



NOISE IMPACT ASSESSMENT KINGS ROAD, READING

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REPORT PREPARED FOR: TITAN PROPERTY DEVELOPMENTS LTD

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A CONCEPT LIFE SCIENCES COMPANY





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Date	06/04/2018	19/04/2018		
Prepared by	Elizabeth Samphier	Elizabeth Samphier		
Signature				
Position	Senior Consultant	Senior Consultant		
Checked by	Lee Faulkner	Lee Faulkner		
Signature				
Position	Principal Acoustic Consultant	Principal Acoustic Consultant		
Verified by	John Goodwin	John Goodwin		
Signature				
Position	Regional Director	Regional Director		
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EXECUTIVE SUMMARY

Resource and Environmental Consultants Ltd were instructed by Titan Property Developments Ltd to provide a Noise Impact Assessment to support the planning application for the proposed residential development on Kings Road in Reading.

A Sound Survey has been completed in order to determine the existing noise levels across the Site due to road traffic noise associated with Kings Road.

Noise modelling software has been used in general accordance with British Standard 8233:2014 to determine the impact from the existing road noise on the proposed residential facades.

The Noise Impact Assessment has determined the mitigation measures that will be required to ensure that the internal noise criterion is met with regards to the local roads when windows are opened.

Recommended Mitigation Measures

Northern Facing Façade

Following the findings from the assessment, it has been recommended that in order to meet the criterion defined within British Standard 8233:2014 the below mitigation measures should be adhered to.

Development Area	Mitigation Measures
Glazing	Standard Glazing (6mm – 12mm airgap – 6mm)
Ventilation	Acoustic Ventilators (Minimum of $D_{n,e,w} + C_{t,r}$ 43dB in open position)

Southern Facing Façade

The Southern Facing Façade (overlooking Muirfield Close) will meet the required criterion with a lower specification ventilation. The following mitigation measures will be suitable:

Development Area	Mitigation Measures
Glazing	Standard Glazing (6mm – 12mm airgap – 6mm)
Ventilation	Normal Ventilators (Minimum of $D_{n,e,w} + C_{t,r}$ 19dB in open position)





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1. INTRODUCTION

Resource and Environmental Consultants Ltd were instructed by Titan Property Developments Ltd to provide a Noise Impact Assessment for a proposed residential development on Kings Road in Reading; to be referred to hereafter as '*the Site*'.

This assessment has been undertaken to identify key sound sources in the vicinity of the Site which may have the potential to impact upon the proposed noise-sensitive development.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.1 Site Location

The Site is located to the west of Central Reading and is accessible via Kings Road following the A329(M). The surrounding area is made up of a mix of both commercial units, which are located to the immediate north, east and west, and residential properties situated to the south.

The predominant source of noise likely to impact the site is road noise from Kings Road. Consideration was initially also given to Fatherson Road, which is located to the west of the Site, however onsite observations concluded that the resultant noise levels would be negligible and would have no adverse impact on the proposed residential properties.

1.2 Outline of Proposal

It is proposed to construct approximately 13 residential apartments comprising of six 2 bedroom properties, five 1 bedroom properties and two 3 bedroom property across the three storeys. The proposal includes dedicated parking spaces and access to the south.

This assessment has been undertaken with due regard to the supplied planning layout shown in the following planning drawings provided by Titan Property Developments Ltd:

- ▶ Site Layout Plan (PL-04 Proposed Building Plans) dated April 2018.

The Site Layout Plan is shown in the following Appendix.

1.3 Limitations

The limitations of this report are presented in Appendix I.

1.4 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.





2. ASSESSMENT METHODOLOGY

2.1 National Planning Practice Guidance

Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- ▶ Whether or not a significant adverse effect is occurring or likely to occur;
- ▶ Whether or not an adverse effect is occurring or likely to occur; and
- ▶ Whether or not a good standard of amenity can be achieved.

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

The Observed Effect Levels are as follows:

- ▶ Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- ▶ Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.
- ▶ No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Table 1 summarises the noise exposure hierarchy, based on the likely average response.

Table 1 Noise Exposure Hierarchy

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			





Perception	Examples of Outcomes	Increasing Effect Level	Action
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			
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 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

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.

These factors include:

- ▶ The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;
- ▶ For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- ▶ The spectral content of the noise and the general character of the noise. The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.

More specific factors to consider when relevant:

- ▶ 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;
- ▶ consideration should also be given to 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 both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.





- ▶ If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.

2.2 Local Planning Authority Guidance – Reading Borough Council Environmental Health Department

REC contacted the Environmental Health Department at Reading Borough Council on Wednesday 21st March 2018 with the following communications:

"We are currently acting as the Noise Consultants on behalf of our client for a proposed residential development on Kings Road in Reading.

We are currently undertaking a Noise Impact Assessment in accordance with British Standard 8233:2014 and are working to meet the following criterion:

- *Daytime Internal Noise Levels in Living Rooms not to exceed 35dB $L_{Aeq,16hr}$;*
- *Night-time Internal Noise Levels in Bedrooms not to exceed 30dB $L_{Aeq,16hr}$ and 45dB $L_{Amax,fast}$; and*
- *External noise levels in gardens to be no more than 55dB $L_{Aeq,16hr}$*

Could you please confirm if these criteria would be suitable to Reading Borough Council or inform if you require anything further."

A response was received on Thursday 29th March 2018 stating the following:

"Dear Elizabeth,

I am writing to you in regards to your recent enquiry about the criteria for noise levels for your proposed development. The information you have is suitable and in line with our policy so there should be no issues there. However I do ask that you take note of the following condition:

Noise mitigation is likely to focus on the weak point in the structure; glazing. Where opening windows will lead to an internal noise level increase of 5 dBA or greater above BS 8233:2014 recommended internal levels, the scheme shall include provision of alternative mechanical ventilation with minimum performance equivalent to a mechanical heat recovery (MVHR) system with cool air bypass as an alternative means of cooling and ventilation. Noise from the system should not result in BS8233 internal levels being exceeded., however non-openable windows are not considered an acceptable solution due to the impact on living standards."

