hons) Geology; MSc Acoustics, Vibration and Noise Control; Fellow of the Geological Society; Member of the Institute of Acoustics; Associate Member Acoustical Society of America

A.1 Phil is a Senior Director and leads the RPS Acoustics Team in Brighton. He is a specialist in environmental acoustics and is active on a number of committees including the Association of Noise Consultants' Vibration Working Group; British Standards Institution (BSi) Committee GME/21/6/4 - BS 6472: Guide to Evaluation of Human Exposure to Vibration in Buildings; BSi Committee B/564/01 on BS 5228: Noise and Vibration Control on Construction and Open Sites which has now also revised and issued BS 8233:2014 Guidance on sound insulation and noise reduction in buildings. He has been a corporate Member of the Institute of Acoustics (MIOA) for over 20 years.

A.2 Phil has over 25 years' experience in the project management of, and technical input to, environmental noise and vibration impact assessments for major developments. He is an expert in the industrial/commercial, transportation and construction sectors including the measurement, calculation, evaluation and mitigation of environmental noise and vibration. Phil has significant experience in the preparation and presentation of technical evidence and reports for public inquiries and planning applications. He is experienced in consultation and liaison with government departments, local authorities and other statutory bodies. He is an experienced expert witness. He has a Continuous Professional Development Record to support this competency and experience.

A.3 Phil has been involved in many BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. He has given evidence at public inquiries where BS 4142 has been the primary assessment methodology. He is very familiar with the Standard and attended the joint ANC/BSi launch of the 2014 version of the Standard. On the basis of Phil's overall experience in acoustics combined with particular focus on BS 4142, he is deemed competent for BS 4142 assessments.

A.4 For this project Phil has taken on the role of Project Director responsible for overseeing and delivering the project. Phil was also responsible for reviewing and authorising the report, figures and appendices.

Susan Hirst – Senior Acoustic Consultant

BSc (Hons) Acoustics; Member of the Institute of Acoustics

A.5 Susan is a Senior Acoustic Consultant and environmental acoustics specialist with over seven years' experience. She has been a member of the Institute of Acoustics since 2007 and a corporate Member of the Institute of Acoustics (MIOA) since 2012.

A.6 Susan has managed projects and undertaken assessments for a variety of developments, including: large scale mixed-use developments, incorporating commercial, retail, leisure and residential elements; on-shore and off-shore windfarms and their associated infrastructure; energy from waste facilities; manufacturing facilities; power stations; warehouses; minerals extraction and processing; and road schemes.

A.7 She has provided input into Environmental Impact Assessments (EIAs) and undertaken noise assessments to support planning applications, discharge planning conditions and planning appeals; provided technical advice on mitigation options and attended planning hearings. She has a Continuous Professional Development Record to support this competency and experience.

A.8 Susan has carried out many BS 4142 noise assessments using both the previous and current 2014 version of the standard. On the basis of Susan's overall experience in acoustics combined with particular focus on BS 4142, she is deemed competent to undertake BS 4142 assessments.

A.9 For this project Susan was responsible for reviewing the assessment, report, figures and appendices.

Peter Barling – Acoustics Consultant

BSc (Hons) Physics; PGDip Environmental Assessment and Management; Associate Member of the Institute of Acoustics

A.10 Peter is an Assistant Acoustic Consultant and environmental acoustics specialist with 3 years' experience. He has a Degree in Physics and also has a Post Graduate Diploma in Environmental Assessment and Management. He has been a member of the Institute of Acoustics since 2013.

A.11 Peter has project managed and undertaken noise assessments for a variety of developments, including: large scale mixed-use developments, incorporating commercial, retail, leisure and residential elements; on-shore substations for off-shore windfarms; energy from waste facilities; manufacturing facilities; distribution centres; retail units; minerals extraction and exploration; solar farms; and petrol service filling stations. He has provided input into Environmental Impact Assessments (EIAs) and undertaken noise assessments to support planning applications and discharge planning conditions. He has a Continuous Professional Development (CPD) Record to support this competency and experience.

