



**NOISE IMPACT ASSESSMENT FOR
PERMITTED DEVELOPMENT
APPLICATION**

**ROSE KILN COURT,
ROSE KILN LANE,
READING
(CLASS O - OFFICES
TO
DWELLINGHOUSES)**

STENPROP LIMITED

JULY 2021

NOISE IMPACT ASSESSMENT FOR PERMITTED DEVELOPMENT APPLICATION

ROSE KILN COURT, ROSE KILN LANE, READING (CLASS O - OFFICES TO DWELLINGHOUSES)

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REVISION HISTORY

Version	Comments	Author	Approved by
0.3	Draft for Project Team Review	CW	RM

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1 INTRODUCTION

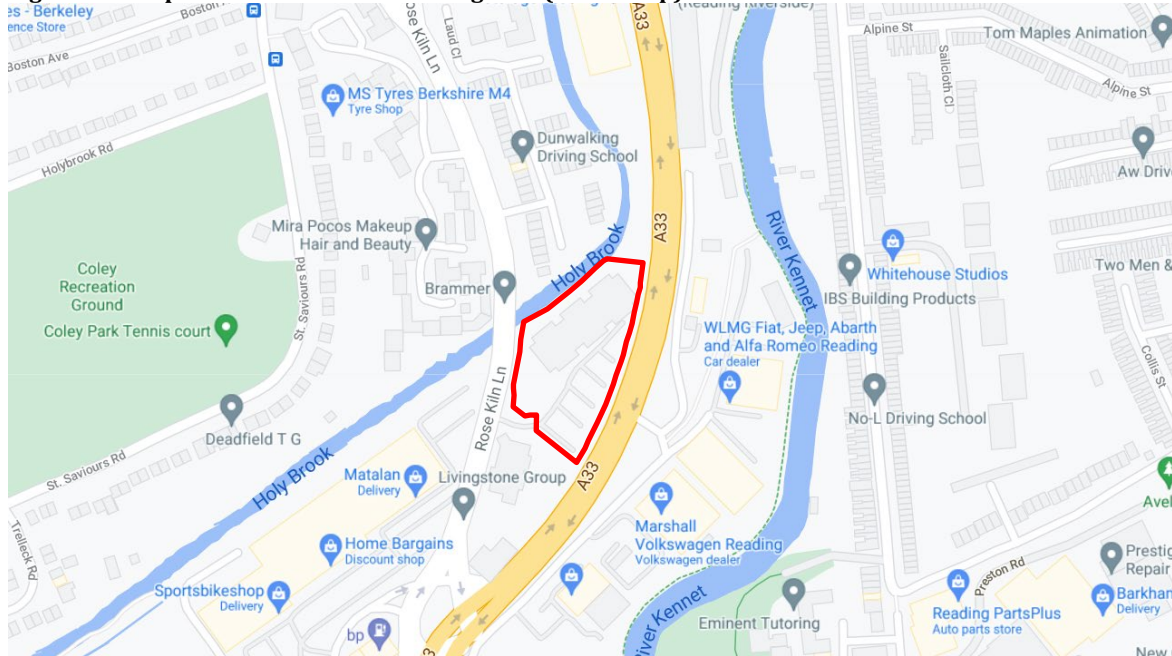
- 1.1 Anderson Acoustics Ltd has been commissioned by Stenprop Ltd to undertake a Noise Impact Assessment in relation to the conversion of existing office space at Rose Kiln Court, Rose Kiln Lane, Reading RG2 0BY to provide either 38 and 34 units of residential accommodation.
- 1.2 The conversion, therefore, comes under *Class O – offices to dwellinghouse* (Schedule 2, Part 3) of **The Town and Country Planning (General Permitted Development) (England) Order 2015**, whereby, relevant to the topic of noise, Condition (1)(d) applies:

...the developer must apply to the local planning authority for a determination as to whether the prior approval of the authority will be required as to—
...(d) impacts of noise from commercial premises on the intended occupiers of the development...
- 1.3 Strictly, therefore, the requirement is to consider “commercial” noise only. Since, however, this not an issue for the site, as confirmed by site visits, but where road traffic noise is, particularly from the A33 (see figures in **Section 2**), the impact of this has been considered on the normal way. This therefore demonstrates an acceptance from the applicant to ensure a quality residential environment over and above the strict requirements of the Class O procedure.
- 1.4 Accordingly, a baseline noise survey has been undertaken on the site visit, which has informed a 3D noise model of the site and surrounding area, which has been used to calculate the external sound levels around the existing building proposed for conversion. The external levels have been compared to the relevant British Standard (**BS 8233**) and good practice guidance, whilst taking into account national and local planning policy (including **CC8**, **ENV16** and **H8**), to determine the acoustic design and façade sound insulation requirements to achieve suitable internal noise conditions during both background ventilation and overheating conditions.
- 1.5 Due to the relatively high sound levels from the A33, with some contribution to the west from Rose Kiln Lane, it is concluded ~~has been found~~ that there is an opportunity to improve the existing level of sound insulation (primarily dictated by the existing windows) through the installation of secondary glazing units behind the existing windows. This solution has been relied upon routinely for many decades when addressing high levels of sound, such as from major roads and airports. This solution would be combined with System 4 (MVHR) ventilation (as per **Approved Document F (ADF)** of the **Building Regulations**). Managing purge ventilation and overheating will be subject to detailed design and can be managed by planning condition should the Council deem this appropriate to do so.
- 1.6 **Section 2** provides details of the site and environs; **Section 3** provides details of the proposed development; **Section 4** presents a summary of the relevant guidance and criteria; **Section 5** describes the existing environment; **Section 6** presents the assessment of external sound levels in relation to relevant criteria and the proposed mitigation; and **Section 7** presents details of the default sound control requirements between the proposed residential units. A summary is presented in **Section 8**.
- 1.7 A glossary of terminology is presented in **Appendix A**.

2 THE SITE AND ENVIRONS

2.1 The site (i.e. Rose Kiln Court) is shown in **Figure 2.1** and **Figure 2.2**.

Figure 2.1: Map of the site and surrounding area (north is up)



Sources: Map data ©2021 (annotated by Anderson Acoustics)

Figure 2.2: Aerial photograph of the site and surround area (north is up)



Sources: Imagery ©2021 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2021 (annotated by Anderson Acoustics)

2.2 It can be seen that the site is between the A33 and Rose Kiln Lane, with houses to the north and northwest, and a similar office building to the south. This is Cadogan House, which has approval for conversion to residential (discussed further in **Section 5**). On the other side of the A33 are a number of car dealerships, with Reading Link Retail Park off to the southwest, on the other side of Rose Kiln Lane.

2.3 3D views of the site are presented below.

Figure 2.3: 3D aerial photograph of the site (looking northwest)



Source: Imagery ©2021 Google, Landsat / Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Map data ©2021

Figure 2.4: 3D aerial photograph of the site (looking west)



Source: Imagery ©2021 Google, Landsat / Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Map data ©2021

Figure 2.5: 3D aerial photograph of the site (looking southeast)



Source: Imagery ©2021 Google, Landsat / Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Map data ©2021

Figure 2.6: 3D aerial photograph of the site (looking northeast)



Source: Imagery ©2021 Google, Landsat / Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Map data ©2021

Figure 2.7: Street View image of the site from the A33 (looking north)



Source: ©2021 Google, Image capture Oct 2020

Figure 2.8: Street View image of the site from the A33 (looking south)



Source: ©2021 Google, Image capture Oct 2020

Note: In **Figures 2.7** and **2.8** the existing wooden fence can be seen. This is not an acoustic barrier and has been discounted from the assessment. The fence on the other side of the A33 is an "absorptive" type of acoustic barrier.

Figure 2.9: Street View image of the site from Rose Kiln Lane (looking north-northwest)



Source: ©2021 Google, Image capture Oct 2020

Note: Little of the site can be seen from Rose Kiln Lane due to the trees along the western and north-western boundaries

Figure 2.10: Street View image of the site from the site entrance off Rose Kiln Lane (looking north)



Source: ©2021 Google, Image capture Oct 2020

2.4 Photographs taken inside and outside the building are presented overleaf.

Figure 2.11: Photograph from inside on the ground floor (looking southeast towards the A33)



Source: Anderson Acoustics (image captured 10/06/2021)

Figure 2.12: Photograph from inside on the first floor (looking southeast towards the A33)



Source: Anderson Acoustics (image captured 10/06/2021)

Figure 2.13: Photograph from outside (looking northeast)

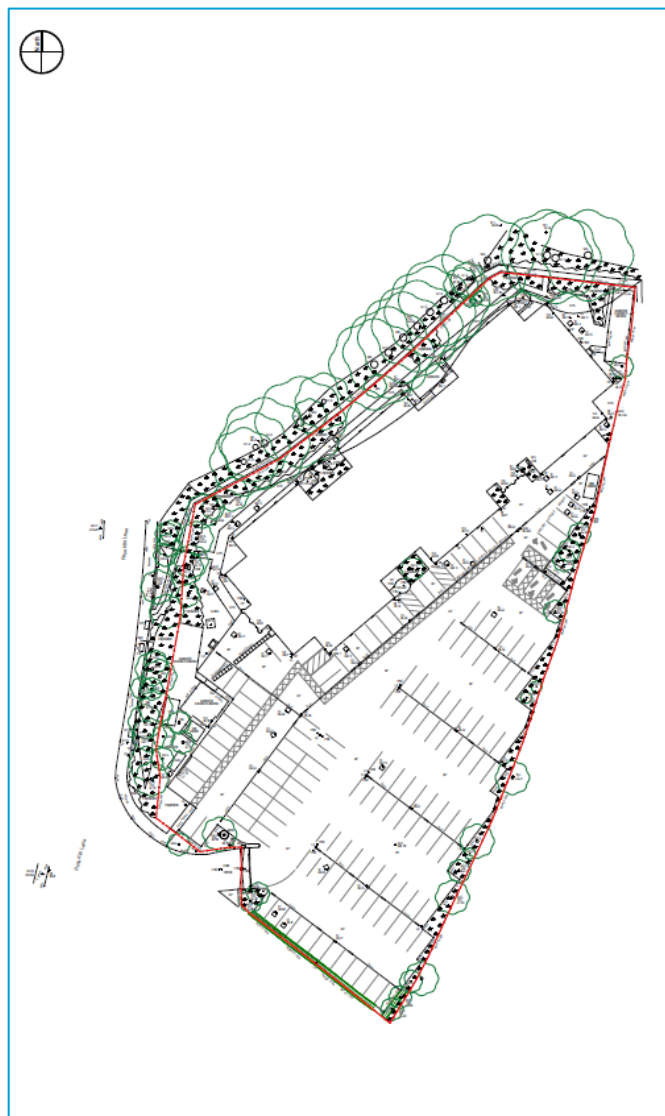


Source: Anderson Acoustics (image captured 10/06/2021)

3 PROPOSED DEVELOPMENT

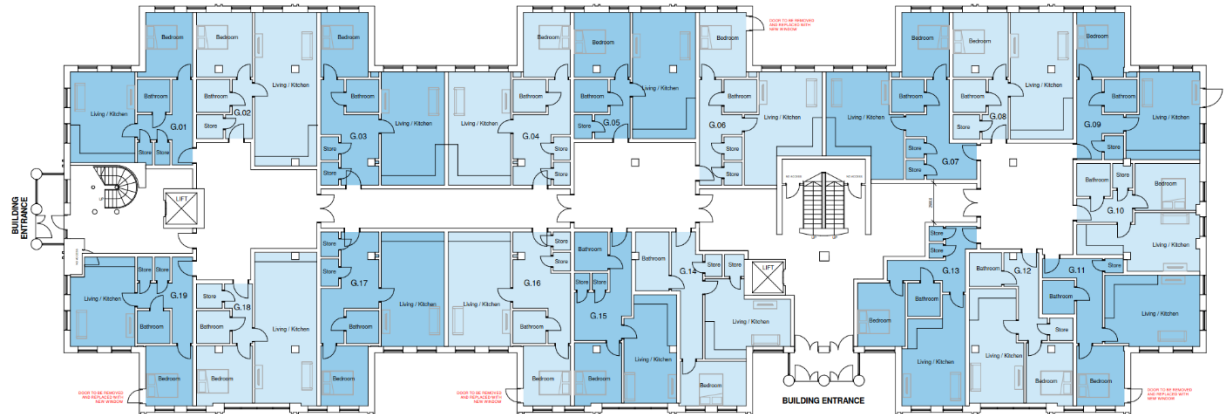
- 3.1 The proposal seeks to retain the existing building but to undertake associated works to change its use and form residential units as is described and shown below and overleaf.
- 3.2 The existing building is a two-storey office block that will be converted into dwelling units using the existing form and structure of the building. The 38 unit option will ~~to~~ provide contemporary one bedroomed dwellings with associated areas for parking. Areas for bin and cycle storage are also provided for the occupiers, with vehicular access to Rose Kiln Lane. The proposal includes the provision of some internal walls in the proposed residential dwellings, which are reasonably necessary for the building to function as a dwelling house.