2.3 Calculation of Road Traffic Noise 1988

The Calculation of Road Traffic Noise (CRTN) memorandum, produced by the Department of Transport for the Welsh Office, describes the procedures for calculating noise from road traffic. Section III of this memorandum details the shortened measurement procedure whereby measurements of the L_{10} parameter are made over any three consecutive hours between 10:00 and 17:00. From the arithmetic average of the three 1-hour values, the $L_{10,18hr}$ noise levels is derived before derivation of the $L_{Aeq,16hr}$ value.



2.4 Transport Research Laboratory – Converting the UK Traffic Noise Index $L_{A10,18hr}$ to EU Noise Indices for Noise Mapping

This document provides a method for converting the $L_{A10,18hr}$ level to the L_{night} level using the following formula, applicable to non-motorway roads;

$$L_{night} = 0.90 \times L_{A10,18hr} - 3.77\text{dB}$$

2.5 British Standard BS8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings

Noise Criteria Limits

The scope of this standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including dwellings, as shown in Table 2:

Table 2 BS8233 Recommended Internal Noise Levels

Criterion	Typical Situation	Design $L_{Aeq,T}$ (dB)
Suitable resting/ sleeping conditions	Living Room	35
	Bedroom	30
For a Reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not exceed 45dB L_{max}		

BS8233 goes on to recommend noise levels for gardens. According to BS8233;

“It is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$ with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised 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 might be warranted”.

BS8233 goes on to say:

“In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited”.





Ventilation Requirements

Where a partially open window cannot be relied upon to provide an adequate level of facade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS8233 states:

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

Alternatively, acoustic ventilation units (see 7.7.2 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

Section 7.7.2 states:

"NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

2.6 World Health Organisation's (WHO) 'Guidelines for Community Noise'

The WHO 'Guidelines for Community Noise' offers advice with regard to setting noise criteria applicable to sleep disturbance. Section 4.2.3 specifies:

'If the noise is not continuous, L_{Amax} or SEL are used to indicate the probability of noise-induced awakenings. Effects have been observed at individual L_{Amax} exposures of 45 dB or less. Consequently, it is important to limit the number of noise events with a L_{Amax} exceeding 45 dB.'

The guidelines go on to state:

'At night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax} so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB.'

The sound insulation performance value of 15dB for a façade containing a partially open window accords with the guidance offered in BS8233:2014.

The guidelines reference a study by Vallet & Vernet, 1991, which concluded that:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB $L_{AF,max}$ more than 10-15 times per night.'

Accordingly, this assessment has utilised the 10th highest measured maximum noise level from the night-time period and allows for an assessment of a typical maximum noise level in determining façade sound insulation performance.

2.7 BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'

This standard describes methods for rating and assessing sound of an industrial or commercial nature which includes:





- ▶ Sound from industrial and manufacturing processes;
- ▶ Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- ▶ Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and,
- ▶ Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

The procedure compares the measured or predicted noise level 'the specific noise level' from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.'

The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- ▶ Daytime (07:00 – 23:00) 1 hour; and
- ▶ Night-time (23:00 – 07:00) 15 minutes.

There are a number of 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound level under investigation as follows. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:

Tonality

- ▶ +2dB: where the tonality is just perceptible;
- ▶ +4dB: where the tonality is clearly perceptible; and
- ▶ +6dB: where the tonality is highly perceptible.

Impulsivity

- ▶ +3dB: where the impulsivity is just perceptible;
- ▶ +6dB: where the impulsivity is clearly perceptible; and
- ▶ +9dB: where the impulsivity is highly perceptible.

Intermittency

- ▶ +3dB: where the intermittency is readily distinctive against the acoustic environment.

In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

BS4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background noise level can yield the following commentary:

- ▶ Typically the greater this difference (between the rating level and the background sound level), the greater the magnitude of impact;





- ▶ A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- ▶ A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- ▶ 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.





3. SOUND SURVEYS

Whilst attending the Site, the surveyor conducted noise measurements within the centre of the proposed site and to the north-west of the site on the corner of Kings Road and Fatherson Road. It was noted on site that the property to the east of the proposed land was being used for construction purposes however current works were not particularly distinguishable over road traffic sound. Accordingly, commercial sound has not been assessed given the dominance of road traffic sound.

3.1 Road Traffic Sound Survey – Kings Road

REC has conducted a road traffic sound measurement for Kings Road following the shortened measurement procedure methodology given in Calculation of Road Traffic Sound (CRTN). The survey was carried out over the following time period:

- ▶ Friday 9th March 2018 between 10:00 and 13:00.

The following sound measurement position was chosen for the Sound Survey:

- ▶ Noise Measurement Position 1 (NMP1): Located to the north east boundary on the corner of Kings Road and Fatherson Road approximately 6m from the nearside kerbstone. The microphone was located 1.5m above ground level and in free-field conditions. Noise sources at this location consisted of road traffic on Kings Road.

A summary of the measured sound pressure levels from the Road Traffic Sound Survey are presented in Table 3 below.

Table 3 Summary of Measured Sound Levels for NMP1

Table 3 – Summary of Measured Sound Levels for NW1-1				
Measurement Period Start	Measured Sound Pressure Levels (dB)			
	L _{Aeq,T}	L _{Amax,fast}	L _{A90,T}	L _{A10,T}
09/03/18 10:00	71.2	84.6*	57.3	74.2
09/03/18 11:00	72.1		58.4	73.9
09/03/18 12:00	70.6		59.5	73.0
* 10 th highest measured maximum noise level in three-hour period.				

