Livingston Homes Ltd

Coombe Valley Road, Dover

Acoustic Design Statement

MLM. Group

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Contents

1 Executive Summary

MLM Consulting Engineers Ltd has been commissioned by Livingston Homes Ltd to assess the impact of noise at the proposed residential development at Coombe Valley Road in Dover. The key acoustic issues are summarised below:

Noise Survey

The assessment has been based on detailed noise measurements made at the Proposed Development site. Environmental sound conditions at the site are mainly affected by road traffic noise from Coombe Valley Road and the A256 London Road, with occasional distant contribution from railway noise.

Initial Site Noise Risk Assessment

During the daytime, the majority of the site is at Low/Medium or Low noise risk, with some areas closer to Coombe Valley road at Medium noise risk. Only areas at less than three metres from Coombe Valley Road are at Medium/High noise risk.

During the night-time, large areas of the site are at Low or Low/Medium risk. Areas of the site closer to Coombe Valley Road are at Medium risk. Only areas at less than seven metres from Coombe Valley Road are at Medium/High noise risk.

Open site noise risk assessment maps for the daytime and night-time periods are presented in Appendix D.

It should also be noted that the noise risk assessment maps are based on $L_{Aeq,T}$ levels (equivalent continuous noise level between 07:00-23:00 for daytime and 23:00-07:00 for night-time). However, L_{Amax} maximum noise events (occasional loud noises) occurring at night have been found relatively high close to Coombe Valley road, which increases the noise risk during the night-time.

Internal Noise Levels

The assessment demonstrates how appropriate internal ambient noise levels can be achieved across the Proposed Development. Example of suitable external building fabric and ventilation strategy for the proposed dwellings are presented in Section 9.1 and Appendix D.

External Amenity Areas

The proposed development does not present private external amenity areas such as gardens or balconies. Therefore, this has been scoped out of the assessment.

Acoustics, Ventilation and Overheating

An outline acoustics and overheating assessment has been carried out to identify the risk of noise ingress during the overheating condition. West facades are at Negligible risk, south façade at Low risk and east facades at Medium risk. North façade facing Coombe Valley road is at High risk of noise ingress if open windows are used to mitigate potential overheating.

Other Relevant Issues

Consideration has been given to other relevant policy and design issues which may have an implication on the outcome of this assessment.

2 Introduction

MLM Consulting Engineers Ltd has been commissioned by Livingston Homes Ltd to assess the impact of noise in support of an outline planning application for a proposed residential development on land at Coombe Valley Road in Dover.

This report presents an Acoustic Design Statement for the above site, including a 'Stage 1: Initial Site Noise Risk Assessment' and a 'Stage 2: Full Assessment', in line with advice on Professional Practice Guidance (ProPG) – Planning & Noise.

The assessment in Stage 1 is based on a detailed environmental noise survey undertaken at the Site. A summary of the noise survey is given in Section 6. A noise model validated at the monitoring positions has been used to predict the noise levels across the site and to inform the subsequent assessment in accordance with ProPG Stage 2.

The report also includes an outline Acoustics and Overheating Risk Assessment in Section 10, identifying the risk of noise ingress if windows need to be open to mitigate overheating.

The report assesses the predicted noise levels across the site and provide outline advice on good acoustic design options to achieve suitable ambient noise levels within habitable rooms.

Whilst every effort has been made to ensure that this report is easily understood, it is technical in nature; a glossary of terms is included in Appendix A to assist the reader.

Details of the Policy, Standards and Guidance used to inform this noise impact assessment are presented in Appendix B.

Full survey methodology and results are presented in Appendix C.

The following noise maps are also presented in Appendix D.

- Figure D.1: Initial Site Noise Risk Assessment – Daytime
- Figure D.2: Initial Site Noise Risk Assessment – Night-time
- Figure D.3: Noise Contour Map – Daytime
- Figure D.4: Noise Contour Map – Night-time
- Figure D.5: Incident L_{Amax} noise levels – Night-time
- Figure D.6: Proposed Outline Façade Mitigation Measures – Daytime (Dining/Living Rooms)
- Figure D.7: Proposed Outline Façade Mitigation Measures – Night-time (Bedrooms)
- Figure D.8: Outline Risk Assessment of Noise Ingress during Overheating Condition

3 Policy, Standards and Guidance Documents

A summary of the relevant policy, standards and guidance documents used to inform the noise impact assessment of the scheme is provided below. Further details are provided in Appendix B.

- National Planning Policy Framework;
- Noise Policy Statement for England;
- National Planning Practice Guidance;
- British Standard BS 8233:2014;
- ProPG Professional Practice Guidance on Planning & Noise;
- British Standard BS 4142:2014+A1:2019;

4 Consultation and Assessment Criteria

4.1 Consultation with the Local Authority

The Environmental Protection Department at Dover District Council was consulted by email on 14 October 2020 with regards to the proposed survey methodology and assessment criteria. Monitoring positions at the Site were also proposed. It was suggested that the assessment would consider the guidance presented above. A response was received on 16 October 2020 from Mr. Liam Flannery, Senior Environmental Protection Officer, confirming his agreement with the proposed approach. Mr. Flannery also confirmed that, in his opinion, traffic flows during the survey period were representative of normal traffic flows at that time of the year, with no substantial decrease in flows due to the Covid-19 outbreak. As such, no adjustments were considered necessary to the measured noise levels.

4.2 Noise Assessment Criteria

As advised in ProPG: Planning and Noise, the following noise level criteria defined within Table 1 have been adopted for this assessment, which would be expected to result in no adverse impact:

Table 1: Noise Levels Criteria

Location	07:00 to 23:00	23:00 to 07:00
Living room	35 dB L_{Aeq}	-
Dining room	40 dB L_{Aeq}	-
Bedroom	35 dB L_{Aeq}	30 dB L_{Aeq} and; ≤10 events > 45 dB L_{Amax}
External Living Areas	50 dB L_{Aeq}	-

It should be noted that BS 8233 advises in Section 7.7.2 Note 7 that '*Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved*'. This relaxation is supported in Section 2.30 of ProPG, on the basis that national planning and noise policy does not require that those internal noise level guidelines are always achieved.

Interpreting the guidance given in BS8233 /WHO/ProPG, with consideration of the guidance given in the NPSE and NPPG Noise, it can be concluded that the noise levels presented above can be considered as 'No Observed Adverse Effect Level (NOAEL)', with a relaxation of 5 dB being considered as 'Lowest Observed Adverse Effect Level (LOAEL)'

In addition, in terms of external noise levels at the wider site, the following criteria can be adopted for the identification of observable effect levels associated with road traffic noise:

Table 2: Identification of Observed Effect Levels

Description	Daytime $L_{Aeq,16\text{-hours}}$, dB	Night-time $L_{Aeq,8\text{-hours}}$, dB	Explanatory Notes
No Observed Adverse Effect (NOEL)	≤50 dB	≤45 dB	No Action
Lowest Observed Adverse Effect Level (LOAEL)	51 to 55	46 to 50	No action required if demand for housing is high and if the ventilation strategy does not require the windows to be open for most of the time.
Observed Adverse Effect Level (OAEL)	56 to 60	51 to 55	Where possible, reduce external noise levels.

Table 2: Identification of Observed Effect Levels			
Description	Daytime $L_{Aeq,16\text{-hours}}$, dB	Night-time $L_{Aeq,8\text{-hours}}$, dB	Explanatory Notes
			Undertake overheating analysis and determine ventilation requirements. Consider dual aspect dwellings and orientation of the site to avoid habitable rooms facing noise source.
Significant Observed Adverse Effect Level (SOAEL)	> 60	> 55	Where possible, reduce external noise levels. Undertake overheating analysis and determine ventilation requirements. Mechanical cooling maybe required. Consider dual aspect dwellings and orientation of the site to avoid habitable rooms facing noise source.

5 Site Description and Development Proposals

5.1 Site Description

The site is located on Coombe Valley road near Dover's town centre. The site is currently being used commercially by Graham Plumber's Merchants, with its associated buildings on site.

The site is bound to the north by Coombe Valley Road, to the east by Graham Plumber's Merchants' building and residential properties, with the A256 London Road beyond. To the south and west it is bound by residential properties. The South Eastern main railway line runs between 60-80m to the west of the site.

The site location and approximate site boundary are shown in Figure 1.

Figure 1 Site Location

5.2 Proposed Development

The proposals comprise a four-storey building with 40 residential units, including one and two bedroom apartments. The Concept Masterplan layout of the current proposal is presented in Figure 2.