Figure 3.1: Proposed site plan (north is up)



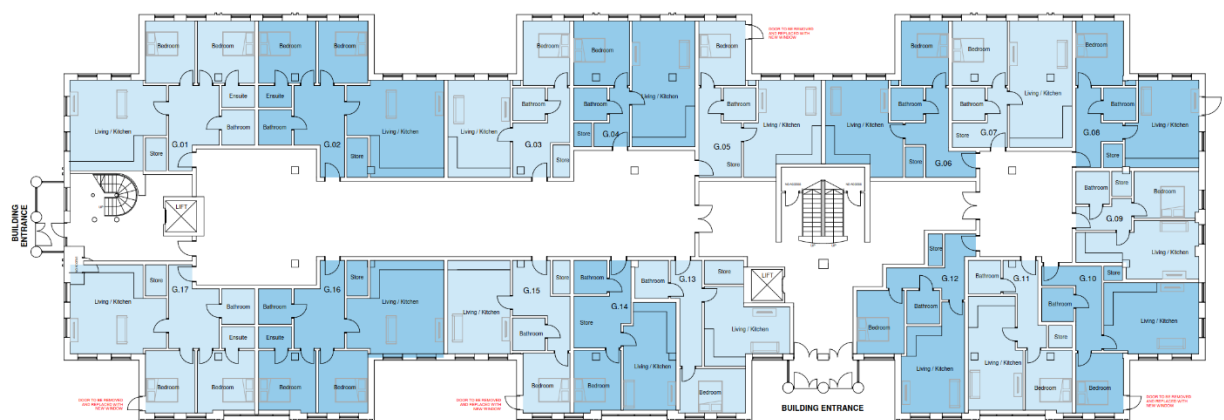
Source: Pozzoni Architecture Limited

Figure 3.2: 38 unit scheme proposed ground floor internal layout plan (northwest is up)



Source: Pozzoni Architecture Limited "Planning – Proposed GF Plan" (Drawing No.5788-POZ-XX-XX-DR-A-1210)

Figure 3.3: 34 unit scheme proposed ground floor internal layout plan (northwest is up)



Source: Pozzoni Architecture Limited "Planning – Proposed First Floor Plan" (Drawing No.5788-POZ-XX-XX-DR-A-1220)

- 3.3 Since the ground and first floor layouts are essentially the same (per scheme), only the ground floors are presented above, for the 38 unit and 34 unit schemes, respectively. The units are identified by the alternating use of the two blue colours. It can be seen that a mix of both "Living / Kitchen" rooms and bedrooms are located along each façade/elevation, with windows, therefore, to the front, rear and at either end of the building.

4 ASSESSMENT CRITERIA

- 4.1 Between the national and local policy, the relevant British Standard, and the good practice guides, there is a significant amount of guidance applicable to this assessment, which we believe we have given sufficient weight to. Full details are presented in **Appendix B**, with a summary presented below. The following is a list of the references considered:
- **Noise Policy Statement for England (NPSE, 2010).**
 - **National Planning Policy Framework (NPPF, last updated 2019)** and its associated **planning practice guidance** on “Noise” (**PPG-N**, last updated 2019).
 - **Reading Borough Local Plan** (November 2019).
 - **Residential Conversions Supplementary Planning Document Conversion of Properties to Self-Contained Flats or for Multiple Occupation** (November 2013).
 - **BS 8223:2014 Guidance on sound insulation and noise reduction for buildings (BS 8233).**
 - **Professional Practice Guidance on Planning & Noise for New Residential Development (ProPG: Planning & Noise, 2017).**
 - **Acoustics, Ventilation and Overheating Residential Design Guide (AVO Guide)** (Version 1.0, January 2020).
- 4.2 It is shown in **Appendix B** that **BS 8233** presents the most relevant guidance, as referenced in the **PPG-N**. To account for current best practice, supplementing the guidance in **BS 8233**, it is also helpful to refer to the **ProPG** and **AVO Guide**, specifically in terms of L_{AFmax} levels and considering conditions during ventilation and overheating conditions.
- 4.3 The criteria are summarised in **Table 4.1** overleaf, and aligned with the **examples of outcomes, levels of effect** and **actions** from the **PPG-N**.

Table 4.1: Adopted noise criteria

Examples of Outcomes ¹	Assessment Location	Internal Sound Level, dB ²		Level of Effect ¹	Action ¹
		Day (07-23)	Night (23-07)		
ADF Ventilation Condition ³					
Noise can be heard, but does not cause any change in behaviour	Inside habitable rooms	≤ 35 dB L _{Aeq,16h}	≤ 30 dB L _{Aeq,8h}	No observed adverse effect	No specific measures required
			≤ 45 dB L _{AFmax}		
Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night		36-40 dB L _{Aeq,16h}	31-35 dB L _{Aeq,8h}	“Low” ⁴ observed adverse effect	Mitigate and reduce to a minimum
			46-50 dB L _{AFmax}		
		41-45 dB L _{Aeq,16h}	36-40 dB L _{Aeq,8h}	Observed adverse effect	
51-55 dB L _{AFmax}					
Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	> 45 dB L _{Aeq,16h}	> 40 dB L _{Aeq,8h}	Significant observed adverse effect	Avoid ⁷	
		> 55 dB L _{AFmax}			
Overheating Condition ⁵					
Noise can be heard, but does not cause any change in behaviour	Inside habitable rooms	≤ 40 dB L _{Aeq,16h}	≤ 35 dB L _{Aeq,8h}	No observed adverse effect	No specific measures required
			≤ 51 dB L _{AFmax}		
Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night		41-50 dB L _{Aeq,16h}	36-42 dB L _{Aeq,8h}	Observed adverse effect ⁶	Mitigate and reduce to a minimum
			52-65 dB L _{AFmax}		
Noise causes a material change in behaviour e.g. having to keep windows closed most of the time		> 50 dB L _{Aeq,16h}	> 42 dB L _{Aeq,8h}	Significant observed adverse effect	Avoid ⁷
			> 65 dB L _{AFmax}		

¹ From **PPG-N**.

² The L_{Aeq,T} values apply to the typical ambient sound levels resulting from external sources, which are presumed to be either dominated by road or rail sources or a mix thereof. The L_{AFmax} levels apply to the typical or 10th highest maximum noise levels (or equivalent) from external (road or rail) sources.

³ This covers the basic level of ventilation requirement that **ADF** also terms as “whole dwelling” or “whole building” ventilation, which can be achieved via trickle vents or other passive or mechanical means (with windows closed).

⁴ This reflects the guidance in **BS 8233** and **ProPG** that the L_{Aeq} criteria can be relaxed by up to 5 dB and “reasonable” conditions still achieved. The same has been considered applicable to the L_{AFmax} criterion. This range has been termed “Low”, which is considered logical, though, strictly, there is no such term in **PPG-N**.

⁵ This covers the situation where, without alternative means, occupants would open windows for ventilative cooling. The criteria are higher than under **ADF ventilation conditions** since they would apply less often.

⁶ A range is presented (in keeping with the guidance in the **AVO Guide**) as the impact on the occupant(s) is likely to depend on the number of occurrences. Generally speaking, the higher (less stringent) values apply when occurrences (of overheating) are “rare”. The lower values would apply when overheating occurs most of the time. See **Figure B.1** within **Appendix B** for a graphical representation.

⁷ This is the first aim of the **NPSE** (i.e. Avoid significant adverse impacts on health and quality of life) while taking into account the guiding principles of sustainable development. The second and third aims are: Mitigate and minimise adverse impacts on health and quality of life; and Where possible, contribute to the improvement of health and quality of life.

- 4.4 Whilst the Class O criteria are only concerned with noise from commercial uses (not road noise) the applicant is seeking to ensure that a quality residential environment is provided and therefore considers the provision of appropriate mitigation accordingly. Due to the proximity of the A33 the site does provide a relatively high noise environment. As well as measures to attenuate noise it is also important to consider ventilation and cooling. The applicant accepts that mechanical ventilation will provide an improved residential environment (such as in the form of MVHR). The applicant also accepts that measures will be required to minimise the risk of overheating and to provide means of cooling (other than opening windows) as necessary- which is subject to detailed design and does not need to be addressed here. Accordingly, it is only necessary in this report to consider the [ADF ventilation condition](#) since the sound insulation performance will be dictated by this condition and not the [overheating condition](#).

5 BASELINE NOISE SURVEY

Commercial Noise

- 5.1 During the daytime site visits described below, not least owing to the road traffic noise, no noise of a commercial nature was witnessed, and nor indeed was it expected to be. No visits were made to site at night; however, none the commercial premises in the vicinity (i.e. on the other side of the A33 and Rose Kiln Lane) are understood to have operational hours into the night-time period, but where, in any case, noise from the A33 is highly likely to remain dominant.
- 5.2 **Accordingly, no noise of a commercial nature is taken to be a feature on site, whereby there is considered to be no reason not to grant prior approval in terms of the relevant condition within the GPDO 2015.**

Road Traffic Noise

- 5.3 Whilst not a requirement of the [GPDO 2015](#), due to the site's proximity to the A33, a baseline noise survey and assessment has been undertaken in this regard, as well as taking into account Rose Kiln Lane.
- 5.4 Accordingly, two sound level meters were installed along the eastern and western boundaries to measure continuously for a period of over five days. This was supplemented with brief additional measurements inside and outside the building to establish the typical levels of sound insulation of the existing building envelope. The survey details and results are presented below.

Survey Details

- 5.5 Continuous unattended measurements were undertaken over five full days and six nights, from **3 pm on Friday 4th to 9.15 am on Thursday 10th June 2021**. The Friday/weekend marked the end of the school half-term break, with schools being back in session for Monday, Tuesday and Wednesday of the survey, whilst, unavoidably, the survey was during the COVID-19 pandemic. In order to consider the potential significance of this, data from the neighbouring Cadogan House application have been considered, as presented later in this section. Future conditions are also considered below.
- 5.6 The monitoring locations are shown in the figures below and overleaf.

Figure 5.1: Noise survey locations (Main/Unattended ; Secondary/Brief Attended)



Sources: Imagery ©2021 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2021 (annotated by Anderson Acoustics)

Figure 5.2: Eastern boundary noise survey location (A33 on other side of fence)



Source: Anderson Acoustics (image captured 10/06/2021)

Figure 5.3: Western boundary noise survey location (A33 on other side of fence)



Source: Anderson Acoustics (image captured 10/06/2021)

- 5.7 The microphones for the main monitoring locations were mounted on a pole such that they were approximately 2.5 m and 3 m above the local ground, with a clear line of sight to the A33 and Rose Kiln Lane, respectively, and in free-field conditions (i.e. away from hard, vertical surfaces). The microphones for the secondary (outside and inside) positions (with two additional meters used) were mounted on a tripod such that they were 1.5 m above the ground/floor, and 1 m from the façade (both internally and externally). In terms of the external measurement, therefore, the position is referred to as a “façade” position, subject to around 3 dB contribution from sound reflected from the façade.

5.8 The equipment details are as follows.

Table 5.1: Survey equipment details

Equipment (ID)	Make & Model	Serial No.	Date Laboratory Calibrated	Calibration Certification Number ¹
"A33" Sound Level Meter (AA-RCDS-08)	Rion NL-31	00640761	27 October 2020 ²	UCRT20/2039
"Rose Kiln Lane" Sound Level Meter (AA-RCDS-14)	Rion NL-31	00341523	27 October 2020 ²	UCRT20/2038
"Internal" Sound Level Meter (AA-DUO-01)	01 dB DUO	10663	26 February 2020 ²	UCRT20/1245
"External" Sound Level Meter (AA-DUO-01)	01 dB DUO	10664	26 February 2020 ²	UCRT20/1243
Calibrator (AA-CAL-08)	Rion NC-74	34304643	24 May 2021 ³	1500367-1

¹ Certificates available on request; ² Valid for two years; ³ Valid for one year.

- 5.9 The measurement chains were field-calibrated before the survey/measurements using the acoustic calibrator listed above. The level was checked at the end of the survey/measurements, and no significant drift was observed. Both the sound level meters and calibrator have been calibrated by a UKAS accredited laboratory with the standard intervals of 24 months and 12 months, respectively.
- 5.10 The two installed meters were set to store the "A" weighted sound levels every 15 minutes, from which period L_{Aeq} levels have been determined, together with the "Fast" time-weighted levels, from which the L_{Amax} , L_{A90} and L_{A10} levels have been determined. The results are presented below and **Appendix C**.
- 5.11 As stated earlier, the only sources audible at the times on site (i.e. during daytime hours) were the road traffic on the A33 and Rose Kiln Lane, with the former being dominant in the majority of instances. It is to be expected that the same will be the case at night.
- 5.12 The weather conditions were noted at the time of the site attendance and from the BBC website during the survey. Conditions were dry with little wind throughout, and thus conducive to reliable data. The wind direction switched from primarily north-easterly at the start (on the Friday, Saturday and Sunday), to southerly on the Monday, then south-westerly on the Tuesday, Wednesday and Thursday. Being so close to the A33, however, it is not a location anticipated to be significantly affected by changes in wind direction or, indeed, wind speed or temperature inversion. As shown by the results below, noise conditions were consistent day to day and night to night.

Survey Results

- 5.13 The 15-minute results are presented in chart form in **Appendix C**, with the period $L_{Aeq,T}$ levels and the night-time L_{AFmax} levels, as most relevant to the assessment, presented overleaf. Strictly, the L_{AFmax} levels should be determined on an "event" basis. Since, as is often the case for long term data, levels are available on a period basis only – 15-minutes in this case – the 95th percentile levels have been determined.

Table 5.2: Summary of sound levels, dB

Date	A33 Position			A33 Position		
	Day (07-23)	Day (07-23)		Day (07-23)	Night (23-07)	
	L _{Aeq,16h} ¹	L _{Aeq,8h} ¹	95 th Percentile L _{Amax} ²	L _{Aeq,16h} ¹	L _{Aeq,8h} ¹	95 th Percentile L _{Amax} ²
Fri 04/06/2021		69	93	-	61	83
Sat 05/06/2021	75	68	87	66	60	79
Sun 06/06/2021	74	69	92	66	61	83
Mon 07/06/2021	75	69	94	67	61	84
Tue 08/06/2021	75	69	89	66	61	81
Wed 09/06/2021	75	69	91	66	61	81
Average (Highest)	75 (75)	69 (69)	91 (94)	66 (67)	61 (61)	82 (84)

1 Based on the logarithmic average of the L_{Aeq,15min} levels.

2 Used on the 15-minute levels as an alternative to the 10th highest “event” level.

5.14 The following are observed from the above data:

- All levels are very consistent. This indicates consistent conditions across the survey and a robust dataset.
- The difference between the daytime and night L_{Aeq,T} levels is 5-6 dB on average, this is to be expected in such a location and for such a road as the A33. Since the day and night-time L_{Aeq,T} noise criteria (see **Table 4.1**) are 5 dB apart, this means that meeting the daytime criterion will be essentially the same as meeting the night-time criterion.
- The differences between the night-time L_{Aeq,8h} and L_{AFmax} levels are 21-22 dB on average. Since the difference between the criteria for these metrics is 15 dB (see **Table 4.1**), meeting the L_{AFmax} criterion will be notably “harder” (when close to the A33 or Rose Kiln Lane) than the equivalent L_{Aeq,8h} criterion. Since, however, L_{AFmax} event levels (assumed from a point source) attenuate with distance faster than from the L_{Aeq,8h} levels (assumed from a line source), and also are, typically, attenuated slightly better by window units, there is likely to be a point (around the building) where the equivalent L_{Aeq,8h} levels dictate the sound insulation performance requirement.