During the noise surveys the weather conditions were conducive to the measurement of environmental noise, i.e. wind speeds no more than 5m/s and dry conditions.

In accordance with the shortened measurement procedure given in CRTN, the daytime and night time L_{Aeq} levels have been derived as the following.



Table 4 Summary of Sound Pressure Levels for NMP1

Period Start	Day Time (07:00 to 23:00)	Night Time (23:00 to 07:00)
Measured Sound Pressure Level (dB) $L_{Aeq,T}$	67.2	58.5

3.2 Background Sound Survey – Centre of Site

REC has conducted a background sound measurement at a position representative of existing and proposed receptors. The survey was carried out over the following time period:

- ▶ 11:38 Thursday 22nd March and 12:43 Monday 26th March 2018.

The following sound measurement position was chosen for the Sound Survey:

- ▶ Noise Measurement Position 2 (NMP2): Located within the centre of the proposed site. The microphone was located 1.5m above ground level and in free-field conditions. Noise sources at this location predominantly consisted of road traffic on Kings Road.

A summary of the measured 1-hour background sound pressure levels are presented in Table 5 below.

Table 5 Measured Background Sound Pressure Levels

Period Start	Measured Sound Pressure Level (dB) $L_{Aeq,T}$	L_{A90} Range
22/03/2018 Daytime 07:00 to 23:00	64.2	41.9 – 64.0
22/03/2018 Night time 23:00 to 07:00	57.3	43.8 - 53.0
23/03/2018 Daytime 07:00 to 23:00	60.4	51.3 – 57.8
23/03/2018 Night time 23:00 to 07:00	58.9	41.4 – 53.0
24/03/2018 Daytime 07:00 to 23:00	60.0	49.6 – 56.1
24/03/2018 Night time 23:00 to 07:00	57.7	39.4 – 53.4
25/03/2018 Daytime 07:00 to 23:00	62.8	46.1 – 55.5
25/03/2018 Night time 23:00 to 07:00	57.8	38.9 – 54.6
26/03/2018 Daytime 07:00 to 23:00	65.6	53.1 – 59.4
26/03/2018 Night time 23:00 to 07:00	56.4	37.5 – 53.7





The following equipment was used for the Noise Surveys.

Table 6 Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1 and NMP2	Sound Level Meter	01dB-Metravib Black Solo	65771	25 th October 2019
	Pre-amplifier	01dB-Metravib PRE 21 S	16539	
	Microphone	01dB Metravib MCE212	175280	
	Calibrator	01dB-Metravib CAL-21	34634218	25 th October 2018

The sound level meter was field calibrated prior to and following the survey. No significant drift was reported. Calibration certificates are available on request.





4. NOISE IMPACT ASSESSMENT

4.1 Road Traffic Noise Impact

For the purposes of this assessment, REC have used noise modelling software, CadnaA 2018, to determine the impact of noise from Kings Road across the Site. A noise model has therefore been constructed in order to calculate façade noise levels and external noise levels due to the impact of road traffic noise.

The following inputs have been included in the model:

- ▶ Site Layout Plan;
- ▶ Site elevations have been taken as existing; using 2m contours via a Digital Terrain Model (DTM);
- ▶ Noise Measurement Position 1 has been used in order to calibrate the noise model;
- ▶ A floor height of 2.5m has been assumed for all proposed dwellings which is a standard separation distance between ground and first floors in a typical dwelling;
- ▶ A reflection order of 2 has been used in all calculations; and
- ▶ Noise levels generated using ISO 9613-1 and ISO 9613-2 “Acoustics – Attenuation of sound during propagation outdoors” as incorporated into the CadnaA software.

4.1.1 External Amenity Areas

In order to assess the noise levels within the proposed external amenity areas, a noise map has been created using the provided site layout plan with the inclusion of 1m balcony screening.

In accordance with BS8233:2014 the proposed criterion for the enjoyment and use of private external amenity space is 55dB ($L_{Aeq, 16\text{hour}}$). The standard states:

“It is desirable that the external noise level does not exceed 50dB $L_{Aeq, T}$, with an upper guideline value of 55dB $L_{Aeq, T}$ which would be acceptable in noisier environments. However, it is also recognised 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 and other factors might be warranted”

The assessment undertaken shows the typical noise levels within the external amenity area fall at 50dB.

Accordingly, no additional mitigation measures are required.

Mitigation is discussed in section 5.

4.1.2 Internal Noise Assessment

In order to accurately determine the noise level within habitable rooms, external noise levels outside of the residential facades have been derived within the noise model for the proposed layout.

With regards to the internal noise levels, BS8233:2014 suggest that a glazing unit with configuration 6mm glass/12mm air space/6mm glass affords sound insulation performance in the order of 33dB. The same unit, weighted for road traffic noise using the '+C_{tr}' correction, has a sound insulation performance of approximately 30dB and so this value has been used to calculate internal noise





levels. BS8233:2014 also goes on to recommend that a partially open window provides approximately 15dB attenuation, and this value is also used here.

The assessment shows that standard thermal double glazing is sufficient for all habitable rooms across the Site. However, with a partially open window, the bedrooms and living rooms on the northern facing facade will experience an exceedance of the criteria. Accordingly, mitigation measures in the form of an alternative ventilation system are required.

Without mitigation in place, the LOAEL is achieved which would be noticeable and disruptive resulting in the following if windows were opened in order to provide background ventilation:

"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".