Figure 2 Concept Masterplan

6 Baseline Sound Conditions

6.1 Survey Overview

The prevailing sound conditions in the area have been determined by an environmental sound survey. Measurements were conducted between Monday 19 and Tuesday 20 October 2020.

Full details of the survey, including survey methodology, equipment used, survey results and time history graphs are provided in Appendix C. However, for summary purposes, a brief description of the noise climate and relevant noise levels measured is provided in Figure 3 below.

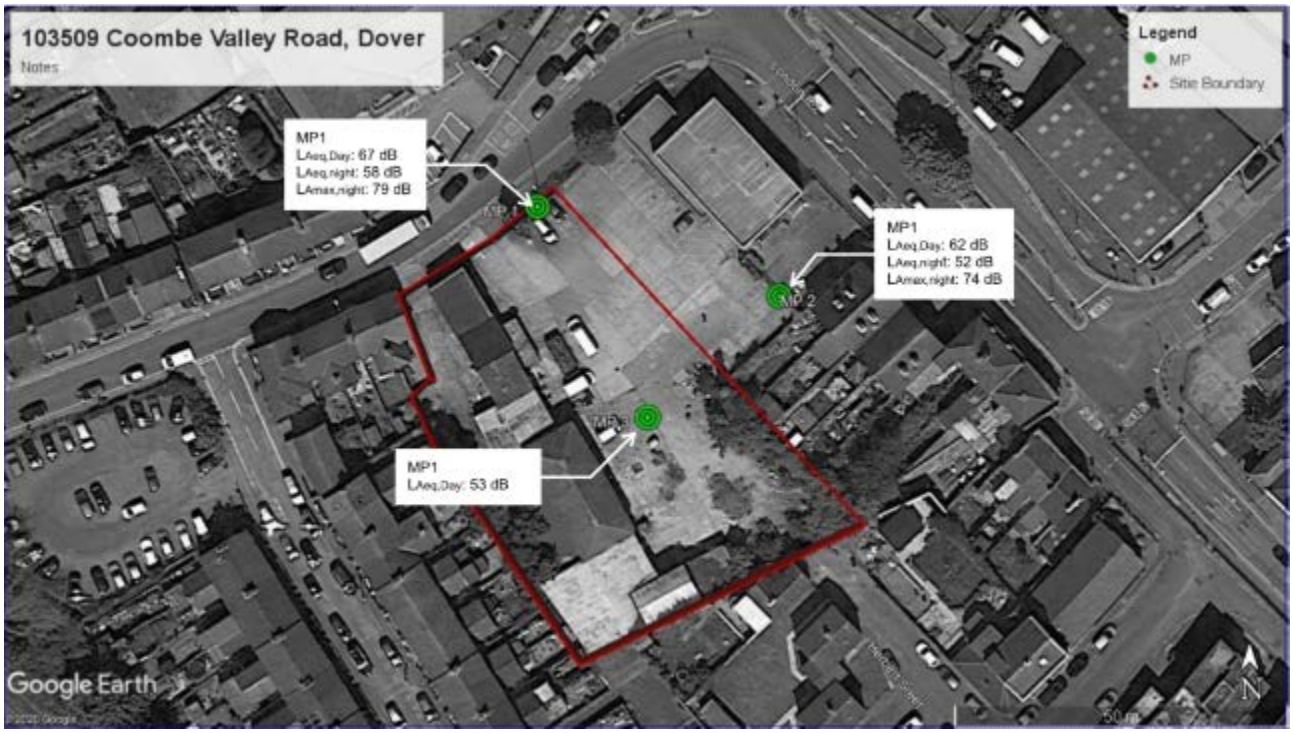


Figure 3: Site Plan Showing Measured Noise Levels

6.2 Local Sound Conditions

Since the survey was largely unattended it is not possible to comment on the specific nature of the noise climate for the entire duration of the survey, however the noise climate during time on site was as follow.

- MP1 - noise climate dominated by road traffic from the adjacent Coombe Valley Road. Occasional noise from freight trains on the South Eastern main railway line was audible, albeit at a much lower level than from the road.
- MP2 - noise climate dominated by road traffic from the A256 London Road.
- MP3 - noise climate dominated by road traffic from Coombe Valley Road and to a lesser extent from the A256 London Road, which was partially screened by buildings at this position.

7 Noise Modelling Approach

The likely effect of noise sources in the vicinity of the site has been predicted using the Cadna/A suite of noise modelling software, to determine the likely noise levels at the location of the proposed residential development. This software utilises standard acoustic principles in conjunction with approved prediction methodologies and it is a tried and tested method for accurately predicting and assessing the impact of noise from a variety of sources.

In addition to the source noise levels used in the predictions, the model also considers the effects of the topographical conditions throughout the area, ground absorption, acoustic reflections and acoustic screening.

For 'Stage 1: Initial Site Noise Risk Assessment' the noise model was validated to ensure that the $L_{Aeq,T}$ levels predicted at the location of the monitoring positions were an accurate reflection of real world measured noise levels, both at daytime and night-time periods. Existing buildings to be demolished were not included to account for an open site.

For the 'Stage 2: Full Assessment', the proposed build form of the Concept Masterplan is included in the model, and both equivalent continuous noise level ($L_{Aeq,T}$) and maximum noise levels ($L_{Amax, night}$) assessed. For predicting the potential impacts of maximum noise events from the railway line at night, a reasonable worst-case approach has been taken by using a reference maximum sound level from a diesel locomotive of 88 dB L_{Amax} at 15m[1].

[1] Transit Noise and Vibration Impact Assessment, Office of Planning and Environment Federal Transit Administration, USA, May 2006

8 Stage 1: Initial Site Noise Risk Assessment

8.1 Section Overview

The results of the environmental noise survey and the noise modelling exercise have been used to determine the noise levels and the potential noise risk across the open site. Open site noise risk assessment maps for the daytime and night-time periods are presented in Appendix D.

8.2 Noise Risk Assessment

The noise maps identify that during the daytime (07:00 – 23:00) the majority of the site is at Low or Low/Medium risk, with some areas closer to Coombe Valley Road at Medium risk. Only areas at less than three metres from the site boundary close to Coombe Valley Road are at Medium/High risk.

During the night-time (23:00-07:00) large areas of the site are at Low or Low/Medium risk. Areas of the site closer to Coombe Valley Road are at Medium risk. Only areas at less than seven metres from the site boundary close to Coombe Valley Road are at Medium/High risk.

It must be noted that the above noise risk assessment considers an open site, without the built form of the proposed development. It should also be noted that individual noise events (L_{Amax}) during the night were found to be relatively high, particularly close to Coombe Valley Road, which would increment the noise risk of the site during the night-time period.

From the initial noise risk assessment, it is concluded that the majority of the site is acceptable from a noise perspective. Areas of the site closer to Coombe Valley Road present more acoustic challenges. The following Stage 2 Full Assessment confirms how the adverse impacts of noise will be mitigated and minimised, and demonstrates that significant adverse noise impact will be avoided in the finished development.

9 Stage 2: Full Assessment

In accordance with Stage 2 of Professional Practice Guidance (ProPG) – Planning & Noise, a full noise assessment of the proposed development Coombe Valley Road in Dover has been undertaken.

9.1 Internal Noise Level Guidelines

In order to achieve appropriate noise levels within internal living spaces, the dwellings themselves need to be considered with regards to the level of façade mitigation required. BS 8233:2014 and ProPG recommend internal noise levels of <35 dB(A) in living rooms and bedrooms during the daytime (07:00 – 23:00) and <30 dB(A) in bedrooms during the night-time (23:00 – 07:00). In addition, ProPG recommends that individual noise events should not normally exceed 45 dB $L_{Amax,F}$ more than 10 times per night in bedrooms and no event higher than 55 dB $L_{Amax,F}$ should be permitted.

It is worth noting that ProPG guidance clearly states that "*designing the site layout and the dwellings so that the internal target noise levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet the internal target levels with windows open, internal noise levels can be assessed with windows closed, however, any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the open position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded.*"

The assessment has aimed to achieve the internal target levels with open windows in as many dwellings as possible, which is mostly achieved during the daytime. At facades where closed windows and suitable ventilation are required in order to achieve the target internal noise levels, it is necessary to determine the minimum acoustic performance requirements of the building envelope and the ventilation system.

Building Envelope Sound Reduction Requirements

The glazing and ventilation elements are typically the weakest acoustic link in the construction of a building facade. Therefore, in order to assess the acoustic performance of the proposed dwellings, it is appropriate in the first instance to explore the level of protection that will be afforded by the performance of the glazing and ventilation elements.

The Building Regulation Approved Document F (ADF) recommends continuous 'whole dwelling ventilation' to provide fresh air to the building. Internal noise levels should be considered in the context of room ventilation requirements.