5.15 Overall, the data is as expected.

5.16 In terms of the additional measurements inside and outside the building, two pairs of 10-minute measurements were taken between **8.30 and 9 am on Thursday 10th July 2021**. Subtracting 3 dB for façade reflected sound from the external levels, and accounting for background sound within the building, the level differences have been found to be between 20 and 24 dB. Such levels are at the lower end of what we would have expected, likely as a result of a high proportion of glazed to non-glazed areas.

5.17 For context, the levels measured internally (albeit only 1 m from the windows, during the am rush hour, and midway along the building (fronting the A33)), were around 37 dB and 43 dB (L_{Aeq,10min}) within the ground and first floors, respectively. These levels are 2 dB and 8 dB higher than the daytime **BS 8233** threshold (for living rooms and bedrooms), indicating that additional sound insulation will be required, especially at points of the building closer to the A33. This is considered further in **Section 6**.

Likely effect of the pandemic on the measured levels

5.18 For the location in question (close to a busy road such as the A33), there are three potential ways for assessing the likely effect of the pandemic on the measured levels: any road traffic flow data that may be available for before and during the pandemic; from Defra noise mapping; and from any noise surveys undertaken for other applications in the vicinity.

- 5.19 For roads other than the strategic road network (SRN) (of motorways and some A-roads) managed by Highways England, the source of available road traffic data is the Department for Transport's Road traffic statistics website (<https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints>).
- 5.20 As it happens, data are available for both the A33 and Rose Kiln Lane, but only up to last year (2020) at this point. The data indicate a reduction in flow of around 30% between 2019 and 2020 on both roads, but where flows are likely to have increased since then (with the noise survey being undertaken in June 2021). A 30% reduction is equivalent to around 1.5 dB, but where any reduction in practice is likely to be less due to flows having since increased. Furthermore, the chances are that with reduced traffic, average speeds are higher, potentially resulting in higher sound levels.
- 5.21 The Defra mapping (<http://extrium.co.uk/noiseviewer.html>) is very crude, with levels based on 2017 traffic flow data, calculated on a 10x10 m grid and presented in 5 dB noise bands. As far as we can estimate, the daytime ($L_{Aeq,16h}$) levels at the A33 and Rose Kiln Lane measurement locations are in the order of 75 dB and 70 dB, respectively. These compare with the average of the measured levels of 75 dB and 66 dB, indicating that levels close to the A33 are as to be expected (bearing in mind that, COVID aside, 2017 traffic flows will be sufficiently representative of current conditions), but where levels close to Rose Kiln Lane are perhaps lower than expected.
- 5.22 In terms of historical survey data, the neighbouring building, Cadogan House, went through the same prior approval application process in 2018, with approval being granted in January 2019 (Application No: 182166), and with the associated baseline noise survey having been undertaken in January 2017. Based on the survey, which was limited to a few hours only during the day and again at night due to lack of secure monitoring locations, the daytime and night-time levels at the front (Rose Kiln Lane) and rear (the A33) of Cadogan House were determined to be 74 dB & 68 dB (front) and 64 dB & 58 dB (rear). Since the monitoring/assessment locations are different to those relevant here, the noise model described in **Section 6** has been used to calculate the equivalent levels. These, assuming +3 dB for façade reflection, have been found to be 71 dB & 66 dB and 71 dB & 65 dB.
- 5.23 The 2021 equivalent levels are, therefore, 2-3 dB less than the 2017 values at the front of Cadogan House, but 7 dB more than those at the rear. Assuming Rose Kiln Lane and the A33 are the dominant sources to the front and rear of Cadogan House, respectively, at face value the levels indicate that Rose Kiln Lane is quieter than in 2017, but the A33 is noisier.
- 5.24 Ignoring the traffic flow data, where no data are available for 2021 (and, where, just because flows were less in 2020, doesn't mean noise conditions were less in 2021, as discussed above), and since the 2021 survey data for the A33 is, as far as can be established, corroborated by the Defra mapping, and higher than the 2017 data would suggest, we are inclined to adopt the 2021 "A33" survey data as measured (for use in the noise model described in **Section 6**). In terms of the "Rose Kiln Lane" survey data, where both the Defra mapping data and the 2017 survey data indicate around a 3 dB difference – the 2021 data being lower – we have applied a +3 dB correction as a precaution to the flows on Rose Kiln Lane as if being materially affected by the ongoing pandemic.

Future conditions

- 5.25 In terms of the dominant sources of noise, i.e. the road traffic on the A33 and Rose Kiln Lane, ordinarily we would see no reason to expect noise conditions to be significantly different in the foreseeable future. If, however, conditions are still being affected by the pandemic, as indicated above for Rose Kiln Lane at least, then there is certainly a chance conditions could change. Since, however, the assessment presented in this report includes for a correction for Rose Kiln Lane, we see no further reason to apply any other corrections to account for future conditions.

6 ASSESSMENT

3D noise model construction

- 6.1 To facilitate the assessment of the application site, a computerised 3D noise model of the area has been generated using the CadnaA® proprietary noise mapping software. This allows the calculation of noise levels around the proposed building, in order that the noise levels can be assessed at all key locations, beyond those covered in the baseline survey. This has entailed using a combination of input data and required a number of steps and assumptions. Full details are provided in **Appendix D**.
- 6.2 Two key points to note are that the noise from Rose Kiln Lane has been increased by 3 dB as per the discussion presented in **Section 4**, and that the existing fence on the boundary with the A33 has been discounted since it is not an acoustic barrier and the acoustic performance cannot be reliably determined or guaranteed. It is likely, therefore, that noise conditions in some areas, especially at ground floor level, will be lower than calculated. This therefore builds in a degree of robustness which should provide the Council further reassurance as to the approach taken by this assessment.

Calculated external levels and comparison with internal noise criteria

- 6.3 The noise model has been used to calculate the sound levels at evenly distributed points around the buildings, approximately representing the mid-point of the windows on each floor. The calculated levels are summarised in the table below in relation to the **BS 8233/ProPG** criteria, and shown graphically in the images presented in **Appendix E**.

Table 6.1: Calculated sound levels around Rose Kiln Court compared to BS 8233/ProPG criteria

Façade (elevation)	Range in calculated (free-field) sound levels, dB	Criteria (ADF ventilation condition), dB	Difference (equivalent to $R_w + C_{tr}$ value), dB
Northeast (upper end)	73-75 $L_{Aeq,16h}$	35-40	33-40
	67-69 $L_{Aeq,8h}$	30-35	32-39
	85-91 L_{AFmax}	45-50	35-46
Southeast (front)	65-75 $L_{Aeq,16h}$	35-40	30-40
	59-69 $L_{Aeq,8h}$	30-35	25-35
	78-93 L_{AFmax}	45-50	28-48
Southwest (lower end)	64-65 $L_{Aeq,16h}$	35-40	24-30
	59-60 $L_{Aeq,8h}$	30-35	24-30
	78-83 L_{AFmax}	45-50	28-38
Northwest (rear)	55-68 $L_{Aeq,16h}$	35-40	15-33
	50-62 $L_{Aeq,8h}$	30-35	15-32
	71-82 L_{AFmax}	45-50	21-37

- 6.4 It can be seen that, given the range in calculated levels around the building, with some areas screened from the A33 and/or Rose Kiln Lane, and the range in the criteria, difference levels of between 15 dB and 48 dB are shown. It can also be seen that it is the L_{AFmax} levels at night that require the highest levels of attenuation.
- 6.5 To put these levels into perspective, 15 dB is typically the most that would be assumed for a partially open window, with the existing sound insulation performance found to be between 20 and 24 dB. In some instances, therefore, the existing sound insulation would be sufficient, but, in others – greater performance will be required. The required noise control measures are considered below.

Noise break-in mitigation

- 6.6 Since the non-glazed areas of the building façade are made up of double masonry cavity wall construction, the windows (and associated panels in some instances) will be the weak link acoustically. Example glazing performances are given in **BS 6262-2:2005 Glazing for buildings – Part 2: Code of practice for energy, light and sound**. According to this Standard, glazing comprising 10 / 12 / 6.4 should provide a reduction of 33 dB R_w+C_{tr} . Likewise for Pilkington United Kingdom Ltd's 6 / 16 / 6.8 Optiphon™ unit. This would be sufficient (to within 2 dB) to achieve the upper criteria in all instances, i.e. where internal noise conditions would be at least **reasonable**. This is relevant to any consideration of replacing the existing glazing units.
- 6.7 Where greater performance is required, the use of secondary glazing is a preferred option. This is where two glazing units are used in parallel/combo, with the secondary unit (traditionally single-glazed) installed, typically, between 100 and 200 mm from the main unit, on the inside of the building. Where window reveals are deep enough, therefore, then the unit can be installed without any structural works. Where this is not the case, or where no reveals are present, then the required gap can be achieved by boxing in or floor to ceiling installations. **BS 6262-2** indicates that performances of up to 45 dB R_w+C_{tr} are achievable, which is in keeping with data from Selectaglaze Ltd, for example. Such performance would be sufficient to achieve **reasonable** levels in all instances, and the lower criteria in the majority of instances.
- 6.8 Due to the relatively high external sound levels, in some areas at least, passive ventilation or cooling of the rooms will provide inadequate mitigation (i.e. by opening windows or trickle vents). Accordingly, **ADF** System 4 (MVHR) ventilation systems will be installed, with the inlets and outlets suitably sound attenuated to ensure the required composite façade sound insulation performance is achieved. The requirement for, and means of, cooling will be subject to separate assessment at the detailed design stage. Likewise, the means of purge ventilation, but during which it is typically not a requirement to consider any associated noise implications. These both fall outside the Class O protocols but nevertheless the applicant would be agreeable to provide further detail by way of planning condition should that be deemed appropriate and necessary.
- 6.9 With the use of secondary glazing (discussed in 6.7), there would be **no observed adverse effect in the majority of instances**, with a **"Low" observed adverse effect in those residual instances**.
- 6.10 Accordingly, it is considered unlikely that it would be necessary to replace the double-glazed units (discussed in 6.6) because the installation of secondary glazing alongside ventilation provides appropriate mitigation. For completeness we confirm that if the existing glazing were to be replaced there would be a **"Low" observed adverse effect in the majority of instances**, and **no observed adverse effect in some instances**.

7 BUILDING REGULATIONS SOUND CONTROL REQUIREMENTS

- 7.1 Any new or retained party walls and floors will need to meet the requirements of the latest applicable version of **Approved Document E Resistance to the passage of sound (ADE)** of the **Building Regulations**. The assessment of which will be undertaken during the detailed design stage and falls outside the protocols of the Class O approval process. This section is therefore provided for completeness and should not necessarily be controlled by planning condition as it will be managed through the Building Regulations process.

Wall and Floor Sound Insulation Requirements

Separating walls and floors

- 7.2 For the separating walls and floors between residential dwellings, Requirement E1 as described in **ADE** states that the following performance standards for flats formed by material change of use must be achieved on site:

- Airborne sound (minimum values): $D_{nT,W} + C_{tr} 43 \text{ dB}$
- Impact sound (maximum value): $L'_{nT,W} 64 \text{ dB}$

Corridor walls and doors

- 7.3 Although **ADE** requires a separating construction to be used between dwellings and common circulation areas (including stairwells), it recognises that in many cases the sound insulation will be limited by the entrance door. In this regard, **ADE** states:

Ensure that any door has good perimeter sealing (including the threshold where practical) and a minimum mass per unit area of 25 kg/m^2 or a minimum sound reduction index of $29 \text{ dB } R_w$ (measured according to BS EN ISO 140-3:1995 and rated according to BS EN ISO 717-1:1997).

- 7.4 Where possible, doors should be fitted within rebated frames with compressible neoprene/rubber seals fitted at head and jambs.
- 7.5 The installation of drop-threshold seals, whilst not essential, should be considered good acoustic practice where neighbouring front doors are closer than 2 m away from each other.
- 7.6 Lightweight doors within residences will provide a lower standard of sound insulation than walls. However, there is no minimum performance requirement for these elements. Notwithstanding this, we would suggest that, wherever possible, doors be solid core and fitted within fully rebated frames.

Internal partitions

- 7.7 Requirement E2 states:

Dwelling-houses, flats and rooms for residential purposes shall be designed and constructed in such a way that: (a) Internal walls between a bedroom or a room containing a water closet, and other rooms; and (b) internal floors, provide reasonable resistance to sound.

- 7.8 This applies to any internal floors / partitions between a bedroom and other rooms, and for partitions between a toilet and other rooms. The requirement does not apply to any internal walls that separate an en-suite bathroom from the associated bedroom.
- 7.9 A minimum design requirement of $R_w 40 \text{ dB}$ is set, but there is no requirement for testing. The requirement does not apply to partitions containing a door since in this case the sound insulation is limited by the door. Furthermore, it does not apply to existing walls and floors in a conversion. To demonstrate compliance, it is sufficient to show that the design intent is for the $R_w 40 \text{ dB}$ requirement to be achieved.
- 7.10 Manufacturers of partition and floor systems will usually rate the acoustic performance in terms of the R_w index and therefore suitable partitions can be selected from manufacturer's literature.

Control of Reverberation in Common Parts

- 7.11 Under the current revision of **ADE**, measures must be taken to control the reverberation in the common internal parts of buildings containing flats or rooms for residential purposes. These will comprise the use of absorbent finishes such as carpets and acoustic ceiling tiles in common areas.
- 7.12 The amount of absorption required depends on whether the particular common area is an entrance hall, defined as a space for which the ratio of the longest to the shortest floor dimension is three or less; or a corridor and hallway defined as a space for which the ratio of the longest to the shortest floor dimension is greater than three. To demonstrate that this has been complied with, two methods are provided in **ADE** to control reverberation time in common internal parts of residential buildings; which are described in detail below.

Method A

- 7.13 This method recommends covering a specified area with an absorber of an appropriate class that has been rated according to **BS EN ISO 11654:1997 Acoustics – Sound absorbers for use in buildings – Rating of sound absorption**. For entrance halls, corridors or hallways, cover an area equal to or greater than the floor area with a Class C absorber or better.
- 7.14 For stairwells or a stair enclosure, calculate the combined area of the stair treads, the upper surface of the intermediate landings, the upper surface of the landing and the ceiling area on the top floor. Either cover at least an area equal to this calculated area with a Class D absorber, or cover an area equal to 50% of this calculated area with a Class C absorber or better. The absorptive material should be distributed equally between all floor levels. It will normally be convenient to cover the underside of intermediate landings, the underside of the other landings, and the ceiling area on the top floor.