A.12 Within the past three years Peter has been involved BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. He is familiar with the Standard and has attended and participated in RPS CPD training seminars regarding the revised 2014 version of the Standard. On the basis of Peter's overall experience in acoustics, combined with particular focus on BS 4142 and with the assistance of more experienced colleagues, he is deemed competent for BS 4142 assessments.

A.13 For this project Peter has taken on the role of: Project Manager and has been responsible for overseeing the project. Peter was also the consultant responsible for undertaking of the assessment and preparation of the report, figures and appendices.

Appendix B: National Planning Policy and Guidance & Consultation

National Planning Policy Framework

B.1 The National Planning Policy Framework (NPPF) [1], published in March 2012, sets out the Governments planning policies for England. The document does not contain any specific noise policy, or noise limits but it provides a framework for local people and local authorities to produce their own local and neighbourhood plans, which reflect the needs and priorities of their communities.

B.2 In Section 11, 'Conserving and enhancing the natural environment', paragraph 123 relates to noise and states:

'123. 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.'

B.3 The first bullet point refers to 'significant adverse impacts' which relates to the 'significant observed adverse effect level' (SOAEL) in the Noise Policy Statement for England (NPSE) [2], though the term 'effect' is used instead of the term 'impact' although these have been deemed to be interchangeable in this context. Therefore, given the comments above on the NPSE with regard to assessment methods and criteria, the current content of the NPPF does not require any change in previously adopted approaches.

Noise Policy Statement for England

B.4 The NPSE, published in March 2010 by Defra, aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion. The NPSE provides the following definition of '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.*

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."

B.5 Paragraph 1.6 of the NPSE sets out the long-term vision and aims of Government noise policy:

"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."*

B.6 The aims require that all reasonable steps should be taken to avoid, mitigate and minimise adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development, which include social, economic, environmental and health considerations.

B.7 With regard to the terms 'significant adverse' and 'adverse' included in the 'Noise Policy Aims', these are explained further in the 'Explanatory Note' as relating to established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation which 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 human health and quality of life due to noise.

LOAEL – Lowest Observed Adverse Effect Level

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

B.8 Defra has then extended these concepts for the purpose of the NPSE to introduce the concept of:

'SOAEL – Significant Observed Adverse Effect Level

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

B.9 The accompanying explanation states:

'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'.

B.10 With regard to 'further evidence', Defra has commissioned research to try and identify the levels at which the above effects occur but this is not yet in the public domain. However, early indications are that this research has been largely inconclusive. On this basis, and until further guidance becomes available, and given that there is no specific guidance in the NPPF on noise, there is no justification to vary assessment methods and criteria from those previously adopted from British Standards etc.

Planning Practice Guidance - Noise (PPGN)

B.11 The Government has published Planning Practice Guidance on a range of subjects including noise [3].The guidance forms part of the NPPF and provides advice on how to deliver its policies. The PPGN reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE and British Standards (BSs) and contains examples of acoustic environments commensurate with various effect levels. Paragraph 006 of the PPGN explains that:

'The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.'

B.12 According to the PPGN, factors that can influence whether noise could be of concern include:

- the source and absolute level of the noise together with the time of day it occurs;
- for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- the spectral content and the general character of the noise;
- the local topology and topography along with the existing and, where appropriate, the planned character of the area.
- where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;

- whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time;
- in cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur;
- where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations;
- the effect of noise on wildlife;
- if external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces; and
- the potential effect on an existing business of a new residential development being located close to it as the existing noise levels from the business may be regarded as unacceptable by the new residents and subject to enforcement action.

B.13 The PPGN provides a relationship between various perceptions of noise, effect level and required action in accordance with the NPPF. The PPGN describes noise that is not noticeable to be at levels below the NOEL. It describes a range of noise exposure that is noticeable but not to the extent there is a perceived change in quality of life. Noise exposures in this range are below the LOAEL and need no mitigation. On this basis, the audibility of noise from a development is not, in itself, a criterion to judge noise effects that is commensurate with national planning policy.