In order to achieve the target daytime and night-time internal noise levels, it is necessary to determine the minimum acoustic performance requirements of both the glazing and ventilation system. It is assumed that the default choice of glazing for the habitable rooms of the proposed development will be standard thermal double glazing and the default choice for ventilation will be window-mounted trickle ventilators (referred to in ADF as 'background ventilators').

To determine the glazing and ventilation acoustic requirements in order to provide an adequate level of protection against external noise intrusion, $L_{Aeq,16hour}$ daytime and $L_{Aeq,8hour}$ /L_{Amax} night-time noise levels have been predicted at the building façades. Accordingly, the required composite sound reduction performance for the worst-case dwelling façade has been determined, to provide appropriate internal noise levels.

For the purposes of this outline planning application and based on indicative floor plans, the assessment assumes bedrooms floor dimensions of 11m^2 and dining/living rooms floor dimensions of 22m^2. Total windows size have been assumed to be 1.7m^2 in bedrooms and 2.5m^2 in dining/living rooms. It has also been assumed that bedrooms are to be acoustically 'soft', with carpets, curtains and other soft furnishings, and living rooms to have a hard floor finish and to be less acoustically absorptive. For the purposes of our analyses we have assumed the following absorption coefficients:

Table 3: Assumed Absorption Coefficients (α) at Octave Band Centre Frequency (Hz)							
Room	63	125	250	500	1k	2k	4k
Bedroom	0.15	0.18	0.25	0.26	0.30	0.31	0.31
Living Room	0.16	0.19	0.22	0.23	0.23	0.23	0.25

As a reference, the following standard constructions and associated acoustic performance have been considered for the external wall, roof, glazing and ventilation elements.

Wall

The Table below sets out the performance requirement for the external wall (non-glazed elements).

Table 4: Sound Reduction of Example External Wall, R (dB)									
External Wall Example	Frequency (Hz)							R_w	C_{tr}
	63	125	250	500	1k	2k	4k		
260kg/m^2 brick wall	31	36	40	41	45	52	52	46	-3

Roof

The Table below sets out the performance requirement for the roof.

Table 5: Sound Reduction of Example External Roof, R (dB)									
Roof Example	Frequency (Hz)							R_w	C_{tr}
	63	125	250	500	1k	2k	4k		
Flat Roof, 100mm reinforced concrete (230 kg-m2)	34	39	40	49	53	57	57	52	-5

Glazing

Table 6: Sound Reduction Performance of Example Glazing Options, R (dB)									
Glazing Examples	Frequency (Hz)							R_w	C_{tr}
	63	125	250	500	1k	2k	4k		
Standard Double Glazing (4mm/12mm/4mm)	19	24	20	25	34	37	35	31	-4
Enhanced Double Glazing (10mm/12mm/6mm)	21	26	27	34	40	38	46	37	-4
Acoustic Laminated Double Glazing 8.4(lam)/12mm/10.8(lam)	23	28	29	39	44	50	61	42	-6
Double Window (separate frames) 10mm-200mm-6mm	30	35	46	46	46	56	65	49	-4

The 4mm/12mm/4mm notation refers to a glazing unit comprising two 4mm pane's of glass separated by a 12mm air gap, and similarly for the other notations. The glazing system performance specifications detailed above apply to the glazing package as a whole, inclusive of glazing, framing, spandrel panels, etc. The performance of the glazing systems will depend on many factors, such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc. Performance specifications are frequency specific. Overall performance values are given for guidance purposes only.

Ventilation

The Table below sets out the performance requirement for the ventilation elements to comply with ADF 'whole dwelling ventilation' condition when windows need to be closed to avoid noise ingress.

Table 7: Acoustic Performance of Example Ventilation Options, D (dB)

	Frequency (Hz)							D_{new}
Ventilation Element Examples	63	125	250	500	1k	2k	4k	
Hit & Miss Standard Trickle Vent	26	31	31	31	37	28	31	32
Acoustic Trickle Vent (I)	26	31	33	42	43	39	44	41
Acoustic Trickle Vent (II)	27	32	33	42	45	52	56	44

One trickle ventilator or air inlet has been assumed per room. Where more ventilators are used, the acoustic performance of the ventilators would need to be upgraded by 10*log(N); being N the number of ventilators per room'.

Windows may be openable for purge ventilation purposes at the user's discretion, as this is applicable only to occasional occurrences, such as to remove smoke from burnt food, and not subject to acoustic assessment.

Façade Mitigation Options

In practice, using the built form of the development is in many cases a very efficient form of reducing site-wide noise levels from the dominant noise source, which in this instance is Coombe Valley Road. This typically results in building frontage being exposed to higher noise levels, hence this would need to be sufficiently mitigated, to provide suitable internal noise levels to future residents.

Based on the results of the noise modelling exercise for the Concept Masterplan, the following table provides examples of façade mitigations to achieve the Indoor Ambient Noise Levels Guidelines. When ventilation means other than partially open windows are required, windows should be closed and ventilators in the open position.

Table 8: Example of Suitable Façade Mitigations

External Noise $L_{Aeq,T}$ dB		Mitigation Type	Glazing	R_W+C_{tr}	Ventilation	D_{new}
Day	Night					
≤50	≤45	TYPE 1a	Standard Double Glazing	-	Partially Open Windows	-
51-55	46-50	TYPE 1b	Standard Double Glazing	-	Partially Open Windows (5 dB relaxation)	-
56-60	51-55	TYPE 2	Standard Double Glazing	27	Standard Trickle Vent	32
61-65	56-60	TYPE 3	Enhanced Double Glazing	33	Acoustic Trickle Vent (I)	41
66-70	61-65	TYPE 4	Acoustic Laminated Double Glazing	36	Acoustic Trickle Vent (II)	44

Table 8: Example of Suitable Façade Mitigations						
71-75	66-70	TYPE 5	Double Window (Separate Frames)	45	Mechanical Ventilation	-

The results of the assessment identify that during the daytime (Dining/Living Rooms) large areas of the development can achieve suitable internal ambient noise levels using natural ventilation with windows partially open (i.e. mitigation Type 1). Also large areas exposed to slightly higher ambient noise levels would achieve 'reasonable' internal noise levels with windows partially open (Type 1b). Dining/Living rooms closer to Coombe Valley Road would need to use closed windows and trickle ventilation to avoid excessive noise ingress (façade Types 2 and 3).

Figure D.6 in Appendix D of this report graphically outlines the mitigation type required at each façade during the daytime (Dining/Living Rooms) of the proposed residential development.

During the night-time (Bedrooms) the noise guideline levels would be exceeded with windows open, mostly due to maximum noise events from road traffic and railway traffic. The majority of the facades can be provided with standard double glazing and standard trickle vents (façade Type 2). However, bedrooms closer to Coombe Valley Road would need enhanced façade mitigation (façade Type 3 and Type 4).

Figure D.7 in Appendix D of this report graphically outlines the mitigation type required at each façade during the night-time (Bedrooms) of the proposed residential development.

The above outline mitigation measures demonstrate that appropriate internal noise levels are achievable throughout the entire development with the use of suitable façade treatments and ventilation strategy.

It should be noted that the façade mitigations detailed in Table 8 apply to habitable rooms only, such as dining/living rooms and bedrooms. For non-habitable rooms, such as kitchens, bathrooms, stairways, halls, landings etc, lower façade insulation performances would be permissible.

The glazing and ventilation strategy above is given as a reference only. Other glazing and ventilation units may be suitable and it is the responsibility of the contractors and manufacturers to recommend and provide appropriate systems.

The above analysis is provided to demonstrate that a design solution is feasible at the proposed development for the purposes of obtaining a grant of planning permission and not necessarily for the purposes of detailed design or glazing procurement. The detailed design of the proposed properties will affect both the required sound reduction performance and the appropriate selection of glazing and ventilator units. The aspects of the detailed design that are important are the room dimensions, room finishes, window dimensions and the sound reduction performance of non-glazed elements, which should be assessed at detailed design stages.

9.2 Assessment of Other Relevant Issues

Compliance with Relevant National/Local Policy

The principals of the NPPF and NPSE have been followed by mitigating noise levels with the provisions of appropriate building envelope specifications and ventilation strategies.

Magnitude and Extent of Compliance with ProPG

The site layout is such that the majority of dwellings fall within the Low and Medium/Low risk areas with a small number of dwellings closer to coombe valley Road within the Medium risk zone. Only the development frontage at Coombe Valley Road will be at the Medium/High risk zone, and appropriate mitigation have been proposed.