Method B

- 7.15 This method requires determining the minimum amount of absorptive material using a calculation procedure in octave bands. In comparison to **Method A**, this method takes into account the existing absorption provided by all surfaces, which allows greater flexibility in meeting requirement E3 from **ADE** and requires less additional absorption than **Method A**.

Entrance Halls

- 7.16 A minimum of 0.2 m² total absorption area per cubic metre of the volume should be provided.

Corridors and Hallways

- 7.17 A minimum of 0.25 m² total absorption area per cubic metre of the volume should be provided.
- 7.18 We recommend a Class C absorber covers the total area of the ceiling (following **Method A**), which should ensure reverberation time is controlled in communal areas; combined with the thin carpet being provided in all corridors.

8 SUMMARY

- 8.1 This Noise Impact Assessment report has been prepared in support of the proposal by Stenprop Ltd to convert the existing office building known as Rose Kiln Court, Rose Kiln Lane, Reading RG2 0BY to provide either 34 or 38 residential units.
- 8.2 The conversion comes under *Class O – offices to dwellinghouse* (Schedule 2, Part 3) of the **GPDO 2015**, whereby it is necessary to consider the potential “...impacts of noise from commercial premises on the intended occupiers of the development...”.
- 8.3 As was set out within Section 5, it has been determined that no noise of a commercial nature is taken to be a feature on site (either now or in the future). By consequence there is considered to be no reason not to grant prior approval in terms of the relevant condition within the GPDO 2015.
- 8.4 Nevertheless, in recognition of the proposal’s noise-sensitive status and the proximity of the site to the A33, as well as Rose Kiln Lane, an assessment of road traffic noise on the internal amenity of the dwellings has been undertaken. Whilst the Class O criteria are only concerned with noise from commercial uses (not road noise) the applicant is seeking to ensure that a quality residential environment is provided and therefore considers the provision of appropriate mitigation accordingly.
- 8.5 Accordingly, Anderson Acoustics has visited site during June 2021 and monitored sound levels continuously for five full days and six nights in proximity to both the A33 and Rose Kiln Lane. Brief additional measurements were also undertaken to establish the approximate degree of sound insulation achieved by the existing building envelope.
- 8.6 The survey occurred during predominately dry and calm conditions, with the levels day to day, and night to night, found to be very consistent, indicating robust and representative data. For completeness, as an attempt to establish the potential effect of the ongoing pandemic on the noise conditions on site, consideration has been given to available traffic flow data, the Defra noise mapping and survey data from the neighbouring Cadogan House scheme, which was granted approval for conversion in January 2019. On balance, it has been concluded that the noise from the A33 is no lower that would be otherwise be expected, but where the noise from Rose Kiln Lane could be around 3 dB lower than it might otherwise have been. Accordingly, a 3 dB correction has been applied to the noise from Rose Kiln Lane as a likely worst case scenario. No further changes are anticipated in the foreseeable future.
- 8.7 Based on the measured and corrected sound levels for the A33 and Rose Kiln Lane, a 3D noise model of the site and surrounding area as been constructed, which has been used to calculate the sound levels outside the windows of the building. These have been compared to the relevant internal noise criteria, which are based on a combination of the guidance in **BS 8233** and the **ProPG**. Due to some areas of the building being screened from the A33 and/or Rose Kiln Lane, a large range in external levels have been calculated, from 55 to 75 dB $L_{Aeq,16h}$ (during the day), 50 to 69 dB $L_{Aeq,8h}$ (at night) and 71 to 93 dB L_{AFmax} (also at night). Which, due to the range in the relevant criteria, results in a range of sound insulation (i.e. noise mitigation) requirements of 15 to 48 dB (equivalent to R_w+C_{tr} performance values).
- 8.8 In a minority of areas, therefore, the existing sound insulation, which was found to be between 20 and 24 dB, would be sufficient. In the majority of instances, however, better performance would be needed if those standards were to be applied.
- 8.9 According to the example glazing performances are given in **BS 6262-2**, glazing comprising 10 / 12 / 6.4 should provide a reduction of 33 dB R_w+C_{tr} . Likewise for Pilkington’s 6 / 16 / 6.8 Optiphon™ unit. This would be sufficient (to within 2 dB) to achieve at least **reasonable** noise conditions in all instances.
- 8.10 Where greater performance is required, the use of secondary glazing is a preferred option. **BS 6262-2** indicates that performances of up to 45 dB R_w+C_{tr} are achievable, which is in keeping with data from Selectaglaze Ltd. Such performance would be sufficient to achieve **reasonable** levels in all instances, and the lower criteria in the majority of instances.

- 8.11 Ventilation is to be provided **ADF** System 4 (MVHR) systems, with the inlets and outlets suitably sound attenuated to ensure the required composite façade sound insulation performance is achieved. The requirement for, and means of, cooling will be subject to separate assessment at the detailed design stage. Likewise, the means of purge ventilation, but during which it is typically not a requirement to consider any associated noise implications.
- 8.12 With the use of secondary glazing (discussed in **6.7**), there would be **no observed adverse effect in the majority of instances**, with a **“Low” observed adverse effect in those residual instances**.
- 8.13 Accordingly, it is considered unlikely that it would be necessary to replace the double-glazed units (discussed in **6.6**) because the installation of secondary glazing alongside ventilation provides appropriate mitigation. For completeness we confirm that if the existing glazing were to be replaced, there would be a **“Low” observed adverse effect in the majority of instances**, and **no observed adverse effect in some instances**.
- 8.14 Notwithstanding the façade performance, it is envisaged that the Building Regulations process will dictate that the new and retained separating walls and floors will need to meet the sound insulation requirements of **ADE**, with details of the requirements presented in **Section 7**. This should not be a matter controlled by planning condition in relation to this Class O submission.
- 8.15 Accordingly, in the absence of commercial noise (as relevant to the **GPDO 2015**), and since the road traffic noise can be sufficiently controlled with the use of suitable glazing and ventilation systems, it is considered that prior approval can be granted for the scheme subject to suitable noise conditions.
- 8.16 It is anticipated that there will be a condition to ensure compliance with the internal criteria and façade sound insulation performances presented in this report, taking into account any noise break-in via the ventilation system, with any system generated noise being suitably controlled. Controls to achieve **ADE** requirements is expected through the Building Regulations process, whilst any external building plant would be expected to be subject to separate assessment in accordance with **BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound**.
- 8.17 In this way, with further details presented in **Appendix B**, it is considered that the scheme will be compliant with national and local planning policy, including policies **170 e)**, **180 a)** and **182** of the **NPPF**, and **CC8: Safeguarding Amenity**, **ENV16: Pollution and Water Resources**, **EN17: Noise Generating Equipment** and **H8: Residential Conversions** of **Reading Borough Local Plan Adopted November 2019**.

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APPENDIX A

GLOSSARY OF ACOUSTICS TERMINOLOGY

Introduction to Acoustics, Sound and Noise

The word 'acoustic' is derived from the Greek words 'akoustikos' (meaning "of or for hearing, ready to hear") and 'akoustos' (meaning "heard, audible").

Acoustics is the branch of physics concerned with the properties of sound, including ultrasound, infrasound and vibration. A scientist or engineer who works in the field of acoustics is an acoustician or acoustic engineer.

Sound can be measured by a sound level meter or other measuring system. Noise is related to a human response, and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive.¹ Care has been taken in this document to use the most relevant of these terms (whereby 'sound' is used predominantly); however, in most reference documents, and, indeed, generally, 'sound' and 'noise' are used interchangeably. Consequently, just because the term 'noise' is used doesn't necessarily mean a negative effect exists or will occur, and the context of the accompanying text should be taken into account.

Human hearing is 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 sound in a manner that approximates the response of the human ear, a weighting mechanism is used, which reduces the importance of lower and higher frequencies in a similar manner to human hearing.

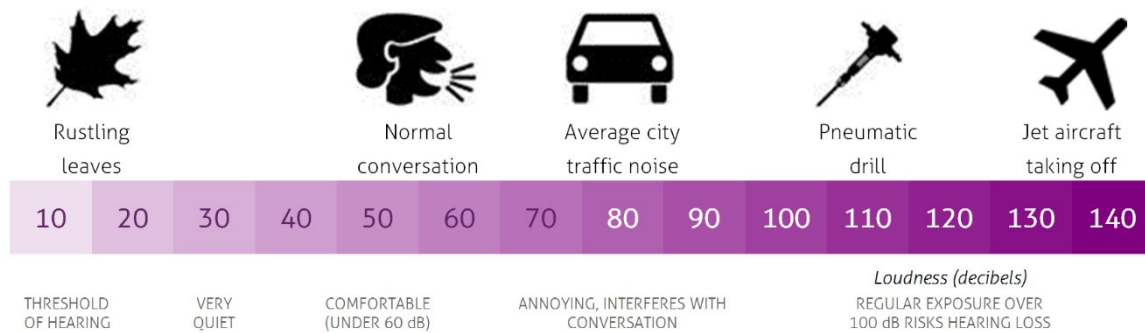
The weighting mechanism that best corresponds to the response of the human ear (though not necessarily perfectly) is the 'A'-weighting scale. This is widely used for environmental sound measurement, and the levels are denoted as dBA, dB(A) or L_{Aeq} , L_{A90} etc. according to the metric being measured or determined (see the Definitions over leaf).

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 dBA increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dBA is generally regarded as the minimum difference needed to perceive a change under normal listening conditions. Where other changes occur (associated with the change in sound level), such as additional vehicle movements on a road, which can be seen, then these may result in changes in sound level being more noticeable than they might otherwise be.

Further to such visual clues, and any other non-acoustical factors that affect people's response (such as personal characteristics, and social, residential or environmental factors), the subjective response to a sound is dependent not only upon the sound pressure level and component frequencies, but also its intermittency. Consequently, various metrics have been developed to try and correlate people's attitudes to different sounds with the sound level and its fluctuations. The metrics used in this document, as per the relevant guidance, are defined overleaf.

¹ Taken from the Foreword to [BS 4142](#)

Figure A.1: Typical noise levels



Definitions

- **Airborne sound:** Sound that reaches the point of interest by propagation through air.
- **Ambient Sound:** Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.
- **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.
- **Background sound:** Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.
- **Calibration:** The measurement system/ chain should be periodically calibrated, within a laboratory, against traceable calibration instrumentation, to either National Standards or as UKAS-Accredited, as required. The calibration of the system should also be checked in the field using a portable calibrator before and after each short term measurements, and periodically for longer term monitoring.
- **Class 1:** The Class of a sound level meter describes its accuracy as defined by the relevant international standards – Class 1 is more accurate than Class 2. The older standard IEC 60651 referred to the grade as "Type", whereas the new standard IEC 61672 refers to it as the "Class". The most accurate meters used in the field (as opposed to a laboratory) are Class 1. Class 2 meters can be used in some instances; however, Anderson Acoustics use Class 1 (or Type 1) meters by default, as required by BS 4142, for example.
- **Context:** The circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood. When considering context, pertinent factors include: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; evidence on human response to the sound; and the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.
- **C_{tr}:** Correction/adaption term applied against the sound insulation single-number values (R_w, D_w, and D_{nT,w}) to provide a weighting for low frequency performance. The reference values used within the C_{tr} calculation are based on urban traffic sound.
- **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 20 µPa.
- **Dwelling:** A building used for living purposes. A mobile home used for permanent living should be included in an assessment. If calculations are being conducted for compensation purposes, then some mobile homes are dealt with under the Highways Noise Payments and Moveable Homes Regulations.
- **Façade/ Façade Level:** At a distance of 1 m in front of a large sound reflecting object such as a building façade. According to BS 8233:2014, "Façade level measurements of L_{pA} are typically 1 dB to 2 dB higher

than corresponding free-field measurements because of the reflection from the façade.” The Calculation of Road Traffic Noise (1988) uses 2.5 dB, whilst BS 5228-1:2009+A1:2014 recommends 3 dB. Owing to the latter examples, together with other historical documents, it is more usual to apply 3 dB.

- Fast time-weighting (F): Averaging time used in sound level meters. Defined in BS EN 61672-2:2013 *Electroacoustics. Sound level meters. Pattern evaluation tests*.
- Hertz (Hz): The unit of Frequency or Pitch of a sound. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
- IOA: The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society (a daughter society of the Institution of Mechanical Engineers). It is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels.
- $L_{AF90,T}$: The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time fast time-weighting (F). Generally used to describe the ‘background’ sound conditions.
- L_{AFmax} : The maximum A-weighted sound pressure level during a given time period. L_{max} is sometimes used for the assessment of occasional loud sounds, which may have little effect on the overall L_{eq} noise level, but could still affect the sound environment. Unless described otherwise, it is measured using the fast time-weighting (F).
- $L_{eq,T}$: A sound level index called the equivalent continuous sound 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. Where the value is A-weighted, it will be presented ‘ $L_{Aeq,T}$ ’ or ‘dBA $L_{eq,T}$ ’, otherwise it should be an un-weighted (or linear) value.
- L_p : See Sound Pressure Level.
- Octave/ octave band: Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit. E.g. the 1000 Hz octave band contains sound energy at all frequencies from 707 to 1414 Hz.
- Percentile Level: The sound pressure level exceeded for N% of a specified time interval, see $L_{AF90,T}$ etc.
- Point source: A sound source whose dimensions are small compared to the propagation distances involved. Due to the Inverse Square Law, the sound level pressure level decreases by 6 dB every time the distance between the measurement point and the source is doubled.
- R: See Sound Reduction Index.
- R_w : See Weighted Sound Reduction Index.
- Sound level metrics, Indices or Parameters: Sound levels usually fluctuate over time, so it is often necessary to consider an average or statistical sound level. This can be done in several ways, so a number of different metrics have been defined, according to how the averaging or statistics are carried out.
- Sound pressure level (sound level), L_p : The sound level is the sound pressure relative to a standard reference pressure of 20 μ Pa (20×10^{-6} Pascals) on a decibel scale.
- Sound pressure: Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
- Sound reduction index (SRI), R: Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.
- Weighted sound reduction index (SRI), R_w : Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies as measured in a laboratory.