With regards the maximum instantaneous noise levels at night for Kings Road, the 10th Highest measured level at the closest boundary was 85dB $L_{Amax,fast}$ which has been distance corrected to the closest habitable room in order to inform a worst case assessment. Accordingly, standard glazing is sufficient for bedrooms on the boundary with Kings Road (note no frequency content is accounted for due to the instantaneous nature of the noise so no correction for road traffic is applied). However, there would be an exceedance of +15dB when windows are open. Accordingly, alternative ventilation would be required for bedrooms overlooking Kings Road. However, this is not above and beyond the requirements for the average noise level and, as such, additional measures are not required.

Results for internal daytime amenity noise levels (35 dB(A)) can be summarised as follows;

- ▶ At all storeys, the bedrooms and living rooms on the northern and northern variation facades exceed the 50 dB(A) external criterion for amenity with open windows
- ▶ Note that these criteria do not apply to use for non-sensitive uses such as kitchens/bathrooms.

Results for compliance with the night-time L_{Aeq} internal criterion (30 dBA) can be summarised as follows, though note that this applies only where the facade includes a bedroom.

- ▶ At all storeys, the bedrooms and living rooms on the northern and northern variation facades exceed the 45 dB(A) external criterion for amenity with open windows

Internal Noise Assessment for Habitable Rooms can be found in Appendix IV.

4.2 Plant Noise Emission Limits

The sound measurements undertaken on site indicate that the traffic noise associated with Kings Road will be the dominant noise source at the proposed site and any noise associated with future fixed plant will not be prevailing.

At the time of producing this report no specific details had been provided for any proposed mechanical equipment so it is therefore appropriate to set emission limits based on the existing





background noise levels and the criteria set out within BS4142. The following table demonstrated the plant noise emission limits for both the daytime and night time periods. For this purpose, the lowest background sound levels from the measurement period have been used.

Table 7: Calculation of Plant Noise Emission Limits for the Daytime and Night-time Periods

Day	Lowest Measured Background Sound Level, $L_{A90,T}$ (dB)	Noise limit using $L_{A,r} = L_{A90,t}$
Daytime	41.9	41.9
Night-time	38.9	38.9

The lowest background levels for both day and night time were extracted from the full measurement data to ensure a more robust assessment.





5. MITIGATION

A mitigation schedule is provided to the rear of the report in Appendix IV.

5.1 External Amenity Areas

As noted in Section 4, the communal amenity areas located on the third floor and attic level roof to the west will meet the criteria of 55 dB as required within BS8233:2014.

Accordingly no mitigation measures will be required.

5.2 Internal Habitable Rooms

The assessments determined that standard thermal double glazing is sufficient for all rooms across the Site. However, with a partially open window, the internal noise levels for bedrooms and living rooms overlooking Kings Road will exceed the internal target criteria due to road traffic sound. Accordingly, it is necessary to consider an alternative ventilation scheme which does not require the opening of windows to provide fresh air flow and background ventilation. Windows should remain openable for purge ventilation. The Environmental Officer at Reading Borough Council has requested a ventilation system with a minimum performance equivalent to a mechanical heat recovery system (MVHR).

The exact requirement for alternative ventilation ultimately falls to the developer and, from an acoustics perspective, needs to ensure that fresh air flow can be achieved without the need for opening windows. It is necessary to meet the requirements given in BS8233:2014, Section 8.4.5.4, which states that:

“The Building Regulations’ supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant’s choice.

Alternatively, acoustic ventilation units (see 7.7.2) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.”

Section 7.7.2 states:

“NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.”

Wherever possible, habitable rooms should be located away from the noise source with less noise sensitive rooms facing the noise source.





6. CONCLUSION

REC Ltd were instructed by Titan Property Developments Ltd to provide a Noise Impact Assessment for a proposed residential development on Kings Road in Reading.

A Noise Survey has been completed in order to determine the existing levels of noise across the Site predominantly due to road traffic noise associated with Kings Road.

Noise modelling software has been used in general accordance with British Standard 8233:2014 to determine the impact from the existing road noise on the proposed residential facades and external amenity areas.

With regards to road traffic sound, the Noise Impact Assessment has determined that mitigation measures are required to ensure that internal noise levels do not exceed the criteria when windows are opened.

With regards to the criterion set out within BS4142:2014 it would be recommended that the resultant noise levels of any future fixed plant should not exceed -0dB below the existing background sound level.

Subject to the incorporation of the identified mitigation measures, it is considered that in principle, the Site is suitable for the proposed development.





APPENDIX I LIMITATIONS





1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Limited and the Client as indicated in Section 1.2.
2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
3. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.





APPENDIX II GLOSSARY OF ACOUSTIC TERMINOLOGY





Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1 Typical Sound Pressure Levels

Sound Pressure Level	Location/Example
0	Threshold of hearing
20 - 30	Quiet bedroom at night
30 - 40	Living room during the day
40 - 50	Typical office
50 - 60	Inside a car
60 - 70	Typical high street
70 - 90	Inside factory
100 - 110	Burglar alarm at 1m away
110 - 130	Jet aircraft on take off
140	Threshold of pain





Acoustic Terminology

Table A2 Terminology

Descriptor	Explanation
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10 ⁻⁵ Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L _{Aeq, T}	L _{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L _{Amax}	L _{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L _{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L ₁₀ & L ₉₀	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L ₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L ₉₀ is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L ₁₀ index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.