The vast majority of the development can achieve suitable or reasonable internal ambient noise levels using natural ventilation with windows partially open during the day. At night, opening windows will lead to internal noise levels guidelines exceeded, therefore alternative means of ventilation are proposed.

Due to the constraints of the site, it is not feasible to set back the building frontage to increase the separation distance with Coombe Valley Road sufficiently to substantially reduce the noise impact. From an architectural and development perspective, the current positioning of the building is key to the street scene. Also, relocation of the building footprint would cause loss of units making the scheme financially unviable.

Guidance on the façade acoustic performance have been given including ventilation. Appropriate indoor acoustic conditions can be achieved following the building envelope and ventilation strategy design advice provided in this report.

Acoustic Design versus Unintended Adverse Consequences

The implications of the acoustic design should not be considered in isolation of other design issues. Mitigations against noise ingress may affect the strategies for ventilation and prevention of overheating, and vice versa.

This report includes an outline assessment of risk of noise ingress if windows are open to mitigate overheating. If facades at Medium or High risk of noise ingress are deemed to overheat (to be assessed by Building Services engineers in due course) then a more detailed Acoustics and Overheating assessment is recommended.

Acoustic Design versus Planning Objectives

The current need for additional houses in the area, and across the country, brings challenges with regards to the acoustic design of developments close to the transportation networks. The acoustic advice provided in this assessment allows indoor acoustic conditions to be achieved through carefully considered design work.

10 Acoustics, Ventilation and Overheating

To avoid significant adverse impacts on residents, it should be ensured that apartments do not overheat for prolonged periods. Enhanced ventilation rates are often required to mitigate overheating and therefore it is possible that higher noise levels may be experienced in habitable rooms during this ventilation condition.

It should be ensured that noise levels within habitable rooms do not exceed the guideline values from The Association of Noise Consultants' Acoustics Ventilation and Overheating: Residential Design Guide (AVO), during the overheating condition.

At this stage an initial risk assessment of noise ingress during the overheating condition is provided to inform the overheating ventilation strategy. It presents the risk of noise ingress at each façade of the development if open windows are used to mitigate overheating. Figure D.8 presents facades at High, Medium, Low and Negligible risk of adverse noise effect during periods of overheating.

Where a Negligible or Low risk has been predicted, windows may be openable to mitigate overheating, at Medium risk, windows may be open for short periods to mitigate overheating, but if extended periods of open windows are required, alternative mitigation measures should be sought. Where a High risk is predicted, significant adverse effects due to noise would occur with windows open during the overheating condition. Therefore, alternative methods of ventilation or cooling should be considered.

According to the AVO guide a level 2 assessment is "*recommended*" in areas of High risk and a level 2 assessment is "*optional*" in areas of Medium or Low risk. For Negligible risk areas an assessment of noise ingress during overheating condition is not necessary.

A TM59 overheating assessment should be undertaken by the Building Services Engineers to determine which facades might experience overheating and the necessary measures to mitigate it. Mitigations should be coordinated with acoustics to control excessive noise ingress during the overheating condition. In order to undertake a level 2 acoustic assessment additional information would be required such facades at risk of overheating, as estimation of how frequently and for what duration open windows are required to mitigate overheating, ventilation opening areas, etc.

For the Medium Risk and High risk facades, there is potential for adverse noise impact if windows are required to be open to mitigate overheating. It is therefore recommended that alternative means for mitigating overheating are used for rooms on these facades.

Measures for the mitigation of overheating may include the following:

- Reduced window sizes;
- Increased solar control in the glazing (lower G values);
- Solar shading;
- Enhanced provision of thermal mass.

If additional ventilation is still deemed to be necessary to mitigate overheating then the following measures may need to be considered:

- Incorporating oversized acoustic ventilators;
- Design a system where windows may be open in unoccupied rooms;
- Using an MVHR boost system with a heat recovery bypass system for warmer weather;
- Using comfort cooling.

The results of the Acoustics and Overheating assessment show that west and south facades are at Negligible and Low risk of noise ingress during overheating condition respectively. East facades are at Medium risk of noise ingress if windows are open to mitigate overheating, while north façade facing Coombe Valley road is at high risk of noise ingress.

It should be noted that this outline assessment does not consider individual noise events at night (L_{Amax}), which should be assessed at further stages if the building is predicted to overheat for prolonged periods with windows closed.

Figure D.8 in Appendix D of this report graphically outlines the risk of noise ingress during the overheating condition at each façade of the proposed residential development.

11 Building Services Noise Emission

11.1 Proposed Plant Installations

Noise from potential plant installation should be controlled so that it does not adversely affect the nearest Noise-Sensitive Receptors (NSRs). At this stage of the design, the layouts are not showing any potential external plant in the development, however a noise limiting exercise has been undertaken in case plant installations are finally proposed.

11.2 Nearest Noise Sensitive Receivers (NNSR)

The nearest/worst-affected existing noise-sensitive receptors are expected to be the residential properties along the site perimeter, as shown in Figure 1.

11.3 External Sound Level Criteria

The Assessment is based on the following guidance:

- British Standard 4142:2014+A1:2019 Method for Rating and Assessing Industrial and Commercial Sound.

The noise criteria set out in Table 9 are proposed to ensure that the sound rating level do not exceed the typical measured background sound level at the nearest noise sensitive receptor. These limits apply to the operating hours of the installation, which may be during the daytime and night-time periods.

Table 9: Proposed Plant Noise Rating Limits

NSR Location	Operating Period	Typical Measured Background Noise Level $L_{A90,T}$	Proposed "Rating Level" At The Nearest Noise Sensitive Receptor $L_{Ar,T}$
Dwellings facing Coombe Valley Road	Daytime (07:00-23:00)	57	54
	Night-time (23:00-07:00)	37	37
Others	Daytime (07:00-23:00)	48	48
	Night-time (23:00-07:00)	33	33

The above limits apply to the total sound emission level from all static plant within the proposed Development. Individual plant items may need to be designed to a lower limit such that the overall total achieves the stated criteria above. Should the proposed plant items be found to be tonal, or impulsive in nature (so as to attract attention), a penalty correction would likely be applied to the above limits.

11.4 Practical Control Measures

Screening of any external plant as well as provision of sound attenuators to items of plant may be necessary to control the transmission of sound and achieve the above criteria as well as to reduce the sound level produced by the plant to a reasonable extend around the footprint of the building itself.

Environmental attenuators and possibly other means of sound mitigation such as acoustic louvres or acoustic screens may be required to control sound emanating from the plantrooms, air intake and discharge points or from externally mounted plant.

Locating the future plant installation as far as possible from the NSRs and using the proposed building to screen any future plant items would to ensure compliant emissions sound levels.

11.5 Indoor Ambient Noise Levels from Mechanical Services

The Association of Noise Consultants' Acoustics Ventilation and Overheating: Residential Design Guide (AVO) provides guidance on desirable internal ambient noise levels in bedrooms and living rooms from mechanical services. A summary is presented below.

Table 10: Proposed Indoor Ambient Noise Levels from Mechanical Services

Ventilation Condition	Bedrooms L_{Aeq}	Living Rooms L_{Aeq}
Continuous whole dwelling ventilation	≤ L_{Aeq} 26 or 30 dB [Note 1]	≤ L_{Aeq} 30 dB
Overheating condition	L_{Aeq} 30 (± 5) dB	L_{Aeq} 35 (± 5) dB

[Note 1] *Evidence indicates that "a more prudent limit for mechanical services noise around 24 – 26 dB(A) is likely to be required to prevent an adverse reaction from most occupants while falling asleep.*

12 Conclusions

MLM Consulting Engineers Limited has been commissioned by Livingston Homes Ltd to assess the impact of noise in support of an outline planning application for a residential development at Coombe Valley Road, Dover.

This report presents an Acoustic Design Statement of the proposed development site in line with Professional Practice Guidance (ProPG) – Planning & Noise.

The underlying noise modelling exercise and acoustic assessment is based on a detailed noise survey undertaken at the site between Monday 19 and Tuesday 20 October 2020.

From the full noise assessment presented here, it can be concluded the Site is acceptable from a noise perspective providing that dwellings' facades are provided with the minimum sound reduction performance as presented in Table 8 above and in Figure D.7 in Appendix D.

This assessment demonstrates that appropriate internal ambient noise levels are entirely achievable through the use of suitable façade treatments.

Consideration has also been given to other relevant issues, such as the risk of noise ingress during the overheating condition.

Adoption of the mitigation options presented in this report would mitigate and minimise adverse impact in the finished development, ensuring that significant adverse noise impacts are avoided. In policy terms, this is considered to not exceed the LOAEL (Lowest Observed Adverse Effect Level).