B.14 In line with the NPPF and NPSE, the PPGN states that consideration needs to be given to mitigating and minimising effects above the LOAEL but taking account of the economic and social benefits being derived from the activity causing the noise. The PPGN states that effects above the SOAEL should be avoided and that whilst the economic and social benefits being derived from the activity causing the noise must be taken into account, such exposures are undesirable.

B.15 The non-numeric guidance contained within the PPGN, based upon the initial advice in the NPSE, is summarised in Table 1 below.

Table B.1: Noise Exposure Hierarchy Based On the Likely Average Response

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

B.16 The PPGN suggests that:

"the noise impact may be partially off-set if the residents of those dwellings have access to:

- *a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling, and/or;*
- *a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or;*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;*
- *a relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)."*

Consultation e-mail

From: Brian Gibson [mailto:]
Sent: 15 February 2016 16:59
To: Peter Barling
Subject: RE: Albert Road, Deal - Air Quality Assessment

Hello Peter,

I did get your phone message earlier but have been flat out today so haven't had a chance. These are the previous notes I had made for planners:-

Looks to me like you've got all this covered in your assessment plans.

Best regards

Noise

Vibration

Vibration from the railway line adjacent to the proposed site. An assessment should be undertaken and mitigation put in place if required, such that;

Internal vibration levels shall not exceed the category of "low probability of adverse comment" as detailed in BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. The details as approved shall be fully implemented prior to the first occupation of the dwellings.

Noise

Noise from external sources affecting new residential properties. External sources are Minters Industrial Estate, Hutchings Timber Yard, the Builder Centre, trains. The desirable internal levels shown in Table 4 of BS8233:2014 should be met.

Noise from new sources affecting new and existing residential properties. Services for the proposed supermarket should be subject to a BS4142 assessment and mitigation put in place if required.
A scheme should be provided showing that, when operating, the design and installation of new items of fixed plant shall be such that the cumulative noise level L_{Aeq} T_r arising from the proposed plant, measured or predicted at 1 metre from the facade of the nearest noise sensitive premises, shall be a rating level 5dB (A) below the background noise level L_{Af90} T_{bg}.

Times of deliveries to the supermarket may need to be limited, depending on design and siting of the delivery yard.

Construction Noise should be mitigated in line with guidance provided in BS5228. A construction management plan should be produced. Hours for noisy work should be limited to 0800-1800 Mon-Fri and 0800-1300 on Saturdays, with no noisy work on Sundays or Bank Holidays.

Brian Gibson
Senior Environmental Protection Officer
Dover District Council
Council Offices, White Cliffs Business Park, Whitfield, Dover CT16 3PJ
Tel:
Mob:
Email:
Web: dover.gov.uk

From: Peter Barling [mailto:peter.barling@rpsgroup.com]
Sent: 15 February 2016 16:12
To: Brian Gibson
Cc: Mark Fenton
Subject: RE: Albert Road, Deal - Air Quality Assessment

Hi Brian

My colleague, Russell Francis, passed me on your contact details regarding the proposed residential development at Albert Road, Deal and the required noise assessment.

Similarly I just wanted to confirm our survey and assessment approach in terms of noise. We are proposing to attended site tomorrow to set up one long term survey, close to the boundary of the site with Albert Road. This will be left out for a period of one week and the survey data will be used to determine the baseline ambient $L_{Aeq,16h}$, $L_{Aeq,8h}$, $L_{A90,16h}$ and $L_{A90,8h}$ from which we will base our assessments.

The assessments will follow the guidance contained within British Standard (BS) 8233:2014 'Guidance on sound insulation and noise reduction for buildings' and BS 4142:2014 'Methods for rating and assessing industrial and commercial sound', with regards to residential suitability and industrial/commercial noise from the retail area respectively.

Can you confirm if this will be a suitable approach and if you have any comments etc.