APPENDIX B

NOISE POLICY, GUIDANCE AND CRITERIA

Please note that this section is provided for completeness only. The Class O process requires reference to specific criteria and the requirements of both national policy advice and Development Plan objectives are strictly inapplicable.

B.1 National Policy

The national policy of relevance comprises the **Noise Policy Statement for England (NPSE, 2010)** and the online **National Planning Policy Framework (NPPF, regularly updated)** and its associated **planning practice guidance** on “**Noise**” (also regularly updated). The guidance is necessarily generic and primarily geared towards local authorities preparing their own policies and associated guidance. The documents are described below.

B.1.1 Noise Policy Statement for England (NPSE, 2010)

The **NPSE** is the Government’s overarching statement on noise policy for England, and applies to all forms of noise other than occupational noise, setting out the long-term vision of Government noise policy, which is to:

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

Which is supported by the following noise policy aims:

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

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life.

When discussing the meaning of significant adverse and adverse within an **Explanatory Note**, the **NPSE** states:

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

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

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

To which the **NPSE** added the following related concept:

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

The **Explanatory Note** continues:

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

The **NPSE** concludes by explaining in a little more detail how the **LOAEL** and **SOAEL** relate to the three aims listed above. Logically, it starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the **LOAEL** and the

SOAEL, when “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development.” The final aim envisages proactive management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

B.1.2 National Planning Policy Framework (NPPF, 2019)

First published in 2012, and most recently updated in June 2019, the **NPPF** sets out the Government’s planning policies for England, and how these are expected to be applied. Noise is referenced within the **NPPF** as follows. These are effectively the **NPPF**’s policies on noise.

170. Planning policies and decisions should contribute to and enhance the natural and local environments by:

...e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans...

180. 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:

a) 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 life⁶⁰...

Reference number 60 of the above quotation points to the **Explanatory Note** to the **NPSE** (see above).

The following policy is also relevant to noise.

182. 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 mentioned above, the Government has published accompanying web-based planning guidance for a number of categories, including noise (see below).

B.1.3 NPPF Planning Practice Guidance, Noise (PPG-N, 2019)

Following initial release in 2014, the planning practice guidance now forms part of the **NPPF**, referred to as **relevant planning practice guidance**, which includes guidance on the category of **Noise**. The guidance is often referred to as PPG-Noise, **PPG-N** or PPG(N).

In keeping with the **NPSE** and **NPPF**, no values (in dB) are presented; however, plenty of guidance is provided as to the issues to consider in assessing noise and determining suitable thresholds. Whilst, in keeping with this report, reference is made to **BS 8233** (see **B.2.1** and **B.3.2**).

A **noise exposure hierarchy table** is provided, which summarises the noise exposure hierarchy based on the likely average response of those affected, and is reproduced below. It includes **examples of outcomes** relevant to the **NOEL**, **LOAEL** and **SOAEL** effect thresholds described in the **NPSE**. These outcomes are in descriptive form; there is no numerical definition of the **NOEL**, **LOAEL** and **SOAEL**.

Table B.1: Noise exposure hierarchy table (as per PPG-N)

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

It is left to other guidance documents (e.g. [BS 8233](#) – see further below) and professional opinion to determine thresholds where required.

Please note that this section is provided for completeness only. The Class O process requires reference to specific criteria and the requirements of both national policy advice and Development Plan objectives are strictly inapplicable.

B.2 Local Policy

B.2.1 Reading Borough Local Plan Adopted November 2019

The policy relevant to noise is presented below. Where considered necessary, comments on the policy are provided.

CC8: SAFEGUARDING AMENITY

Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

- *Privacy and overlooking;*
- *Access to sunlight and daylight;*
- *Visual dominance and overbearing effects of a development;*
- *Harm to outlook;*
- *Noise and disturbance;*
- *Artificial lighting;*
- *Vibration;*
- *Dust and fumes;*
- *Smell;*
- *Crime and safety; or*
- *Wind, where the proposals involve new development of more than 8 storeys.*

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy.

As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable.

Where an otherwise acceptable development could change its character to a use that would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes.

The nature of the proposed development and surrounding area are such that there is considered to be no noise (or vibration) risk in this regard, as relevant to this report.

EN16: POLLUTION AND WATER RESOURCES

Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution; where it would result in no deterioration in, or ideally enhance, ground and surface water quality; and where adequate water resources, sewerage and wastewater treatment infrastructure will be in place to support the proposed development prior to occupation.

Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.

Development will only be permitted on land affected by contamination where it is demonstrated that the contamination and land gas can be satisfactorily managed or remediated so that it is suitable for the proposed end use and will not impact on the groundwater environment, human health, buildings and the wider environment, during demolition and construction phases as well as during the future use of the site.

4.2.90 Exposure to high levels of noise can have a significant effect on human health. This policy deals with noise issues in general, whilst policy EN17 deals particularly with noise-generating equipment. It is worth noting that there is a Professional Practice Guide on Planning and Noise

available⁶⁰ which provides guidance on design of residential developments to take account of noise, and taking account of this from the early design stage will help to reduce noise effects on future residents.

⁶⁰ IOA, ANC & CIEH (2017)

<http://ioa.org.uk/sites/default/files/14720%20ProPG%20Main%20Document.pdf>

It is noted that “Proposals for development that are sensitive to the effects of noise... will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.” It is expected that, despite the high levels of noise from the A33, with suitable glazing and ventilation units, such as those discussed in this report, adequate mitigation will be provided to suitably minimise the impact.

EN17: NOISE GENERATING EQUIPMENT

Where noise generating equipment is proposed, the noise source specific⁶¹ level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor.

⁶¹ The noise source specific level is the measured noise level, as opposed to the rating level, which is the specific level with correction factors included.

It is not known at this stage if noise generating equipment will be included as part of the development. It is expected that any such equipment will be subject to separate assessment, as secured by planning condition.

H8: RESIDENTIAL CONVERSIONS

Proposals to convert buildings into self-contained flats or for multiple occupation will be assessed against the impact on the amenity and character of the surrounding area, particularly in terms of intensification of activity, loss of privacy, loss of external amenity space, the provision and location of adequate on-site car parking and the treatment of bin storage areas and other related servicing.

Proposals to convert properties into self-contained flats or for multiple occupation will only be acceptable where:

- *The proposal respects the physical character of the area in terms of scale, location, materials and design, the arrangement of doors, windows and other principal architectural features;*
- *The proposal would not, either individually or cumulatively, unduly dilute or harm an existing mixed and sustainable community through the significant loss of single family housing;*
- *There are no unacceptable adverse impacts to residents of the scheme or surrounding properties arising from noise and disturbance in terms of the number and layout of units proposed and the proximity to other properties;*
- *There is no inappropriate stacking and location of rooms between units;*
- *Bin and cycle storage is of an appropriate size and standard for the units proposed and should be located at ground floor level with easy access; and*
- *The resulting property or properties would provide adequate internal floorspace and headroom⁸⁶ for residents.*

Additionally, in the case of conversions of houses to self-contained flats:

- *The property to be converted measures more than 120 square metres gross;*
- *At least 25% of the units formed and, where there are 4 or fewer units at least one unit of accommodation, should be suitable for family occupation with a minimum of two bedrooms.*

Additionally, in the case of sui generis houses in multiple occupation (HMOs):

- *The property to be converted measures more than 120 square metres gross;*
- *There is sufficient communal space⁸⁶.*

Additionally, in areas covered by an Article 4 direction that restricts changes of use from Class C3 to Class C4:

- *Planning permission will not normally be granted where the proportion of HMOs (either C4 or sui generis) will result in HMOs representing 25% or more of the residential properties within a circle of 50m radius measured from the application site.*

⁸⁶ This is defined in the Council's Residential Conversions SPD – see www.reading.gov.uk/readingldf

It is noted that, “Proposals... will only be acceptable where... There are no unacceptable adverse impacts to residents of the scheme or surrounding properties arising from noise and disturbance in terms of the number and layout of units proposed and the proximity to other properties...” and “There is no inappropriate stacking and location of rooms between units...” As states above in relation to **CC8: SAFEGUARDING AMENITY**, no noise impacts are to be expected as a result of the development on existing receptors, whilst, as presented in the report, the proposed rooms are considered appropriately stacked and located.

B.2.2 Residential Conversions Supplementary Planning Document Conversion of Properties to Self-Contained Flats or for Multiple Occupation Adopted November 2013

It is taken this document has been largely, if not actually, superseded by the latest version of the Local Plan (above), but where the details are presented here for completeness. Note: ‘DM’ refers to adopted Sites and Detailed Policies Document policies.

Noise and Disturbance

Checklist 8 (DM4, DM8): It will be necessary to ensure appropriate sound insulation between proposed and neighbouring units before a converted property is occupied.

- 2.24 Such works are likely to be required by way of condition attached to any planning permission issued, and a minimum standard of sound insulation is also required under the Building Regulations. Failure to adequately sound-proof conversions when built could lead to complaints, which may result in action under the Environmental Protection Act (1990) (as amended).
- 2.25 In accordance with Building Regulations entrance lobbies should be provided for each flat so that entry is not achieved directly into a living room from a flight of communal stairs. Adequate ventilation and daylight must be available to all rooms.

Stacking and Location of Rooms and Sound Insulation

- 2.26 When considering a conversion the impact from noise and disturbance, in terms of the number and layout of units proposed and the proximity of the property to other residential properties, will need to be addressed.

Checklist 9 (DM4, DM8): Proposed layouts should avoid locating living rooms, bathrooms and kitchens next to, above, or below proposed and neighbouring bedrooms. Instead, the ‘stacking’ of rooms of a similar type is preferable.

Checklist 10 (DM4, DM8): Habitable rooms, such as living rooms and bedrooms, should benefit from an external window. The provision of natural light and ventilation is a legal requirement under Environmental Health legislation.

- 2.27 These requirements will often be secured through Building Regulations and Environmental Health legislation and, therefore, pre-application discussion with a Building Control and Environmental Health Officer is advised.

Other Sites for Development in Central Reading

- 5.4.35 In some cases, residential development is proposed in areas where noise levels may be an issue. It should be possible to mitigate this through the design of the scheme. In order for the internal noise levels to be reasonable and not adversely affect health, it would be necessary to provide a system of ventilation that entirely removes the necessity to open windows, even in very hot weather. Similarly, in terms of air quality, mitigation of impacts on residential development may be required, including means of ventilation that remove the need to open windows, and draw in the lowest levels of pollution possible, for instance from roof sources. This should be secured through the design of the proposal, and planning condition if necessary. Such systems will require additional energy use, which will need to be offset in order to comply with policy CC2 or H5.

In accordance with **Checklist 8**, and as per the guidance in this report, the sound insulation between the proposed units will be designed to meet the requirements of the **Building Regulations**.

In accordance with **Checklist 9**, the proposed rooms are considered to be appropriately stacked and located.

In accordance with **Checklist 10**, the proposed habitable rooms will benefit from external windows, whilst ventilation will be provided by mechanical means to meet the requirements of the **Building Regulations**.

The advice for **Other Sites for Development in Central Reading** is noted and would be relevant here if this was not a Class O submission. Nevertheless, the applicant does intend to “provide a system of ventilation that entirely removes the necessity to open windows, even in very hot weather.” This will be secured through the detailed design of the scheme, with the expectation that this requirement will be covered by a suitable planning condition should the Council consider it appropriate and necessary to do so.

Please note that this section is provided for completeness only. The Class O process requires reference to specific criteria and the requirements of both national policy advice and Development Plan objectives are strictly inapplicable.

B.3 Standard internal noise criteria for dwellings

B.3.1. British Standard 8233:2014 Sound insulation and noise reduction for buildings – Code of practice

BS 8233:2014 Sound insulation and noise reduction for buildings – Code of practice provides the following guideline values (and accompanying notes) for internal noise levels within residential dwellings.

Table B.2: BS 8233 indoor ambient noise levels for dwellings

Activity	Location	Daytime (07-23)	Night-time (23-07)
Resting	Living room	35 dB $L_{Aeq, 16\text{hour}}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16\text{hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16\text{hour}}$	30 dB $L_{Aeq, 8\text{hour}}$

NOTE 1 [Table B.2] provides recommended levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The levels shown in Table 4 are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in [Table B.2].

NOTE 3 These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.

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.

If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

NOTE 6 Attention is drawn to the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

If there is noise from a mechanical ventilation system, the internal ambient noise levels should be reported separately with the system operating and with it switched off. If the room contains items such as fridges, freezers, cookers and water heaters, these should be turned off during measurement. Shorter measurement periods such as $L_{Aeq, 1\text{ hour}}$ may be used by agreement, provided the selected shorter measurement period is shown to be representative of the entire night or day period.

Please note that this section is provided for completeness only. The Class O process requires reference to specific criteria and the requirements of both national policy advice and Development Plan objectives are strictly inapplicable.

B.4 Additional Guidance

B.4.1 ProPG: Planning and Noise (2017)

The **Professional Practice Guidance on Planning & Noise (ProPG)** (Planning & Noise, 2017) for New Residential Development was produced by a Working Group consisting of representatives of the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), together with practitioners from a planning and local authority background, to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.

The **ProPG** acknowledges and reflects the Government's overarching **NPSE**, the **NPPF** and the associated **PPG-N**, as well as other authoritative sources of guidance.

Of key relevance, the external and internal noise level guidelines presented in ProPG are primarily based on the guidance in **BS 8233**, with further guidance incorporated based on the WHO's **Guidelines for Community Noise** and current good practice. The thresholds are, therefore, as presented above (i.e. those within **Table B.1**, plus the night-time L_{Amax} threshold of 45 dB). The associated text where the guidance in **BS 8233** has been expanded upon is as follows (as per the blue text of Figure 2 of **ProPG**):

In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A [**ProPG**]).

Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet 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 [as per the text below].

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 (see Section 3.D [**ProPG**]).

Whilst, in addition to the above, **ProPG** includes recommendations on steps to be undertaken for assessments, following these, or using the **ProPG**-specific terminology, is not strictly necessary when following the guidance in the British Standards, which is sufficient to ensure national and local policy compliance.