This report demonstrates that ProPG Stage1 and 2 have been followed, including an Acoustic Design Statement that adequately demonstrates good acoustic design. Accordingly, it is recommended that planning consent may be granted subject to the inclusion of suitable noise conditions to reflect the recommendations of this report.

Appendix A - Glossary of Acoustic Terminology

Wording	Description
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

Appendix B - Policy, Standards and Guidance

National Planning Policy Framework, 2019[2]

The revised National Planning Policy Framework (NPPF) published on July 2018 and updated on 19 June 2019 sets out the Government's planning policies for England and how these are expected to be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. The National Planning Policy Framework must be taken into account in preparing the development plan, and is a material consideration in planning decisions.

The document estates that the purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

NPPF goes on to suggest that achieving sustainable development means that the planning system has three overarching and interdependent objectives: an economic objective, a social objective and an environmental objective.

Planning policies and decisions should play an active role in guiding development towards sustainable solutions, but in doing so should take local circumstances into account, to reflect the character, needs and opportunities of each area.

At the heart of the Framework is a presumption in favour of sustainable development, which for decision-taking it means:

- Approving development proposals that accord with an up-to-date development plan without delay; or
- Where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:
  - i. The application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or
  - ii. Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.

Under Section 11; Making effective use of land, the following is stated:

Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions.

Regarding noise pollution, the document states the following:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

[2] National Planning Policy Framework, Ministry of Housing, Communities and Local Government, February 2019

- *The revised NPPF introduces the concept of 'agent of change' and states:*
  - *Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*

As stated above, this document makes reference to mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development, but does not set absolute criteria, so reference has been made to BS8233: 2014, which provides definitive guidance for amenity levels.

Noise Policy Statement for England, 2010[3]

The underlying principles and aims of existing noise policy documents, legislation and guidance are clarified in the Noise Policy Statement for England (NPSE). The NPSE sets out the 'Long Term Vision' of Government noise policy as follows*: "Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development"*.

The NPSE outlines the following three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- *"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".*

The guidance defines three established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation (WHO):

- "NOEL (No observed Effect Level) – This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise";
- "LOAEL (Lowest Observed Adverse Effect Level) – This is the level above which adverse effects on health and quality of life can be detected"; and
- "SOAEL (Significant Observed Adverse Effect Level) – This is the level above which significant adverse effects on health and quality of life occur".

The guidance also states that 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 and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

[3] Noise Policy Statement for England, Defra, March 2010

National Planning Practice Guidance, England[4]

Further guidance in relation to the National Planning Policy Framework and the Noise Policy Statement for England has been published in the National Planning Practice Guidance in England: Noise (NPPG-Noise), which summarises the noise exposure hierarchy, based on the likely average response.

The National Planning Practice Guidance (NPPG) has been revised and updated to be easily accessible and available online.

The Noise Guidance advises on how planning can manage potential noise impacts in new development. It sets out when noise is relevant to planning and outlines the following Observed Effect Levels to determine the noise impact:

- 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.

The document recognises the subjective relationship between noise levels and the impact on those affected, and advises on factors which may influence on whether noise could be a concern.

The significance criteria from NPPG-Noise is reproduced in Table B1 below.

[4] National Planning Practice Guidance for England: Noise. Ministry of Housing, Communities and Local Government, March 2014.

Table B1: Significance Criteria From NPPG In England: Noise			
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 (LOAE)			
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

British Standard BS 8233:2014[5]

BS 8233:2014 provides guidance on internal acoustic environments in difference types of space. The Standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guidance values, as detailed below.

Table B.2: BS 8233:2014 Indoor Ambient Noise Levels (IANL)			
Activity	Location	Daytime 07:00 – 23:00	Night-time 23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,16hour}$

BS 8233:2014 goes on to suggest that where a development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

With regards to maximum noise levels, the Standard identifies that regular individual noise events (such as passing trains or scheduled aircraft etc.) can cause sleep disturbance. The Standard does not provide a guideline design target, but simply goes on to suggest that a guideline value may be set in terms of SEL or L_{AFmax}, depending upon the character and number of events per night. It goes on to suggest that more sporadic noise events could require separate values.

In respect of external noise levels, the guidance in BS 8233:2014 suggests that "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."

BS 8233:2014 provides a much more detailed narrative on noise levels in external amenity areas and acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within these guideline values.

In respect of gardens and patios, BS 8233:2014 states; "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."

It is clear from the narrative of BS 8233:2014, that proposed development within noisy environments should be designed to ensure that the recommended internal design standards are achieved, and that noise levels in external amenity areas are designed to effectively control and reduce noise levels, although it acknowledges that in certain circumstances meeting the external design recommendations may not be feasible, or necessary, especially where the provision of such spaces is desirable for other technical, planning or policy reasons.

[5] British Standard BS 8233:2014 Guidance on sound insulation and noise reduction for buildings, BSI, 2014

ProPG: Professional Practice Guidance on Planning & Noise[6]

ProPG was published on 22 June 2017 and the scope is restricted to new residential development exposed predominantly to airborne noise from transport sources. The guidance encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. The guidance was prepare by the Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health. It encourages a holistic design process where acoustics is integral to the living environment. This covers careful site layout and better orientation of rooms within dwellings. ProPG acknowledges and reflects the Noise Policy Statement for England, the National Planning Policy Framework and Planning Policy Guidance – Noise. The recommended approach for new residential development is in two stages; Stage 1 is an initial noise risk assessment of the proposed development site for an early indication of the initial suitability of the site for new residential development. Stage 2 is a systematic consideration of four key elements:

- Demonstrating a "Good Acoustic Design Process";
- Observing internal "Noise Level Guidelines";
- Undertaking an "External Amenity Area Noise Assessment";
- Consideration of "Other Relevant Issues".

For reference, the indicative noise levels for the initial site noise risk assessment as presented in ProPG are illustrated below.

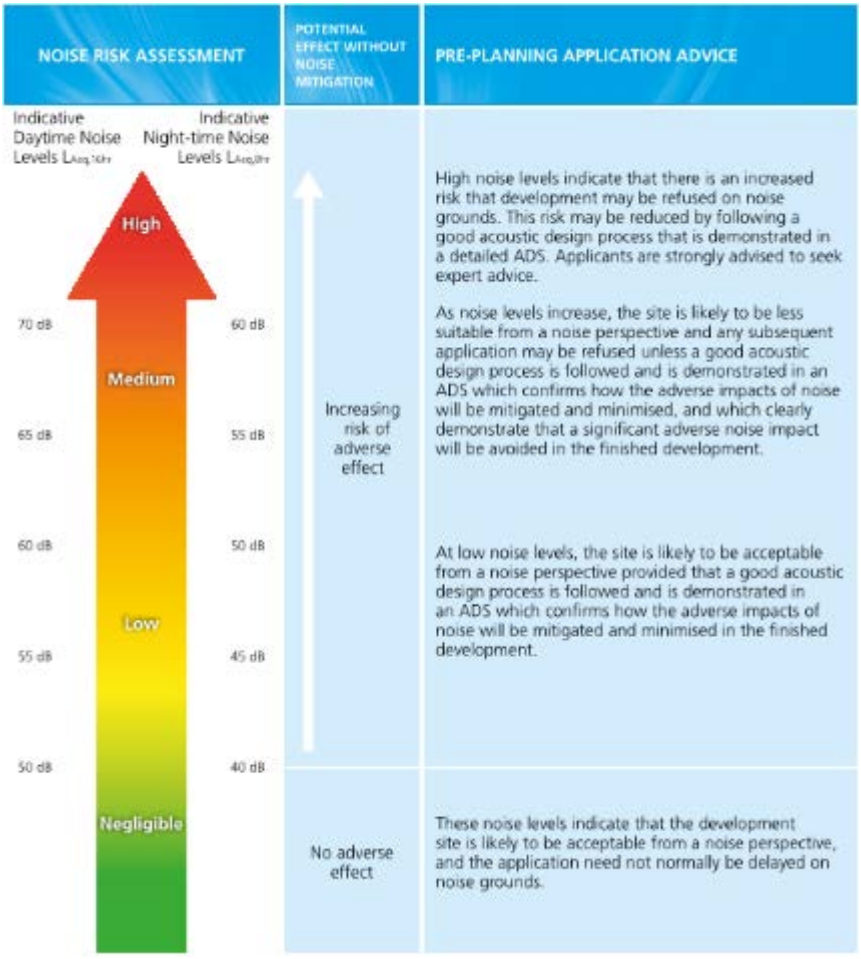


Figure B.1: Stage 1 – Initial Site Noise Risk Assessment

[6] ProPG: Professional Practice Guidance on Planning & Noise. ANC, IOA, CIEH, May 2017

Good Acoustic Design Process

General principles (in order of preference):

i. Maximising spatial separation of noise sources and receptors;
ii. Reducing existing noise levels or relocating noise sources, if possible;
iii. Using existing topography and existing structures;
iv. Incorporating noise barriers as part of the scheme;
v. Using layout to reduce noise propagation across the site;
vi. Using orientation to reduce noise exposure of sensitive rooms;
vii. Using building envelope to mitigate noise.