Kind Regards
Peter Barling

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www: www.rpsgroup.com

References to Appendix B

1 Department for Communities and Local Government. National Planning Policy Framework: HMSO. March 2012.

2 Department for Environment, Food and Rural Affairs. Noise Policy Statement for England. Defra. 2010.

3 Department for Communities and Local Government. National Planning Practice Guidance

Appendix C: Vibration Propagation in Dwellings

Vibration Propagation in Dwellings

C.1 The vibration criteria contained within BS 6472-1:2008 [1] are set in terms of the Vibration Dose Values (VDVs) 'at the point of entry to the subject', i.e. evaluated on the floors of the building. Attenuation occurs due to mass-loading provided by buildings and amplification occurs due to floor resonance. These effects are highly variable and depend upon site, source and project specific vibration characteristics, ground conditions, foundation types, building and floor constructions.

C.2 For this assessment, where the housing layout and design is yet to be determined, it is necessary to make some general assumptions about these transfer functions. These have been made on the basis of information contained within 'Measurement and Assessment of Groundborne Noise and Vibration' (MAGNV) [2].

C.3 In general, attenuation due to mass-loading increases with increasing building mass. Information provided by MAGNV indicates that levels may reduce from the free-field situations to foundations by 10% of the free-field levels for 2 to 4 storey masonry buildings and for large masonry buildings on spread footings. MAGNV suggests that, in general, levels typically reduce by up to 60% of the free-field level. An attenuation factor of 0.6 has been adopted for this assessment to account for mass-loading.

C.4 Amplification of vertical vibration may occur if the resonances of the floors coincide with peaks in the vibration spectrum. MAGNV provides information on floor resonance from two sources. Table 14.3 in MAGNV lists 5 to 15 dB (factors of approximately 3 and 32, respectively) and cites Transportation Noise Reference Book (TNRB) [3] as the source of these data. However, these data are associated in TNRB with residential wood-frame houses. Table 14.3 in MAGNV lists 6 dB (a factor of approximately 4) and cites 'Transit Noise and Vibration Impact Assessment' (TNVIA) [4] as the source of this datum. This datum is associated in TNVIA with no specific building type and is used as part of a 'Genralized Prediction of Ground-borne Vibration and Noise' methodology.

C.5 An amplification factor of 4 in the vertical direction has been adopted for this assessment to account for floor resonance. In RPS' experience, a factor of approximately 2 is more common for wood floors in typical UK houses and may be negligible for concrete floors in houses and flats. On this basis, the vibration criteria derived in Table C.1 below, whilst indicative, are expected to be robust for the purposes of an assessment to accompany an outline planning application. These criteria are approximately commensurate with the VDVs below which there is a low probability of adverse comment based on the guidance contained within BS 6472-1:2008.

Table C.1: Vibration Assessment Criteria

		Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Internal Vibration Assessment Criteria[1]	$VDV_{d/b,day/night}$ ($m/s^{1.75}$)	0.2	0.1
Transfer Functions	Mass Loading	0.6	0.6
	Floor Resonance	4.0	4.0
External Horizontal Vibration Assessment Criteria[2]	$VDV_{d,day/night}$ ($m/s^{1.75}$)	0.3	0.2
External Vertical Vibration Assessment Criteria[3]	$VDV_{b,day/night}$ ($m/s^{1.75}$)	0.1	0.0[4]

Notes:
1. This is the level above which there would be a 'Low probability of adverse comment' and below which 'adverse comment is not expected' with respect to BS 6472-1:2008.
2. This is the corresponding maximum external horizontal (x and y-axis) vibration level above which there would be a 'Low probability of adverse comment' and below which 'adverse comment is not expected'.
3. This is the corresponding maximum external vertical (z-axis) vibration level above which there would be a 'Low probability of adverse comment' and below which 'adverse comment is not expected'.
4. 0.04 to two decimal places.

References to Appendix C

1 British Standards Institution. British Standard 6472-1:2008. Guide to evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting.

2 The Association of Noise Consultants. ANC Guidelines. Measurement and Assessment of Groundborne Noise & Vibration. 2nd Edition. 2012.