B.4.2 Acoustics, Ventilation and Overheating Guide (2020)

The **Acoustics, Ventilation and Overheating Residential Design Guide (AVO Guide)** (Version 1.0, January 2020) has been prepared with contributions from members of the Association of Noise Consultants' (ANC) Acoustics, Ventilation and Overheating (AVO) Group. As stated in the Introduction to the AVO Guide, "It recommends an approach to acoustic assessments for new residential development that take due regard of the interdependence of provisions for acoustics, ventilation, and overheating. Application of the AVO Guide is intended to demonstrate good acoustic design as described in the ProPG: Planning & Noise, May 2017 ('ProPG'), when considering internal noise level guidelines." Whilst,

“Provisions for both ventilation and mitigation of overheating may include façade openings that permit external noise ingress, and/or mechanical equipment that generates noise. In both cases, there is potential for noise impact.”

The scope is further clarified as, “...for the consideration of new residential development that will be exposed predominantly to airborne sound from transport sources, and to sound from mechanical services that are serving the dwelling in question. Other sources of noise, such as noise from industrial, commercial or entertainment premises, and of ground-borne noise and vibration, are outside the scope of the AVO Guide. New apartments, flats and houses are the most common type of new residential development. The approach may also be used for other types of residential development such as residential institutions, care homes etc, although it needs to be remembered that some of the occupants of these types of premises can be more sensitive to indoor environmental conditions.” Whilst “The contribution to internal noise levels from transport sources and from mechanical services are considered separately and independently, because there is evidence that occupants have a different tolerance to each.”

In terms of **External and Internal Ambient Noise Levels due to Transport Noise Sources**, the **AVO Guide** notes that, “the over-arching aspiration of good acoustic design is that residents may open windows without any adverse acoustic impact (ProPG paragraph 2.33); where a site layout achieves these conditions, the portion of the AVO Guide relating to environmental noise is not applicable.” Whilst, “Good acoustic design may be considered as a component of sustainable design. Other aspects of sustainable design include a response to climate change, in terms of aiming to minimise use of energy and other resources.”

It is also noted, “There are other benefits for occupants from opening windows, such as the connection with the outside, sense of fresh air, experience of draughts when overheating, and sense of control over one’s environment. Consideration of these factors is also beyond the scope of the AVO Guide.”

The **AVO Guide** highlights, therefore, that, in the context of sustainable development, good practice should be adopted to minimise noise levels within dwellings with windows open as far as practicable.

The following three key statements are quoted from **ProPG**:

...special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide “whole dwelling ventilation” in accordance with Building Regulations Approved Document F (e.g. trickle ventilators).

It should also be noted that the internal noise level guidelines are generally not applicable under “purge ventilation” conditions as defined by Building Regulations Approved Document F [ADF], as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

In addition to providing purge ventilation, open windows can also be used to mitigate overheating. Therefore, should the LPA accept a scheme is to be assessed with windows closed, but this scheme is reliant on open windows to mitigate overheating, it is also necessary to consider the potential noise impact during the overheating condition. In this case a more detailed assessment of the potential impact on occupants should be provided in the ADS [Acoustic Design Statement].

In other words, there is no requirement to assess external noise ingress during purge ventilation, but there is during whole dwelling ventilation (usually with windows closed but trickle vents open, and referred to as the **ADF ventilation condition**) and the provision of ventilative cooling (usually with windows open, and referred to as the **overheating condition**). With the first condition being essentially a constant requirement, and the second an occasional requirement, subject to various factors associated with internal heat generation, hence different noise criteria are deemed to apply. The derivation of the criteria considered applicable here is presented below, with the **ADF ventilation condition** and **overheating condition** being addresses separately.

For the **ADF ventilation condition**, where the internal levels are at or below the **BS 8233** acoustic criteria with windows closed and trickle vents open, where present, the acoustic requirements are deemed to be met. And where there is no risk of overheating under such conditions (i.e. with windows closed), then there is no need for further assessment (with the exception of external amenity space, where present). Assuming, however, it is not possible to rule out such risk of overheating, it is necessary to also consider the **overheating condition**.

In the case of environmental noise ingress during the temporary **overheating condition**, a two-level assessment procedure is described. The first level is a **site risk assessment** based on external noise levels and the assumption that opening windows are the primary means of mitigating overheating. The second level assessment considers the potential for adverse effect on occupants based on internal ambient noise levels.

The **Level 1 site risk assessment** is performed by comparing the relevant ambient noise levels for the site/representative location of the key dwellings (as measured or otherwise determined) with Table 3-2 of the **AVO Guide**.

A core factor of the assessment is the assumption that the level difference between outside and inside conditions with a window open for ventilative cooling is 13 dB, and that a **Level 2 assessment** is not required if **reasonable** internal conditions are achieved, which are taken to be the **BS 8233** criteria relaxed by 5 dB. For the most noise-sensitive spaces of living rooms and bedrooms, therefore, the thresholds are 53 dB (i.e. 35+5+13) and 48 dB (i.e. 30+5+13) for the daytime and night-time periods, respectively. Accordingly, by applying a banding of 5 dB, the guidance in Table 3-2 of the **AVO Guide** can be summarised as follows.

Table B.3: Interpretation of the Level 1 site risk assessment noise thresholds relating to overheating condition

Risk category for Level 1 assessment	$L_{Aeq,T}$ (07-23)	$L_{Aeq,8h}$ (23-07)	Level 2 assessment?	L_{AFmax} (23-07)
High	> 63 dB	> 58 dB	Recommended	> 78 dB ("normally exceeded")
Medium	59 – 63 dB	54 – 58 dB	Optional/Recommended	n/a
Low	54 – 58 dB	49 – 53 dB	Optional	n/a
Negligible	≤ 53 dB	≤ 48 dB	Not required	n/a

The Level 2 assessment is performed by comparing the ambient noise levels within key habitable rooms with Table 3-3 of the **AVO Guide**. It is noted that the **Examples of Outcomes** (as per the **NPPF's PPG-N**) make references to "a change" or "changes" in condition(s) and/or behaviour(s); however, since the guidance is aimed at new residential development (and thus new occupants), with the assumption that the environmental noise conditions will remain as assessed, it is more a case of the potential "difference" in behaviour compared to what might have been the case under lower noise conditions.

A summary of the **Level 2** assessment guidance is presented in **Table B.4** below. In keeping with the **Examples of Outcomes** references, the guidance has been married with guidance in the **NPSE** and **NPPF**. As noted in the **AVO Guide**, "Although... the word 'level' is used, this does not mean that the impact can only be described as an individual noise level or exposure. It could also include factors such as the number of times the noise impact occurs, the duration of the impact, and the time of day the impact occurs. Thus, depending on the circumstance, the noise impact could be managed by reducing how often it occurs rather than just reducing the level of impact when it does occur." Accordingly, the levels and associated effects presented below are subject to consideration of, in particular, the duration/number of occurrences of overheating. As shown below, it is most likely that the values and corresponding **Examples of Outcomes** and **Level of Effect** are applicable to situations of limited overheating.

Table B.4: Interpretation and summary of guidance for Level 2 assessment relating to overheating condition

Examples of Outcomes	Internal ambient noise level			Level of Effect ¹	Action
	L _{Aeq,T} (07-23)	L _{Aeq,8h} (23-07)	L _{AFmax} (23-07)		
Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	≥ 51 dB	≥ 43 dB	Normally ≥ 66 dB	Significant observed adverse effect	Avoid ²
	51 dB	43 dB	Normally 66 dB	SOAEL (Significant observed adverse effect level)	
Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	41 – 50 dB	36 – 42 dB	52 – 65 dB no more than 10 times a night	Observed adverse effect	Mitigate and reduce to a minimum
	36 – 40 dB	31 – 35 dB	46 – 51 dB no more than 10 times a night	“Low” ³ observed adverse effect	
Noise can be heard, but does not cause any change in behaviour	35 dB	30 dB	45 dB no more than 10 times a night	LOAEL (Lowest observed adverse effect level)	No specific measures required
	< 35 dB	< 30 dB	< 45 dB no more than 10 times a night	No observed adverse effect	

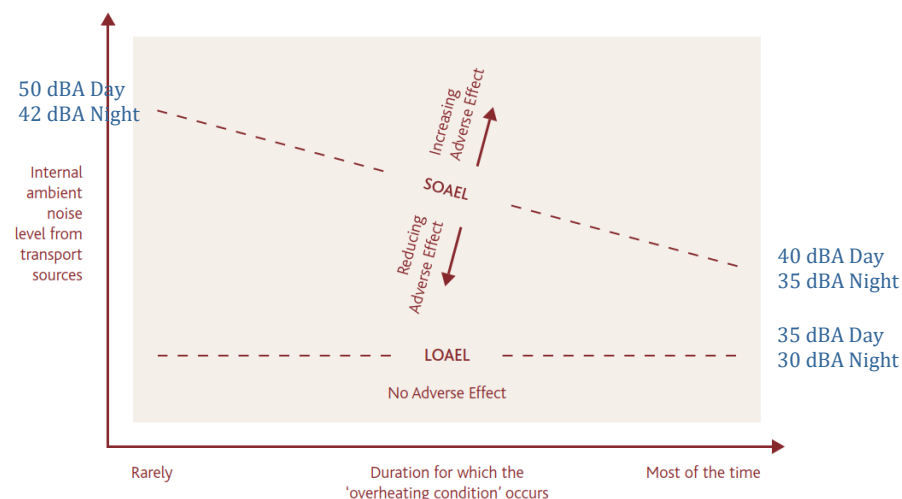
1 Subject to the duration/number of occurrences (see **Figure B.1** of this report below).

2 This is the first aim of the NPSE while taking into account the guiding principles of sustainable development.

3 The “Observed adverse effect” range, which is a relatively large range, has been split into two to reflect the guidance that the BS 8233 L_{Aeq} criteria can be relaxed by up to 5 dB and “reasonable” conditions still achieved. The same has been considered applicable to the L_{AFmax} criterion. This lower end of the range has been termed “Low”, which is considered logical and helpful, though, strictly, there is no such term in the NPPF’s planning practice guidance.

As referenced above, following the Level 2 table in the **AVO Guide** is the figure (Figure 3-2) presenting the qualitative guidance on the consideration of noise level and duration of overheating. This is reproduced below as **Figure B.1**. The original figure references “SOAEL” and “LOAEL” but with no values given at that point in the **AVO Guide**. In the example versions of the figure given in Appendix B of the **AVO Guide**, however, values are given, which are included in the figure below.

Figure B.1: Qualitative guidance on combined effect of internal ambient noise level and duration for the overheating condition (as per AVO Guide Figure 3-2, plus values from AVO Guide Figures B-2 and B-3)



By comparing the example values in blue with the levels presented in **Table B.4** above, it can be seen that they fall within the adopted “observed adverse effect” range, dropping down from just below the SOAEL (i.e. 51 dB for the day and 43 dB for the night) to what we’ve adopted as the top of the “Low” observed adverse effect range (which is where levels are likely to be considered just reasonable). It is considered, therefore, that **Figure B.1** and **Table B.4** show good correlation. It remains, however, to determine what values could apply to the horizontal axis in terms of duration for which the overheating condition occurs.

APPENDIX C

SURVEY DATA

Table C.1: Baseline sound level survey results (free-field), dB

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	LAeq,15min	LAfmax	LAf10,15min	LAf90,15min	LAeq,15min	LAfmax	LAf10,15min	LAf90,15min
04/06/2021 15:00	-	-	-	-	76	87	80	64
04/06/2021 15:15	67	77	71	54	76	95	81	61
04/06/2021 15:30	67	77	71	55	78	101	81	62
04/06/2021 15:45	67	78	71	56	76	84	80	61
04/06/2021 16:00	68	80	71	58	76	87	80	59
04/06/2021 16:15	68	77	71	56	76	88	80	61
04/06/2021 16:30	73	99	72	57	77	99	80	65
04/06/2021 16:45	68	79	72	57	78	100	81	59
04/06/2021 17:00	69	77	72	57	76	85	81	65
04/06/2021 17:15	68	79	71	55	76	89	80	60
04/06/2021 17:30	68	87	71	60	77	95	80	65
04/06/2021 17:45	68	76	71	59	76	86	80	61
04/06/2021 18:00	68	81	71	58	77	97	80	62
04/06/2021 18:15	68	79	71	56	76	86	80	56
04/06/2021 18:30	68	76	72	56	76	91	81	56
04/06/2021 18:45	68	76	72	55	77	101	80	57
04/06/2021 19:00	68	79	71	55	76	87	80	57
04/06/2021 19:15	67	75	71	54	76	90	80	53
04/06/2021 19:30	67	78	71	55	76	99	80	54
04/06/2021 19:45	67	81	71	54	75	89	80	55
04/06/2021 20:00	68	78	72	54	75	85	80	55
04/06/2021 20:15	66	75	71	51	74	87	79	50
04/06/2021 20:30	67	75	71	53	74	87	79	56
04/06/2021 20:45	67	76	71	54	74	90	79	52
04/06/2021 21:00	67	85	71	53	74	90	78	51
04/06/2021 21:15	66	79	70	51	74	103	78	51
04/06/2021 21:30	68	90	71	51	73	87	77	50

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
04/06/2021 21:45	65	75	70	49	73	89	78	46
04/06/2021 22:00	65	80	70	50	73	85	78	49
04/06/2021 22:15	64	83	69	51	73	95	77	53
04/06/2021 22:30	69	97	69	47	72	86	76	50
04/06/2021 22:45	63	75	69	48	71	85	76	49
04/06/2021 23:00	64	79	69	49	71	86	76	47
04/06/2021 23:15	65	83	69	47	71	91	75	45
04/06/2021 23:30	63	78	68	46	71	87	75	46
04/06/2021 23:45	62	75	67	45	71	84	76	46
05/06/2021 00:00	61	74	66	45	73	98	75	46
05/06/2021 00:15	62	77	67	42	67	83	72	42
05/06/2021 00:30	61	80	65	41	68	86	72	40
05/06/2021 00:45	61	78	64	41	70	90	73	41
05/06/2021 01:00	58	73	61	41	68	86	73	42
05/06/2021 01:15	59	77	63	40	67	85	72	40
05/06/2021 01:30	59	80	62	41	67	86	70	41
05/06/2021 01:45	58	75	61	39	65	82	69	40
05/06/2021 02:00	58	75	60	39	67	90	71	40
05/06/2021 02:15	58	78	60	39	65	83	69	39
05/06/2021 02:30	60	78	63	39	67	83	70	40
05/06/2021 02:45	59	75	62	37	65	83	67	38
05/06/2021 03:00	57	75	55	37	65	82	69	38
05/06/2021 03:15	56	74	58	37	64	81	67	39
05/06/2021 03:30	57	79	59	38	65	82	68	41
05/06/2021 03:45	59	77	62	40	65	85	68	42
05/06/2021 04:00	58	76	59	42	64	83	63	41
05/06/2021 04:15	58	76	60	41	66	87	67	41
05/06/2021 04:30	61	80	66	42	68	95	71	42