Internal Noise Level Guidelines

This guidance is based on BS 8233:2014 and World Health Organisation recommendations. Internal ambient noise levels (IANL) are provided in Table B.1. In addition to these values, there is a recommendation for individual noise events to not normally exceed 45 dB $L_{Amax,F}$ more than ten times a night in bedrooms.

ProPG guidance clearly states "*designing the site layout and the dwellings so that the internal target noise levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet the internal target levels with windows open, internal noise levels can be assessed with windows closed, however, any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the open position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.*"

Note 7 from ProPG, states that "*Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form*"

External Amenity Areas

External amenity areas which are an intrinsic part of the overall design should ideally not be above 50-55 dB $L_{Aeq,16hr}$; or designed to achieve the lowest practicable noise levels (BS 8233:2014).

If significant adverse noise impacts remain on any private external amenity space then this is partially off-set if residents are provided with access to a "relatively quiet" alternative external amenity space.

Consideration of Other Relevant Issues

- Compliance with relevant national/local policy;
- Magnitude and extent of compliance with ProPG;
- Likely occupants of the development;
- Acoustic design versus unintended adverse consequences;
- Acoustic design versus planning objectives.

British Standard BS 4142:2014[7]

BS 4142 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS 4142 for assessing the effect of sound is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', with the $L_{A90,T}$ background sound level at the assessment location.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

BS 4142 states: "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

Table B.3: Classification of Industrial/Commercial Noise Impacts	
Difference Between Rating Sound Level and Background Sound Level (Db)	Impact Category (depending on the context)
+ 10 dB or more	Significant adverse impact
+ 5 dB	Adverse impact
Equal or less than	Low impact

For the daytime, the assessment is typically carried out over a reference time period of one hour, but at night-time it is carried out over a 15 minute period. The periods associated with day or night, for the purposes of the Standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound 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 sound level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, and would therefore classified as a No Observed Adverse Effect Level.

[7] BS 4142:2014+A1:2019 'Methods for Rating & Assessing Industrial & Commercial Sound ', BSI, 2019

Appendix C - Environmental Noise Survey

Baseline Sound Conditions

The prevailing sound conditions in the area have been determined by an environmental sound survey. Measurements were conducted between Monday 19 and Tuesday 20 October 2020.

Measurements

Unattended sound measurements were carried out at two positions; MP1 and MP2 for the duration of the survey. In addition, short-term attended measurements were carried out at MP3 on 20 October 2020.

The measurement positions and summary of results are described below and shown in C.1.

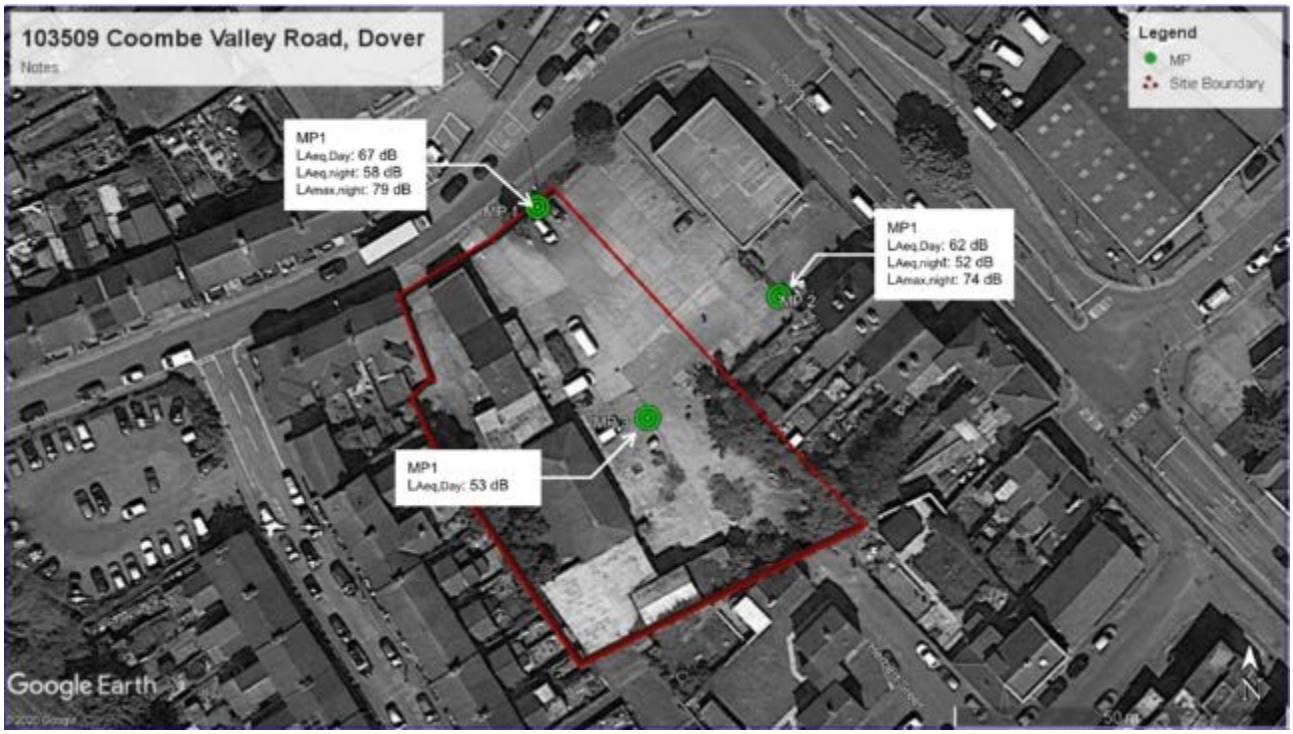


Figure C.1: Measurement positions

MP1 – Unattended measurement position on the north boundary of the site. The microphone was installed on free-field conditions at a height of 3.5m above ground level and at a distance of approximately 5m from the nearest carriageway edge of Coombe Valley Road. This location is representative of the ambient sound levels from Coombe Valley Road.

MP2 – Unattended measurement position to the east of the site. The microphone was installed on free-field conditions at a height of 3.5m above local ground level and at a distance of approximately 20m from the nearest carriageway edge of London Road (A256). This location is representative of the ambient sound levels from London Road.

MP3 – Short-term attended measurement position in the middle of the site. The microphone was installed on free-field conditions at a height of 1.7m above local ground level and at a distance of approximately 40m from Coombe Valley Road and 45m from London Road. This location is representative of the ambient sound within the site away from the main noise source.

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and in accordance with the principles of BS 7445[8]. All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[9].

[8] British Standard 7445: 2003: Description and measurement of environmental noise. BSI.
[9] British Standard 61672: 2013: Electroacoustics, Sound level meters. Part 1 Specifications. BSI.

A full inventory of this equipment is shown below.

Table C1: Inventory of Sound Measurement Equipment				
Item	Make & Model	Serial Number	Calibration Certificate Number	Date of Expiration of Calibration
Sound Level Meter	01dB Fusion	12089	CV-DTE-19-PVE-68072	24-May-21
Preamplifier	01dB PRE-22N°	1805176		
Microphone	GRAS 40CE	331995		
Sound Level Meter	RION - NA28	860027	TCRT19/1109	06-Feb-21
Preamplifier	RION - NH23	60027		
Microphone	RION - UC59	10030		
Calibrator	01dB - Cal31	87808	TCRT20/1198	02-Apr-21

The sound measurement equipment used during the survey was calibrated at the start and end of the measurement period. No significant drift in calibration was found to have occurred.

The calibrator used has been calibrated by an accredited calibration laboratory within the twelve months preceding the measurements. Calibration certificates are available upon request.

Weather conditions during the survey period were suitable for environmental noise measurements, being dry and with wind speeds below 5m/s. All microphones were fitted with a protective windshield.

Noise Climate

Since the survey was largely unattended it is not possible to comment on the specific nature of the noise climate for the entire duration of the survey, however noise sources were noted during time on site.