3 Nelson P. M. (ed) (1987) Transportation Noise Reference Book. Butterworths, London

4 Federal Transit Administration. Office of Planning and Environment. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. May 2006

Appendix D: Baseline Survey Data

Sound Level Survey Record (Attended Baseline Survey)

Location			LT1 - North East Boundary			
Purpose of Monitoring			Baseline			
Relevant Guidance / Standard			BS 7445-1:2003 / BS 7445-2:1991 / BS 4142:2014 / BS 8233:2014			
Sound Measurement System						
RPS ID	Manufacturer / Model		Serial Number	Last Lab Verification	Filename	Memory Card ID
115	Rion NL-52		943366	28/01/2015	1	-
Microphone Height	Measurement Interval	Dynamic Range (dB)	Time Weighting	Frequency Weighting	Façade / Freefield	Photo?
~1.5 m	100 ms	20 - 130	F	A	Freefield	x

		START	END
Personnel		MF	MF
Date / time		16/02/2016 15:00	22/02/2016 14:00
Calibrator	RPS ID	15	33
	Manufacturer / Model	RION NC-74	RION NC-74
	Serial Number	110090	34472822
	Date last verification	19/10/2015	19/10/2015
	Reference level	94.0	94.0
	Meter reading	94.0	94.0
Weather	Wind speed (m/s) & dir'n 1	0 -	1.0 S
	Wind speed (m/s) & dir'n 2	0.3 S	0.6 SW
	Wind speed (m/s) & dir'n 3	0.6 S	2.2 W
	Wind speed (m/s) & dir'n Av.	0.3 S	1.3 SW
	Cloud cover (100%= 8 oktas)	4	8
	Temperature (degrees Celsius)	10.6	13
	Relative Humidity (%)	48	76
	Likely temp. inversion / Precipitation / Fog / Wet ground / Frozen ground / Snow cover? (tick boxes)	TI P F	W F S
	Subjective description / additional details	Mostly clear, gentle breeze, dry	Overcast, gentle breeze, damp

Photographs of measurement location



Description of site (location of equipment, general surroundings, nature of ground between NSR and sound source(s) (hard/ soft ground, topography, intervening features, reflecting surfaces))
Hard ground between survey and rial line.
Description of sound environment at start of survey (principal environmental and natural sound sources, which sources are dominant, character of the sound environment cf. to the character of the new source)
train movements on the railway; road traffic; aircraft passing overhead; people talking; and bird song.
Description of sound environment at end of survey (principal environmental and natural sound sources, which sources are dominant, character of the sound environment cf. to the character of the new source)
train movements on the railway; road traffic; aircraft passing overhead; people talking; and bird song.