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
05/06/2021 04:45	59	77	63	41	67	92	70	42
05/06/2021 05:00	61	77	65	42	65	83	68	41
05/06/2021 05:15	61	77	65	43	67	83	71	41
05/06/2021 05:30	62	77	67	43	69	89	73	42
05/06/2021 05:45	63	78	68	44	70	88	74	44
05/06/2021 06:00	64	84	69	46	71	86	75	46
05/06/2021 06:15	63	81	68	45	70	85	75	46
05/06/2021 06:30	64	86	69	47	71	91	76	45
05/06/2021 06:45	65	77	70	48	72	86	77	47
05/06/2021 07:00	64	75	69	47	72	91	77	45
05/06/2021 07:15	65	80	70	49	73	90	78	45
05/06/2021 07:30	66	79	71	52	74	85	79	49
05/06/2021 07:45	67	77	72	51	74	87	79	48
05/06/2021 08:00	66	79	70	50	74	85	79	49
05/06/2021 08:15	66	78	71	52	74	86	79	51
05/06/2021 08:30	67	76	71	52	75	90	79	50
05/06/2021 08:45	67	77	71	53	75	87	79	52
05/06/2021 09:00	68	81	71	55	75	91	79	53
05/06/2021 09:15	67	76	71	53	75	91	80	52
05/06/2021 09:30	67	78	71	54	75	91	80	54
05/06/2021 09:45	67	79	71	55	75	86	79	56
05/06/2021 10:00	67	76	70	55	75	85	80	53
05/06/2021 10:15	68	85	71	56	75	88	79	57
05/06/2021 10:30	68	77	71	56	75	84	80	56
05/06/2021 10:45	68	76	71	56	75	86	80	57
05/06/2021 11:00	67	82	70	57	75	85	79	58
05/06/2021 11:15	68	82	71	56	75	89	79	58
05/06/2021 11:30	67	76	70	58	76	92	80	55

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
05/06/2021 11:45	67	78	70	56	75	90	79	54
05/06/2021 12:00	67	75	70	54	75	84	79	58
05/06/2021 12:15	66	76	70	55	75	88	80	61
05/06/2021 12:30	66	76	70	55	75	84	79	59
05/06/2021 12:45	66	77	69	56	75	94	79	59
05/06/2021 13:00	66	76	70	57	75	86	80	57
05/06/2021 13:15	66	86	69	55	75	86	80	57
05/06/2021 13:30	66	76	69	56	75	95	80	57
05/06/2021 13:45	66	75	70	56	77	103	79	56
05/06/2021 14:00	66	75	69	58	75	86	79	58
05/06/2021 14:15	68	92	70	55	76	99	79	58
05/06/2021 14:30	67	87	70	55	75	85	80	57
05/06/2021 14:45	68	90	71	56	75	90	79	57
05/06/2021 15:00	69	95	70	56	75	87	79	57
05/06/2021 15:15	66	82	70	53	75	87	79	54
05/06/2021 15:30	66	77	70	53	75	85	79	57
05/06/2021 15:45	67	80	71	54	75	87	80	56
05/06/2021 16:00	67	81	70	53	75	93	79	59
05/06/2021 16:15	66	78	70	53	75	94	79	54
05/06/2021 16:30	66	75	70	52	75	90	79	56
05/06/2021 16:45	66	75	69	54	75	86	79	59
05/06/2021 17:00	67	86	70	53	75	94	79	58
05/06/2021 17:15	67	83	70	54	76	97	80	57
05/06/2021 17:30	66	80	70	54	74	87	79	58
05/06/2021 17:45	67	78	70	54	75	87	80	57
05/06/2021 18:00	68	90	71	55	75	91	79	56
05/06/2021 18:15	68	76	71	55	75	94	79	56
05/06/2021 18:30	67	77	71	53	75	92	79	53

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
05/06/2021 18:45	67	76	70	54	75	85	79	53
05/06/2021 19:00	66	76	70	53	75	89	79	56
05/06/2021 19:15	66	80	70	53	75	92	80	53
05/06/2021 19:30	65	78	70	50	74	87	79	53
05/06/2021 19:45	66	77	70	51	74	87	79	51
05/06/2021 20:00	66	77	71	51	74	93	79	51
05/06/2021 20:15	65	76	70	52	74	85	78	54
05/06/2021 20:30	67	79	71	52	73	88	78	51
05/06/2021 20:45	66	80	70	51	73	88	77	51
05/06/2021 21:00	66	76	70	51	73	90	77	51
05/06/2021 21:15	66	75	70	51	73	88	78	51
05/06/2021 21:30	65	75	69	48	73	85	77	49
05/06/2021 21:45	64	76	69	48	71	85	76	47
05/06/2021 22:00	64	76	69	49	73	84	78	49
05/06/2021 22:15	64	81	69	47	73	91	77	51
05/06/2021 22:30	64	75	69	49	77	98	80	54
05/06/2021 22:45	63	77	68	47	77	104	77	49
05/06/2021 23:00	63	77	68	46	71	86	76	48
05/06/2021 23:15	64	81	69	46	71	84	75	47
05/06/2021 23:30	62	77	67	45	70	84	75	46
05/06/2021 23:45	61	75	66	44	72	89	76	46
06/06/2021 00:00	61	75	67	44	71	86	75	46
06/06/2021 00:15	62	78	66	45	70	85	75	44
06/06/2021 00:30	61	76	66	40	68	82	73	42
06/06/2021 00:45	60	78	65	41	69	87	73	41
06/06/2021 01:00	59	76	63	41	67	82	72	42
06/06/2021 01:15	59	76	64	41	68	83	73	41
06/06/2021 01:30	59	74	63	40	67	83	72	42

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
06/06/2021 01:45	61	75	65	42	68	83	72	43
06/06/2021 02:00	59	73	63	39	67	84	71	40
06/06/2021 02:15	56	74	59	37	65	86	68	38
06/06/2021 02:30	56	76	57	37	64	81	68	38
06/06/2021 02:45	56	74	55	38	66	83	70	39
06/06/2021 03:00	56	76	58	38	66	83	69	39
06/06/2021 03:15	58	74	62	37	63	83	66	38
06/06/2021 03:30	58	78	62	38	65	82	69	40
06/06/2021 03:45	61	77	65	40	66	85	69	43
06/06/2021 04:00	59	76	62	42	65	84	67	42
06/06/2021 04:15	59	77	61	42	63	83	65	41
06/06/2021 04:30	58	79	60	41	63	84	65	41
06/06/2021 04:45	57	77	60	38	64	81	67	39
06/06/2021 05:00	59	75	62	38	63	82	66	38
06/06/2021 05:15	59	75	63	40	66	85	69	39
06/06/2021 05:30	62	76	67	42	68	84	73	42
06/06/2021 05:45	62	77	67	42	68	87	72	40
06/06/2021 06:00	62	78	67	42	68	85	72	41
06/06/2021 06:15	61	77	66	41	67	84	70	41
06/06/2021 06:30	62	80	67	43	69	84	73	43
06/06/2021 06:45	63	77	68	46	70	85	74	43
06/06/2021 07:00	63	80	68	44	69	92	73	43
06/06/2021 07:15	64	76	69	44	69	83	73	42
06/06/2021 07:30	64	77	69	46	70	85	75	45
06/06/2021 07:45	63	79	68	45	70	84	75	44
06/06/2021 08:00	64	76	69	46	70	85	75	45
06/06/2021 08:15	64	77	69	49	71	84	75	47
06/06/2021 08:30	65	84	70	49	72	85	77	46

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
06/06/2021 08:45	65	78	69	48	71	84	76	46
06/06/2021 09:00	66	78	71	51	73	85	78	49
06/06/2021 09:15	65	75	70	50	73	87	78	46
06/06/2021 09:30	66	75	70	51	73	84	78	50
06/06/2021 09:45	67	75	71	52	74	83	79	51
06/06/2021 10:00	66	76	70	50	73	85	78	50
06/06/2021 10:15	66	76	70	51	75	87	79	50
06/06/2021 10:30	67	75	71	53	75	88	79	56
06/06/2021 10:45	67	77	70	54	75	85	80	52
06/06/2021 11:00	67	81	71	52	76	90	80	52
06/06/2021 11:15	67	76	70	55	76	86	80	55
06/06/2021 11:30	67	81	70	58	76	85	80	60
06/06/2021 11:45	68	88	70	57	75	83	79	57
06/06/2021 12:00	67	77	70	57	76	85	80	56
06/06/2021 12:15	66	79	69	57	76	87	80	57
06/06/2021 12:30	68	76	71	56	75	83	80	56
06/06/2021 12:45	72	102	71	57	77	99	80	55
06/06/2021 13:00	67	76	70	57	76	89	80	60
06/06/2021 13:15	67	75	70	56	75	85	80	57
06/06/2021 13:30	67	75	70	56	76	84	80	55
06/06/2021 13:45	66	74	70	55	75	87	79	59
06/06/2021 14:00	67	77	71	54	76	85	80	56
06/06/2021 14:15	66	74	69	54	76	89	80	58
06/06/2021 14:30	67	78	70	54	75	89	80	58
06/06/2021 14:45	67	75	70	55	79	106	79	61
06/06/2021 15:00	66	75	70	55	75	91	79	58
06/06/2021 15:15	67	81	70	56	74	84	79	58
06/06/2021 15:30	66	77	70	53	75	86	79	55

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
06/06/2021 15:45	66	75	70	52	75	95	79	53
06/06/2021 16:00	66	75	70	55	75	86	79	55
06/06/2021 16:15	66	78	69	54	76	102	79	55
06/06/2021 16:30	67	82	70	53	74	85	79	53
06/06/2021 16:45	66	74	70	53	74	86	79	50
06/06/2021 17:00	65	73	70	50	74	86	79	51
06/06/2021 17:15	66	76	70	52	74	87	79	51
06/06/2021 17:30	66	79	70	51	74	86	79	50
06/06/2021 17:45	69	95	70	50	75	96	79	50
06/06/2021 18:00	66	90	70	51	74	95	79	51
06/06/2021 18:15	66	76	70	51	73	87	78	50
06/06/2021 18:30	66	76	70	52	75	101	79	50
06/06/2021 18:45	65	77	70	50	74	92	79	50
06/06/2021 19:00	67	91	70	51	73	94	78	49
06/06/2021 19:15	66	76	70	48	74	88	79	50
06/06/2021 19:30	65	77	70	49	73	84	78	50
06/06/2021 19:45	65	80	70	51	74	89	78	49
06/06/2021 20:00	66	79	70	49	73	89	78	50
06/06/2021 20:15	65	78	70	50	73	86	78	50
06/06/2021 20:30	66	79	70	52	72	86	77	51
06/06/2021 20:45	65	79	69	49	72	84	77	50
06/06/2021 21:00	65	76	69	51	73	94	78	51
06/06/2021 21:15	64	77	69	49	72	89	77	49
06/06/2021 21:30	65	85	69	49	72	86	77	50
06/06/2021 21:45	63	77	68	46	73	96	76	47
06/06/2021 22:00	63	75	68	45	71	83	76	45
06/06/2021 22:15	62	76	68	46	70	84	75	45
06/06/2021 22:30	60	76	65	43	72	97	75	44

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
06/06/2021 22:45	62	75	67	44	70	87	74	43
06/06/2021 23:00	61	78	66	43	70	91	72	42
06/06/2021 23:15	61	76	65	41	68	85	71	42
06/06/2021 23:30	59	74	63	41	67	85	71	42
06/06/2021 23:45	59	73	62	40	69	86	73	42
07/06/2021 00:00	57	76	59	39	66	84	70	40
07/06/2021 00:15	60	82	62	40	67	87	71	40
07/06/2021 00:30	57	73	59	38	66	87	70	39
07/06/2021 00:45	57	78	58	37	64	82	66	38
07/06/2021 01:00	56	74	56	37	66	84	70	38
07/06/2021 01:15	56	75	58	37	61	82	61	38
07/06/2021 01:30	52	71	50	37	64	84	67	38
07/06/2021 01:45	55	72	56	36	65	91	65	38
07/06/2021 02:00	58	77	60	36	63	81	63	37
07/06/2021 02:15	51	74	50	37	64	82	68	38
07/06/2021 02:30	53	76	50	36	65	86	68	37
07/06/2021 02:45	51	73	49	37	64	93	63	38
07/06/2021 03:00	54	72	56	37	63	86	61	38
07/06/2021 03:15	60	85	56	37	62	86	59	38
07/06/2021 03:30	55	75	55	37	63	84	63	39
07/06/2021 03:45	56	74	59	40	65	85	66	42
07/06/2021 04:00	57	74	60	42	61	83	55	43
07/06/2021 04:15	59	76	61	42	64	84	67	42
07/06/2021 04:30	61	78	65	42	68	92	71	42
07/06/2021 04:45	60	80	64	42	67	86	70	42
07/06/2021 05:00	62	77	66	44	66	84	70	41
07/06/2021 05:15	62	75	67	45	69	83	73	45
07/06/2021 05:30	64	77	69	48	71	87	76	47