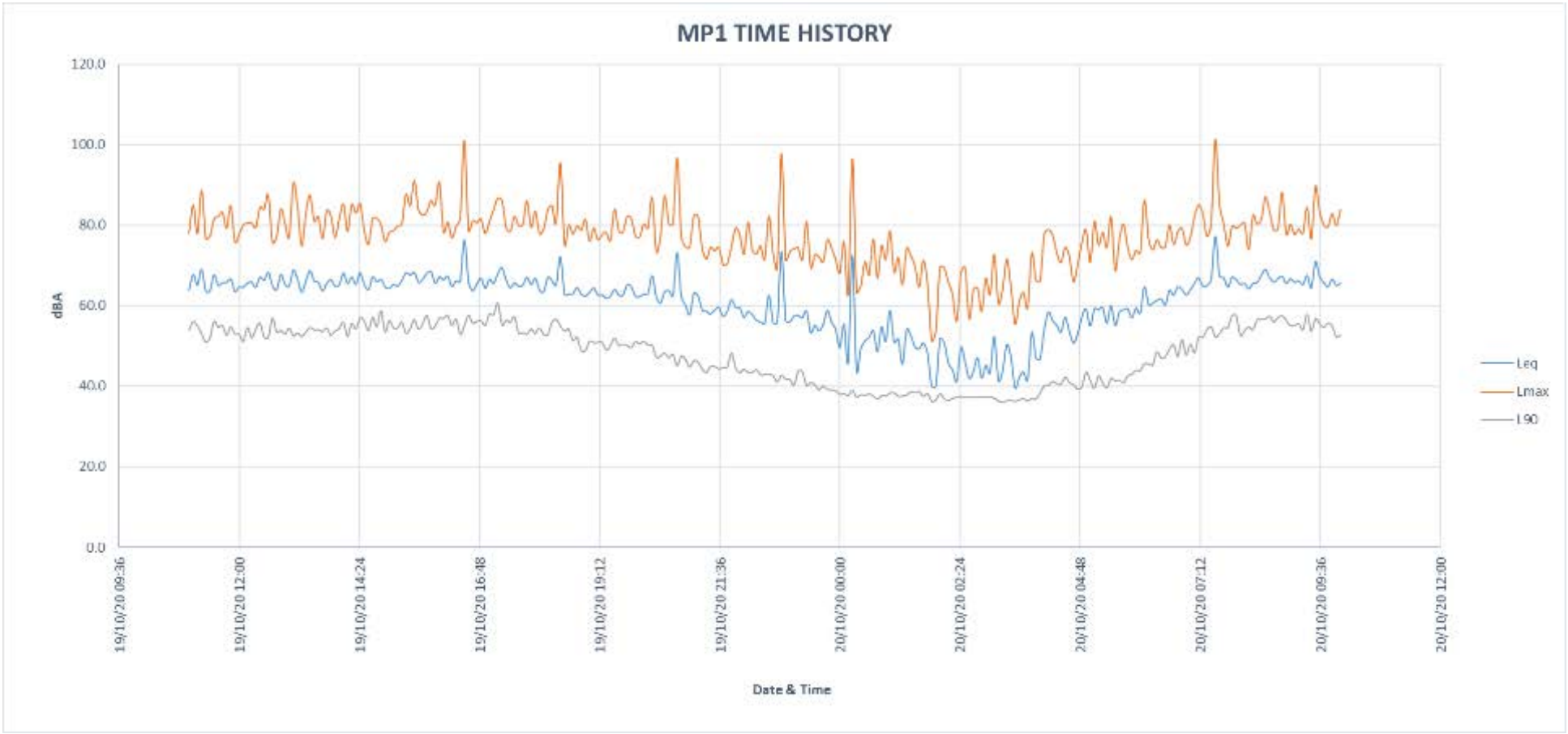
- MP1 - noise climate dominated by road traffic from the adjacent Coombe Valley Road. Occasional noise from freight trains on the South Eastern main railway line was audible, albeit at a much lower level than from the road.
- MP2 - noise climate dominated by road traffic from the A256 London Road.
- MP3 - noise climate dominated by road traffic from Coombe Valley Road and to a lesser extent from the A256 London Road, which was partially screened by buildings at this position.

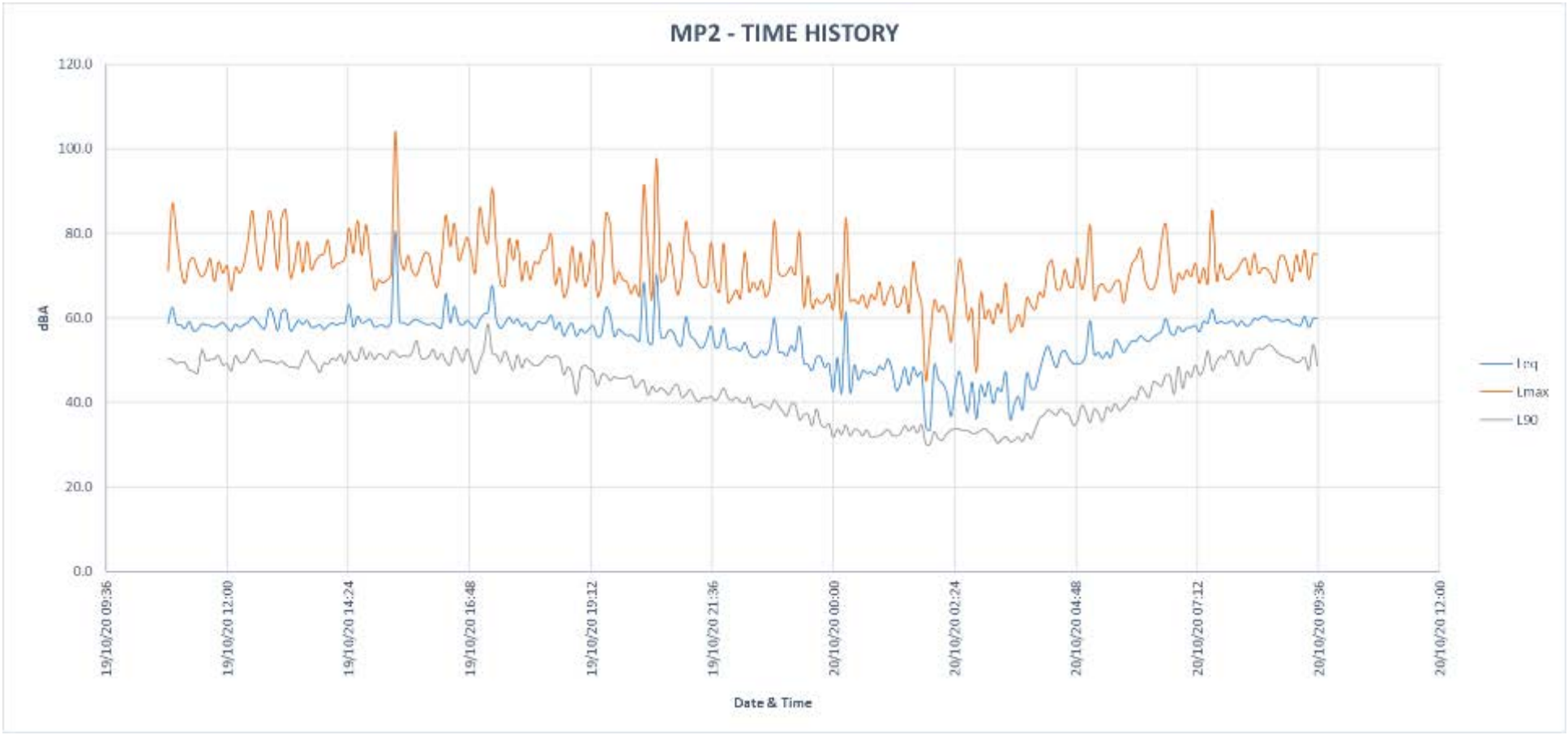
Survey Results

A summary of the daytime and night-time noise levels logged is presented below. The L_{Aeq} average level, typical L_{A90} level and the tenth highest L_{AFmax} level at night are given. The values are rounded to the nearest whole number.