APPENDIX III FIGURES





Figure 1 - Revised Layout Plan

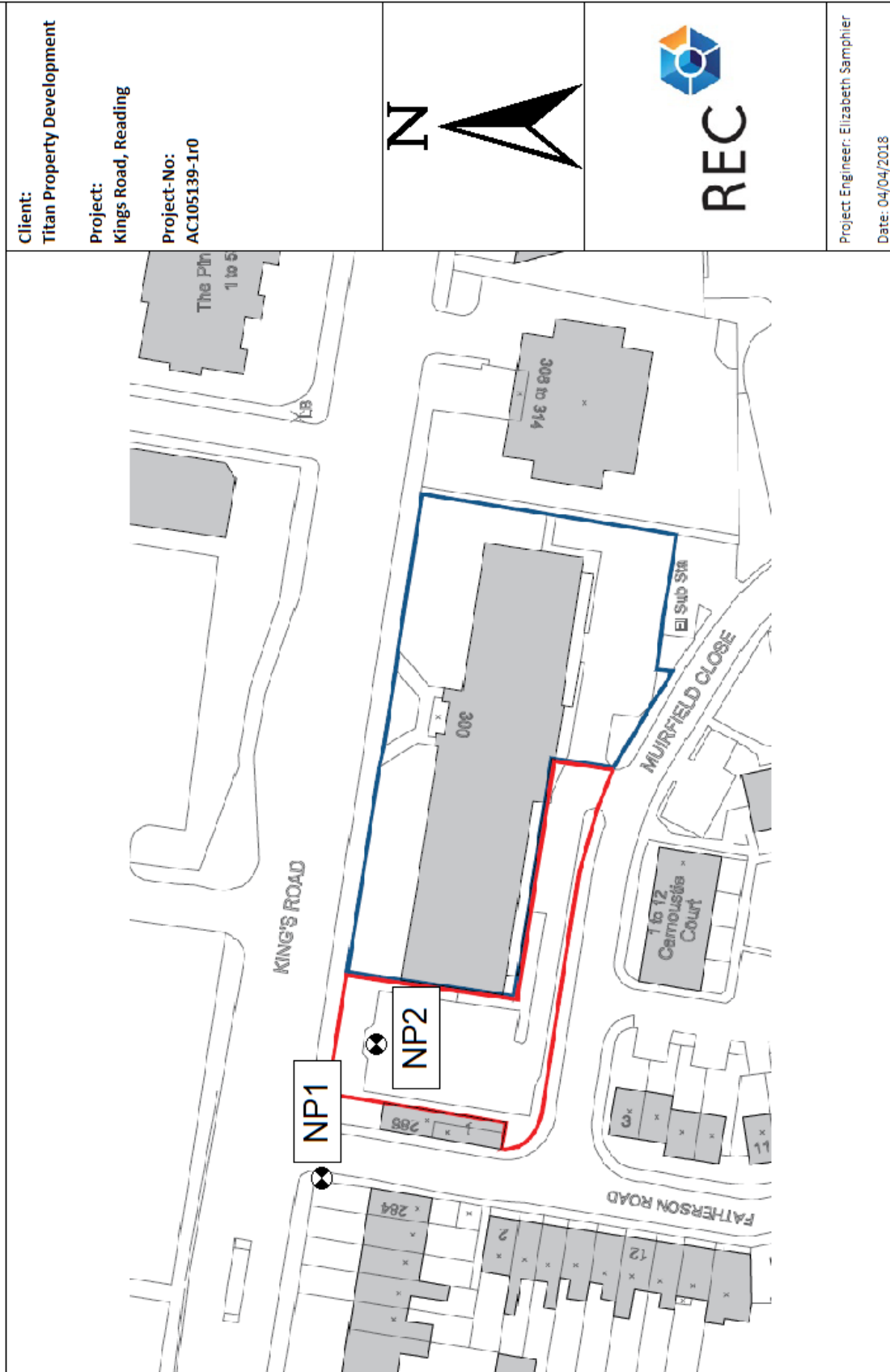




Figure 1.1 - Building Layout