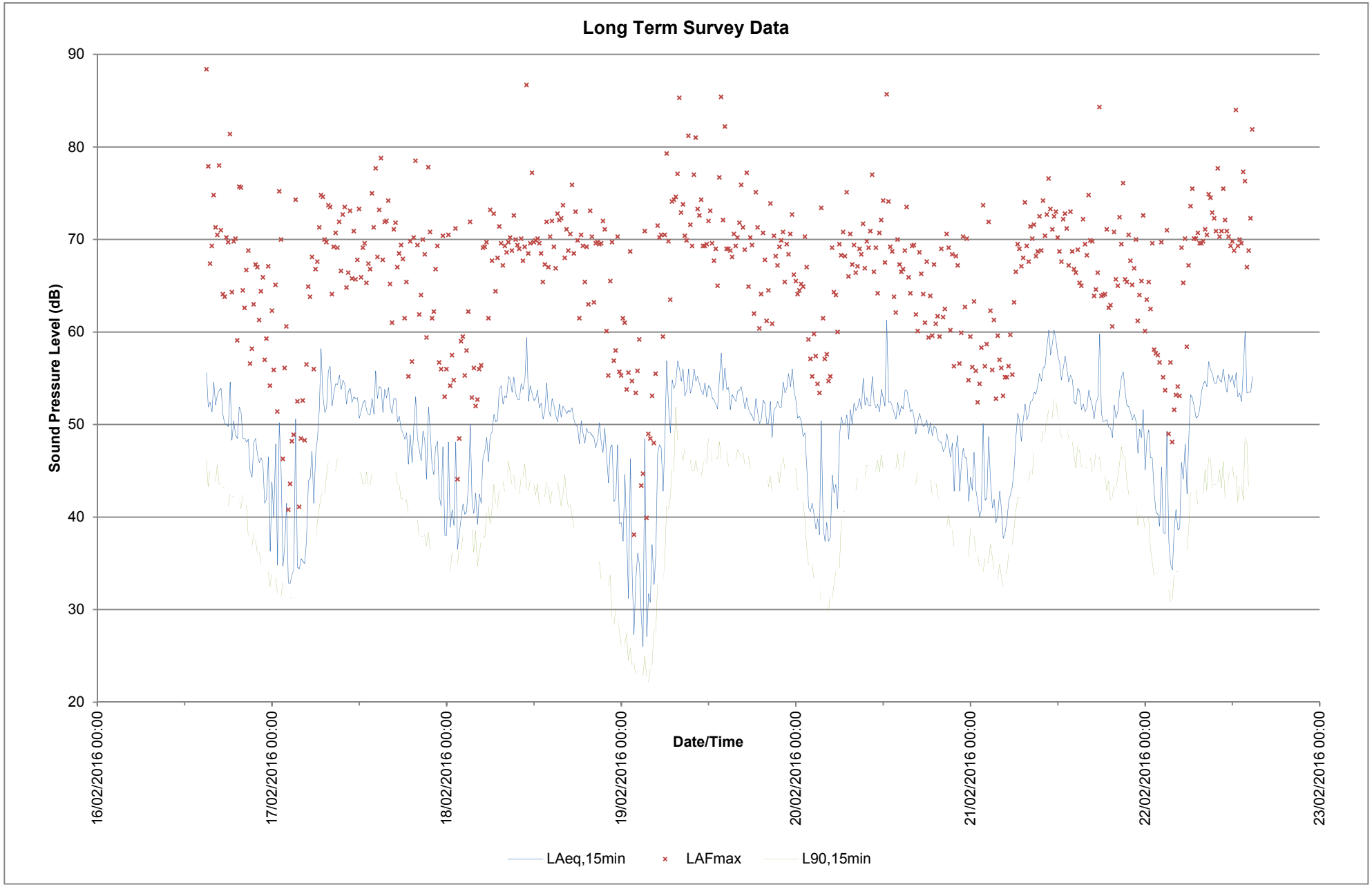
Long Term Survey Data

Daytime

Start	Valid Time	$L_{Aeq,16h}$ (dB)	L_{AFmax} (dB)	$L_{A90,16h}$ (dB)
17/02/2016 07:00	16:00:00	52	79	41
18/02/2016 07:00	16:00:00	52	87	39
19/02/2016 07:00	16:00:00	54	85	46
20/02/2016 07:00	16:00:00	52	86	42
21/02/2016 07:00	16:00:00	55	84	45
	Average	**53**		

Night-time

Start	**Valid Time**	$L_{Aeq,8h}$ (dB)	L_{AFmax} (dB)	$L_{A90,8h}$ (dB)
16/02/2016 23:00	08:00:00	47	75	32
17/02/2016 23:00	08:00:00	45	73	36
18/02/2016 23:00	08:00:00	46	79	24
19/02/2016 23:00	08:00:00	49	73	33
20/02/2016 23:00	08:00:00	45	74	35
21/02/2016 23:00	08:00:00	47	76	34
	Average	**47**		


Long Term Survey Data
Sound Pressure Level (dB)
90
80
70
60
50
40
30
20
16/02/2016 00:00
17/02/2016 00:00
18/02/2016 00:00
19/02/2016 00:00
20/02/2016 00:00
21/02/2016 00:00
22/02/2016 00:00
23/02/2016 00:00
Date/Time
LAeq,15min
LAFmax
L90,15min

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