Table C2: Measured Broadband Sound Levels (dB)				
Measurement Position	Period	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)	L_{AFmax} (dB)
MP1	Daytime (07:00 – 23:00)	67	54	N/A
	Night-time (23:00 – 07:00)	58	37	79
MP2	Daytime (07:00 – 23:00)	62	48	N/A

Table C2: Measured Broadband Sound Levels (dB)				
Measurement Position	Period	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)	L_{AFmax} (dB)
	Night-time (23:00 – 07:00)	52	33	74
MP3	Daytime (09:45 – 10:00)	53	N/A	N/A





Appendix D - Noise Maps

Figure D.1: Initial Site Noise Risk Assessment – $L_{Aeq,T}$ Daytime (Grid at 4m high)

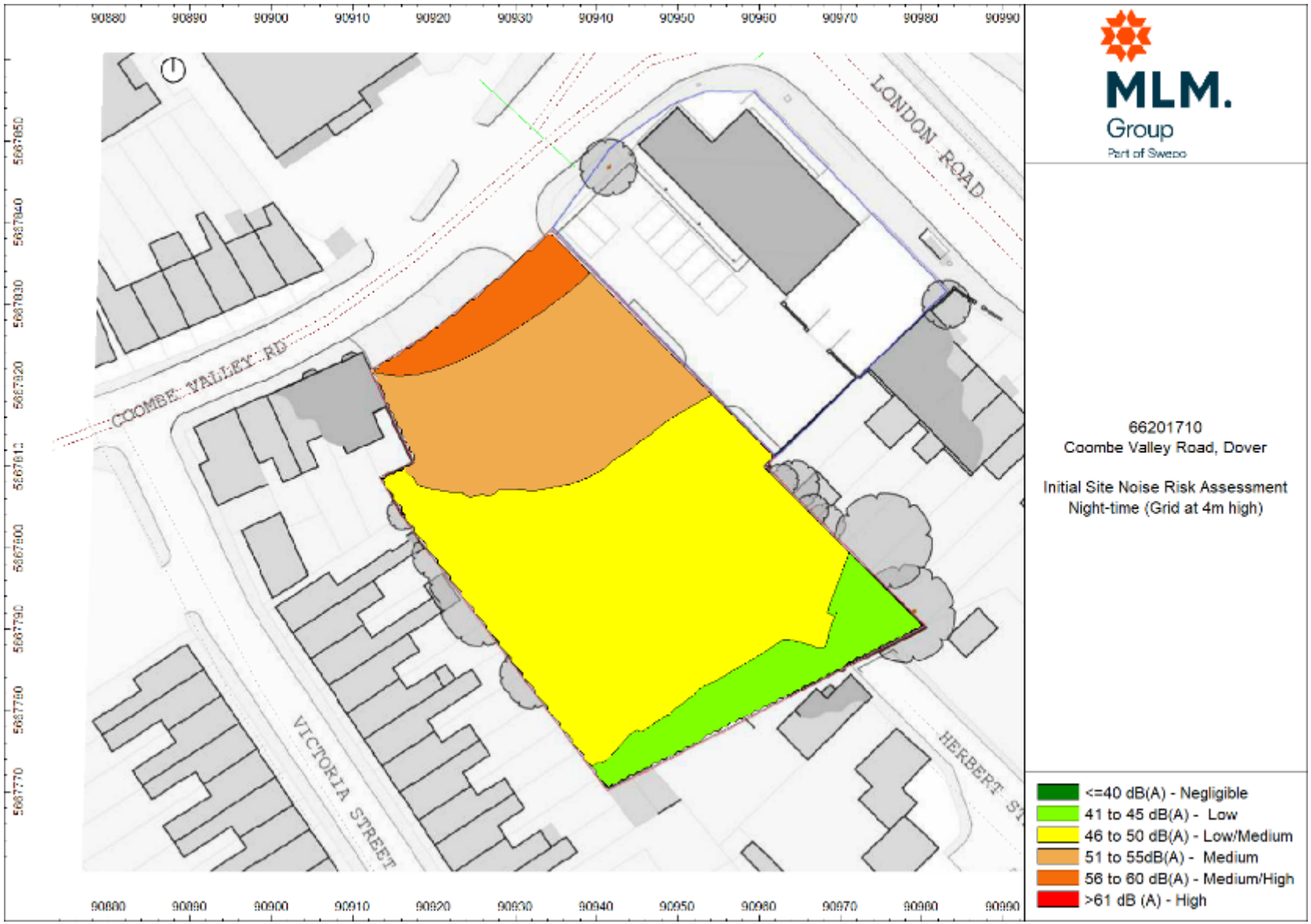


Figure D.2: Initial Site Noise Risk Assessment – $L_{Aeq,T}$ Night-time (Grid at 4m high)

Figure D.3: Noise Contour Map with Concept Masterplan – $L_{Aeq,T}$ Daytime (Grid at 4m high)

Figure D.4: Noise Contour Map with Concept Masterplan – $L_{Aeq,T}$ Night-time (Grid at 4m high)

Figure D.5: Façade Incident Maximum Noise Levels – L_{Amax} Night-time (Grid at 4m high)

Figure D.6: Proposed Outline Façade Mitigation Measures – Daytime (Dining/Living Rooms)

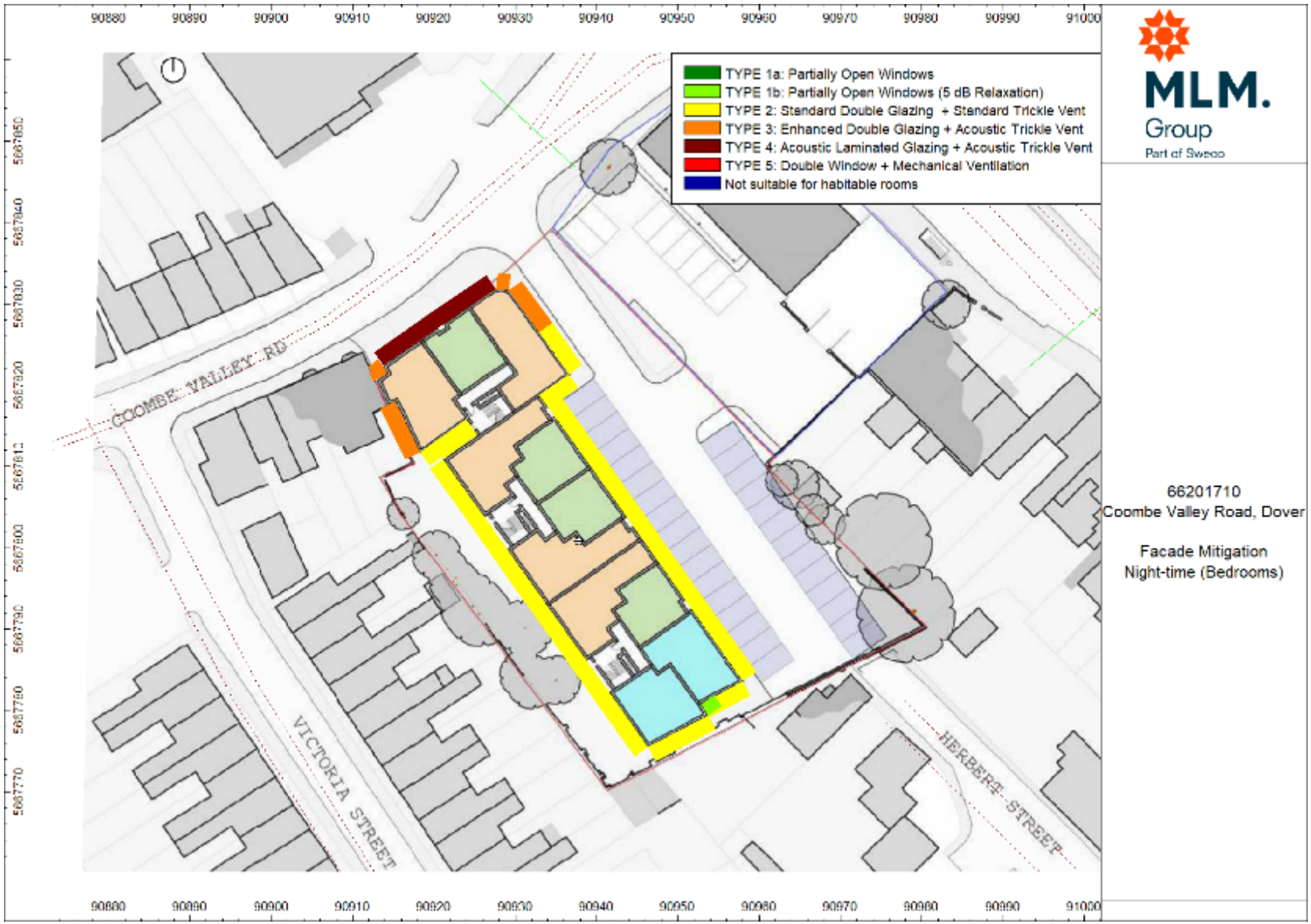


Figure D.7: Proposed Outline Façade Mitigation Measures – Night-time (Bedrooms)

Figure D.8: Risk of Noise Ingress during Overheating Condition

T +44 117 244 5510
A Temple 1852
Lower Approach Road
Temple Meads
Bristol, BS1 6QS

www.mlmgroup.com