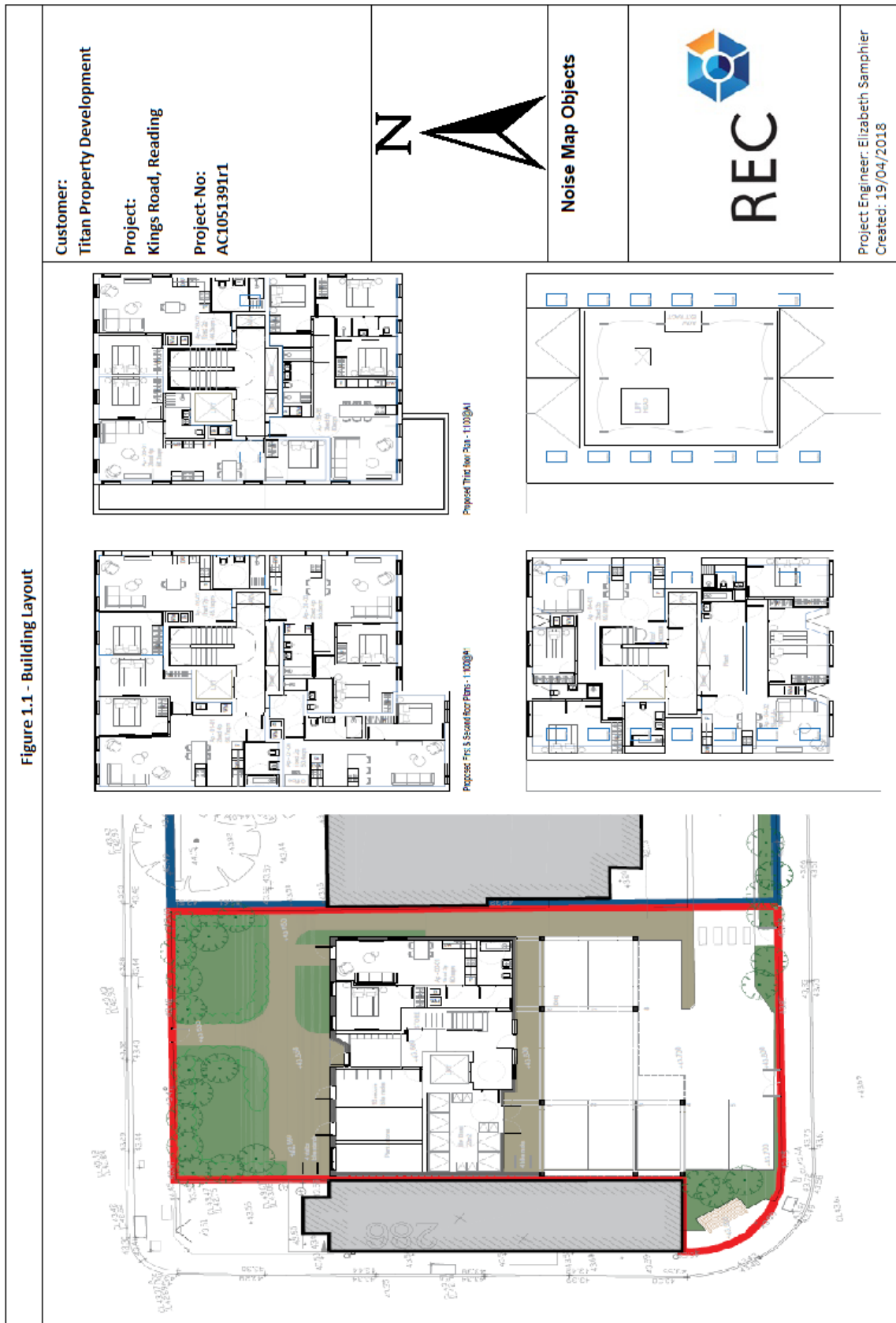




Figure 2 - Daytime Grid Noise Map - Calculation in 1.5m above ground

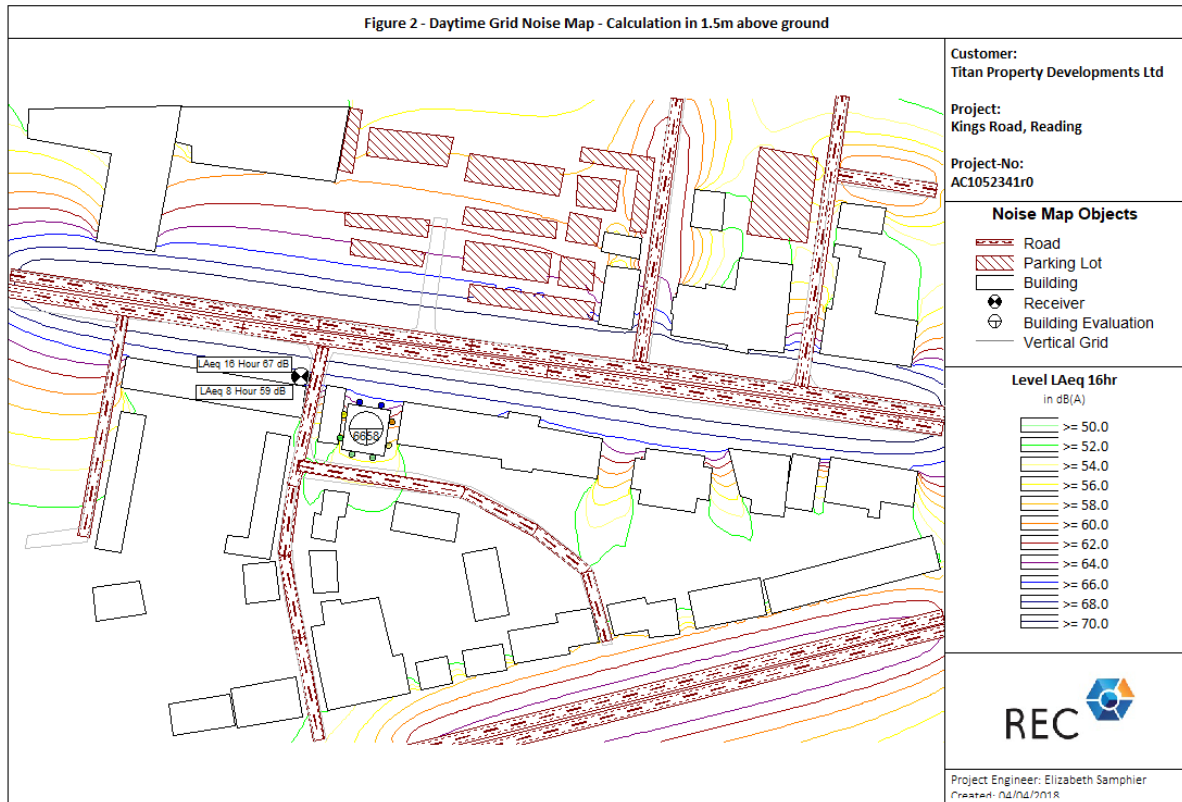
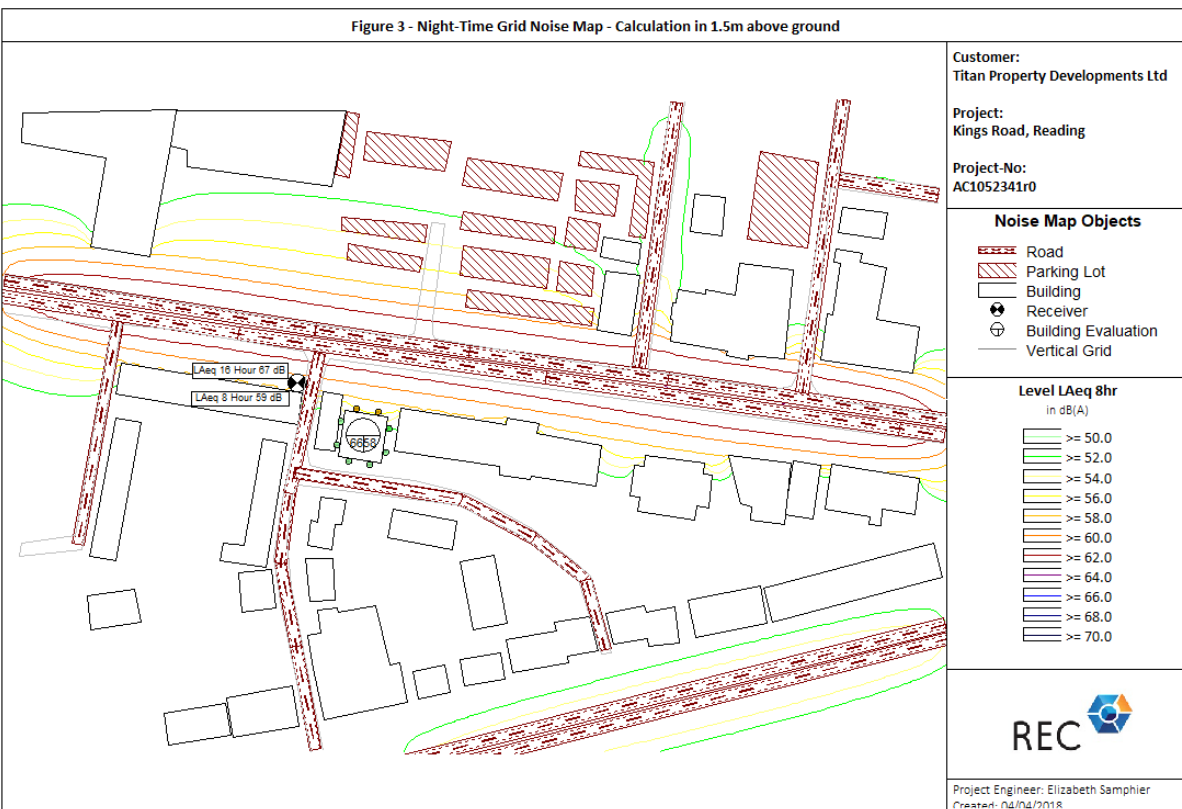
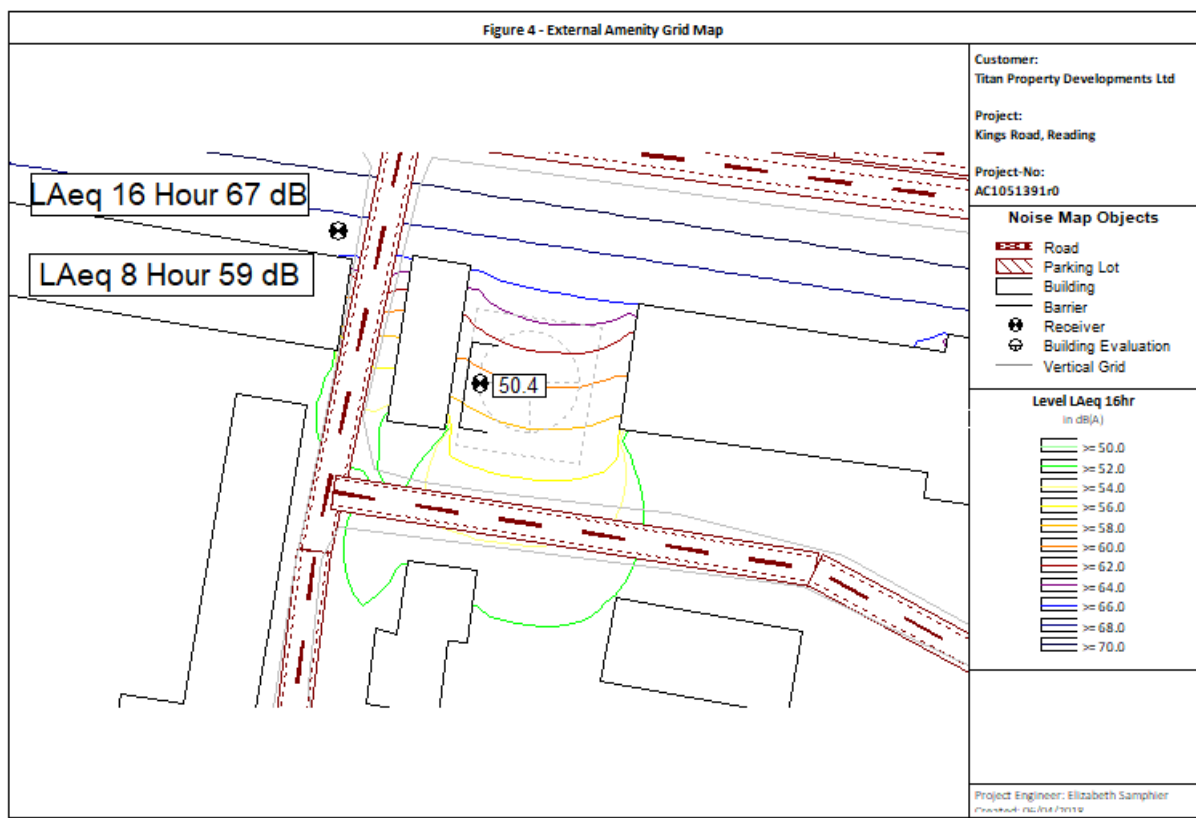


Figure 3 - Night-Time Grid Noise Map - Calculation in 1.5m above ground







APPENDIX IV INTERNAL NOISE ASSESSMENT FOR HABITABLE ROOMS





Table A1 Daytime Internal Noise Impact Assessments

Apartment	Façade Orientation	Predicted External Noise Level at the Façade, $L_{Aeq,16hr}$ (dB)	Internal Noise Level Assuming Standard Double Glazing, $L_{Aeq,16hr}$ (dB)	Difference with BS8233:2014 Internal Noise Criteria, 35dB $L_{Aeq,16hr}$ (dB)	Internal Noise Level Assuming Partially Open Window, $L_{Aeq,16hr}$ (dB)	Difference with BS8233:2014 Internal Noise Criteria, 35dB $L_{Aeq,16hr}$ (dB)
Apt 01-01	N	65.1	32.1	-2.9	47.1	+12.1
Apr 01-01	NW	58.2	25.2	-9.8	40.2	+5.2
Apt 01-02	N	66.5	33.5	-1.5	48.5	+13.5
Apt 01-02	NE	60.1	27.1	-7.9	42.1	+7.1
Apt 01-03	N	45.6	12.6	-22.4	27.6	-7.4
Apt 01-03	SE	54.2	21.2	-13.8	36.2	+1.2
Apt 01-04	S	45.4	12.4	-22.6	27.4	-7.6
Apt 01-04	SW	51.2	18.2	-16.8	33.2	-1.8
Apt 02-01	N	65.6	32.6	-2.4	47.6	+12.6
Apt 02-01	NW	58.2	25.2	-9.8	40.2	+5.2
Apt 02-02	N	66.5	33.5	-1.5	48.5	+13.5
Apt 02-02	NE	61.6	28.6	-6.4	43.6	+8.6
Apt -2-03	S	45.4	12.4	-22.6	27.4	-7.6
Apt -2-03	SE	53.5	20.5	-14.5	35.5	+0.5
Apt 02-04	S	45.2	12.2	-22.8	27.2	-7.8
Apt 02-04	SW	50.1	17.1	-17.9	32.1	-2.9
Apt 03-01	N	63.1	30.0	-5	45	+10
Apt 03-01	NE	58.1	25.1	-9.9	40.1	+5.1
Apt 03-02	S	42.3	9.3	-25.7	24.3	-10.7
Apt 03-02	SE	51.5	18.5	-16.5	33.5	-1.5
Apt 04-01	N	65.3	32.3	-2.7	47.3	+12.3
Apt 04-02	S	44.2	11.2	-23.8	26.2	-8.8





Table A2 Night time Internal Noise Impact Assessments

Apartment	Façade Orientation	Predicted External Noise Level at the Façade, $L_{Aeq,8hr}$ (dB)	Internal Noise Level Assuming Standard Double Glazing, $L_{Aeq,8hr}$ (dB)	Difference with BS8233:2014 Internal Noise Criteria, 30dB $L_{Aeq,8hr}$ (dB)	Internal Noise Level Assuming Partially Open Window, $L_{Aeq,8hr}$ (dB)	Difference with BS8233:2014 Internal Noise Criteria, 30dB $L_{Aeq,8hr}$ (dB)
Apt 01-01	N	57.2	24.2	-5.8	39.2	+9.2
Apr 01-01	NW	52.4	19.4	-10.6	34.4	+4.4
Apt 01-02	N	58.1	25.1	-4.9	40.1	+10.1
Apt 01-02	NE	52.3	19.3	-10.7	34.3	+4.3
Apt 01-03	S	36.9	3.9	-26.1	18.9	-11.1
Apt 01-03	SE	44.8	11.8	-18.2	26.8	-3.2
Apt 01-04	S	37.2	4.2	-25.8	19.2	-10.8
Apt 01-04	SW	42.1	9.1	-20.9	24.1	-5.9
Apt 02-01	N	55.8	22.8	-7.2	37.8	+7.8
Apt 02-01	NW	51.2	31.8	+1.8	46.8	+16.8
Apt 02-02	N	56.8	23.3	-6.7	38.3	+8.3
Apt 02-02	NE	53.2	29.8	-0.2	44.8	+14.8
Apt -2-03	S	36.4	3.4	-26.6	18.4	-11.6
Apt -2-03	SE	44.1	11.1	-18.9	26.1	-3.9
Apt 02-04	S	36.2	3.2	-26.8	18.2	-11.8
Apt 02-04	SW	40.9	7.9	-22.1	22.9	-7.1
Apt 03-01	N	57.2	24.2	-5.8	39.2	+9.2
Apt 03-01	NE	52.4	19.4	-10.6	34.4	+4.4
Apt 03-02	S	37.1	4.1	-25.9	19.1	-10.9
Apt 03-02	SE	45.1	12.1	-17.9	27.1	-2.9
Apt 04-01	N	58.2	25.2	-4.8	40.2	+10.2
Apt 04-02	S	36.4	3.4	-26.6	18.4	-11.6





APPENDIX V MITIGATION SCHEDULE





▶ Northern Facing Façade

Following the findings from the assessment, it has been recommended that in order to meet the criterion defined within British Standard 8233:2014 the below mitigation measures should be adhered to.

Development Area	Mitigation Measures
Glazing	Standard Glazing (6mm – 12mm airgap – 6mm)
Ventilation	Acoustic Ventilators (Minimum of $D_{n,t,w} + C_{t,r}$ 43dB in open position)

▶ Southern Facing Facade

The Southern Facing Façade (overlooking Muirfield Close) will meet the required criterion with a lower specification ventilation. The following mitigation measures will be suitable:

Development Area	Mitigation Measures
Glazing	Standard Glazing (6mm – 12mm airgap – 6mm)
Ventilation	Acoustic Ventilators (Minimum of $D_{n,t,w} + C_{t,r}$ 19dB in open position)

----End of Report----