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
07/06/2021 05:45	63	76	68	49	73	92	77	48
07/06/2021 06:00	65	84	70	50	73	87	78	49
07/06/2021 06:15	66	81	71	50	74	94	79	48
07/06/2021 06:30	66	78	71	51	74	86	78	51
07/06/2021 06:45	67	77	71	54	75	88	80	54
07/06/2021 07:00	67	77	71	54	75	84	80	54
07/06/2021 07:15	67	78	71	51	76	92	80	53
07/06/2021 07:30	67	77	71	53	76	92	80	58
07/06/2021 07:45	67	81	71	54	76	89	80	57
07/06/2021 08:00	67	78	71	52	75	89	80	55
07/06/2021 08:15	67	77	71	54	76	87	81	56
07/06/2021 08:30	67	75	71	50	75	91	80	52
07/06/2021 08:45	68	83	71	55	75	86	80	54
07/06/2021 09:00	67	84	71	54	75	86	80	55
07/06/2021 09:15	66	77	70	53	75	86	79	54
07/06/2021 09:30	66	78	70	54	75	93	80	55
07/06/2021 09:45	67	76	70	53	75	86	80	57
07/06/2021 10:00	66	77	70	55	75	92	79	56
07/06/2021 10:15	66	77	70	52	75	92	79	52
07/06/2021 10:30	67	76	71	52	74	90	79	55
07/06/2021 10:45	67	76	71	54	75	87	79	56
07/06/2021 11:00	67	78	70	56	75	91	80	55
07/06/2021 11:15	66	77	70	54	75	88	79	55
07/06/2021 11:30	66	76	70	54	75	89	79	57
07/06/2021 11:45	67	77	70	56	75	86	80	53
07/06/2021 12:00	67	77	71	55	75	84	79	57
07/06/2021 12:15	72	85	76	61	74	93	79	57
07/06/2021 12:30	74	87	76	61	78	93	81	67

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
07/06/2021 12:45	66	76	70	55	75	85	80	56
07/06/2021 13:00	66	80	70	54	75	85	79	54
07/06/2021 13:15	66	74	70	55	75	93	79	54
07/06/2021 13:30	66	76	70	53	75	94	79	59
07/06/2021 13:45	66	76	70	53	74	85	79	53
07/06/2021 14:00	66	76	70	53	75	91	79	58
07/06/2021 14:15	64	78	67	56	74	89	79	57
07/06/2021 14:30	66	75	70	54	76	97	79	62
07/06/2021 14:45	67	76	70	54	75	85	78	62
07/06/2021 15:00	66	78	69	53	75	92	78	57
07/06/2021 15:15	65	79	69	54	75	84	79	57
07/06/2021 15:30	66	81	69	54	75	91	79	55
07/06/2021 15:45	66	76	70	54	76	92	80	57
07/06/2021 16:00	65	74	69	53	75	84	80	60
07/06/2021 16:15	66	81	70	56	76	92	79	59
07/06/2021 16:30	66	79	70	55	76	100	79	54
07/06/2021 16:45	71	101	70	55	75	85	79	60
07/06/2021 17:00	67	85	70	57	76	92	80	63
07/06/2021 17:15	65	80	69	54	75	94	80	57
07/06/2021 17:30	66	81	70	56	76	87	80	60
07/06/2021 17:45	64	87	66	55	76	89	79	59
07/06/2021 18:00	60	75	64	55	75	90	79	57
07/06/2021 18:15	64	74	67	56	75	87	79	57
07/06/2021 18:30	66	77	70	55	75	89	80	56
07/06/2021 18:45	67	85	71	54	75	85	79	55
07/06/2021 19:00	67	77	70	54	75	88	79	53
07/06/2021 19:15	66	76	70	54	74	87	79	53
07/06/2021 19:30	66	76	70	54	75	90	80	54

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
07/06/2021 19:45	68	94	70	54	75	92	79	51
07/06/2021 20:00	65	78	70	49	73	86	78	52
07/06/2021 20:15	66	86	70	49	73	84	78	48
07/06/2021 20:30	65	77	70	49	73	87	78	50
07/06/2021 20:45	65	77	70	48	72	84	77	47
07/06/2021 21:00	66	80	70	51	73	93	77	50
07/06/2021 21:15	65	76	70	51	72	85	77	48
07/06/2021 21:30	67	92	69	49	72	86	77	49
07/06/2021 21:45	63	75	69	46	72	85	77	47
07/06/2021 22:00	65	82	70	48	72	89	77	48
07/06/2021 22:15	63	76	68	45	71	85	76	47
07/06/2021 22:30	62	74	67	43	70	90	74	44
07/06/2021 22:45	61	78	66	44	68	85	73	44
07/06/2021 23:00	60	79	64	43	69	88	74	44
07/06/2021 23:15	61	78	66	43	69	85	73	45
07/06/2021 23:30	59	73	63	43	70	92	74	44
07/06/2021 23:45	61	84	63	43	69	87	73	43
08/06/2021 00:00	58	74	60	40	67	87	71	41
08/06/2021 00:15	57	74	61	41	68	87	71	41
08/06/2021 00:30	56	74	57	39	67	87	69	39
08/06/2021 00:45	57	75	57	38	66	84	70	39
08/06/2021 01:00	59	76	62	38	64	82	67	38
08/06/2021 01:15	57	79	58	37	68	96	67	38
08/06/2021 01:30	54	76	55	37	64	84	65	37
08/06/2021 01:45	59	78	60	38	67	86	69	38
08/06/2021 02:00	59	75	62	37	66	85	69	37
08/06/2021 02:15	55	74	56	37	67	91	70	38
08/06/2021 02:30	54	75	51	37	62	82	64	37

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
08/06/2021 02:45	52	71	51	37	64	82	67	38
08/06/2021 03:00	54	73	53	37	63	84	63	37
08/06/2021 03:15	51	70	50	37	62	81	65	38
08/06/2021 03:30	54	75	53	39	68	96	70	43
08/06/2021 03:45	57	73	60	43	66	84	69	43
08/06/2021 04:00	57	74	60	43	64	82	67	43
08/06/2021 04:15	57	75	59	42	65	84	68	42
08/06/2021 04:30	59	74	62	41	67	86	70	41
08/06/2021 04:45	60	76	63	42	68	87	71	42
08/06/2021 05:00	60	75	65	42	69	91	72	41
08/06/2021 05:15	63	77	68	45	70	83	75	45
08/06/2021 05:30	64	76	69	47	72	87	76	46
08/06/2021 05:45	64	85	68	45	73	93	79	45
08/06/2021 06:00	66	78	71	47	73	85	77	48
08/06/2021 06:15	66	85	70	49	74	88	79	48
08/06/2021 06:30	67	83	71	52	75	89	79	53
08/06/2021 06:45	67	77	71	53	75	91	80	52
08/06/2021 07:00	67	79	71	52	75	86	80	53
08/06/2021 07:15	67	81	71	55	76	85	80	54
08/06/2021 07:30	67	77	71	54	76	87	80	56
08/06/2021 07:45	67	78	71	52	76	86	80	55
08/06/2021 08:00	66	75	70	51	76	92	80	59
08/06/2021 08:15	67	78	71	57	76	93	80	59
08/06/2021 08:30	67	75	70	56	76	94	80	55
08/06/2021 08:45	67	82	71	55	76	97	80	56
08/06/2021 09:00	68	87	71	55	76	96	80	54
08/06/2021 09:15	67	78	70	54	76	97	80	54
08/06/2021 09:30	66	76	70	53	75	94	80	54

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF} 10,15min	L _{AF} 90,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF} 10,15min	L _{AF} 90,15min
08/06/2021 09:45	66	79	70	53	75	88	80	55
08/06/2021 10:00	66	76	70	52	75	87	80	53
08/06/2021 10:15	66	75	70	52	75	86	79	56
08/06/2021 10:30	66	75	70	53	75	92	79	57
08/06/2021 10:45	66	76	70	55	75	90	79	57
08/06/2021 11:00	67	82	70	54	75	95	79	56
08/06/2021 11:15	66	75	69	54	74	93	79	55
08/06/2021 11:30	66	74	69	52	75	89	79	54
08/06/2021 11:45	66	78	70	54	75	92	79	57
08/06/2021 12:00	66	76	70	55	75	95	79	54
08/06/2021 12:15	67	87	70	55	75	90	79	57
08/06/2021 12:30	66	75	69	53	75	95	79	55
08/06/2021 12:45	66	75	70	54	75	85	79	56
08/06/2021 13:00	66	75	70	55	75	87	79	59
08/06/2021 13:15	66	77	70	53	74	86	79	57
08/06/2021 13:30	66	76	70	55	76	96	79	58
08/06/2021 13:45	67	77	70	55	74	92	79	55
08/06/2021 14:00	66	77	69	55	74	92	79	54
08/06/2021 14:15	65	75	69	51	75	95	79	56
08/06/2021 14:30	65	76	69	50	75	94	80	55
08/06/2021 14:45	66	75	70	52	75	88	80	54
08/06/2021 15:00	66	77	69	54	75	89	79	56
08/06/2021 15:15	66	79	70	54	74	86	79	59
08/06/2021 15:30	65	81	69	57	76	97	79	56
08/06/2021 15:45	65	75	69	53	75	86	79	54
08/06/2021 16:00	66	79	70	53	75	89	80	58
08/06/2021 16:15	67	90	70	54	75	84	79	57
08/06/2021 16:30	66	80	69	55	75	84	80	55

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
08/06/2021 16:45	66	79	70	54	75	90	80	56
08/06/2021 17:00	67	78	70	55	76	90	80	59
08/06/2021 17:15	67	75	70	52	75	90	79	56
08/06/2021 17:30	67	86	70	56	75	96	79	59
08/06/2021 17:45	66	77	70	54	75	85	80	57
08/06/2021 18:00	67	76	70	55	76	92	80	59
08/06/2021 18:15	66	78	70	54	78	98	80	57
08/06/2021 18:30	66	78	70	54	75	86	79	54
08/06/2021 18:45	66	77	70	50	74	86	79	55
08/06/2021 19:00	67	83	70	52	76	100	79	56
08/06/2021 19:15	66	83	70	54	74	86	79	51
08/06/2021 19:30	67	85	70	52	74	85	79	50
08/06/2021 19:45	66	77	70	50	74	85	79	50
08/06/2021 20:00	66	76	70	50	76	101	79	51
08/06/2021 20:15	65	80	70	50	73	87	78	52
08/06/2021 20:30	65	75	70	50	74	96	78	51
08/06/2021 20:45	65	76	70	51	72	85	77	52
08/06/2021 21:00	66	76	70	54	73	93	77	54
08/06/2021 21:15	65	79	69	50	71	88	76	51
08/06/2021 21:30	65	77	70	48	72	86	77	49
08/06/2021 21:45	64	81	69	49	72	85	77	50
08/06/2021 22:00	65	76	69	50	72	86	77	52
08/06/2021 22:15	62	75	67	47	71	84	76	48
08/06/2021 22:30	62	77	66	46	71	92	74	46
08/06/2021 22:45	61	77	66	45	70	92	74	46
08/06/2021 23:00	61	79	66	43	70	87	74	45
08/06/2021 23:15	60	74	65	42	68	84	72	43
08/06/2021 23:30	61	76	66	42	68	84	72	43

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
08/06/2021 23:45	59	75	62	40	68	85	73	41
09/06/2021 00:00	59	79	62	41	68	87	72	42
09/06/2021 00:15	58	77	59	40	68	91	71	41
09/06/2021 00:30	57	78	59	40	68	87	72	41
09/06/2021 00:45	58	81	59	39	65	82	69	39
09/06/2021 01:00	61	84	58	39	66	85	71	40
09/06/2021 01:15	58	77	59	39	66	85	70	40
09/06/2021 01:30	57	75	58	38	64	85	67	39
09/06/2021 01:45	56	74	58	38	66	86	68	39
09/06/2021 02:00	54	71	55	37	65	87	67	38
09/06/2021 02:15	55	78	50	36	64	86	66	37
09/06/2021 02:30	55	76	55	36	65	86	66	38
09/06/2021 02:45	56	77	57	37	64	84	67	38
09/06/2021 03:00	57	80	58	37	64	83	66	39
09/06/2021 03:15	54	74	54	37	64	88	60	38
09/06/2021 03:30	56	75	56	38	66	86	67	41
09/06/2021 03:45	58	77	59	42	65	83	67	43
09/06/2021 04:00	59	76	63	42	66	87	67	43
09/06/2021 04:15	60	78	65	43	67	84	70	43
09/06/2021 04:30	57	76	59	40	67	87	70	41
09/06/2021 04:45	60	78	64	43	69	89	73	42
09/06/2021 05:00	60	75	64	44	69	87	73	44
09/06/2021 05:15	62	80	67	46	70	87	74	45
09/06/2021 05:30	63	77	68	46	71	86	76	46
09/06/2021 05:45	64	77	69	47	73	86	78	47
09/06/2021 06:00	65	81	70	49	73	88	78	49
09/06/2021 06:15	66	78	71	50	73	87	79	49
09/06/2021 06:30	67	79	71	52	74	87	79	51

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
09/06/2021 06:45	67	79	71	52	76	87	81	51
09/06/2021 07:00	67	77	71	53	76	88	81	53
09/06/2021 07:15	67	78	71	53	79	108	81	55
09/06/2021 07:30	66	77	71	54	76	86	81	53
09/06/2021 07:45	67	78	71	53	76	93	81	56
09/06/2021 08:00	67	77	70	56	76	95	80	61
09/06/2021 08:15	67	79	71	54	76	87	81	56
09/06/2021 08:30	66	79	70	56	76	94	80	59
09/06/2021 08:45	67	78	71	56	76	88	80	58
09/06/2021 09:00	67	79	70	54	75	85	79	61
09/06/2021 09:15	67	76	70	54	75	90	79	58
09/06/2021 09:30	66	78	70	52	75	93	80	58
09/06/2021 09:45	66	75	70	52	75	93	79	52
09/06/2021 10:00	66	76	70	54	75	93	79	59
09/06/2021 10:15	65	74	69	56	74	93	79	60
09/06/2021 10:30	66	75	70	53	75	86	79	59
09/06/2021 10:45	68	91	70	53	74	85	79	57
09/06/2021 11:00	66	79	69	53	75	90	79	51
09/06/2021 11:15	66	76	70	54	74	85	79	57
09/06/2021 11:30	66	77	70	54	75	91	79	56
09/06/2021 11:45	66	75	70	53	74	87	79	53
09/06/2021 12:00	67	85	70	52	75	93	79	57
09/06/2021 12:15	66	79	70	51	75	85	79	57
09/06/2021 12:30	66	84	69	52	75	92	80	53
09/06/2021 12:45	66	82	70	54	74	86	79	53
09/06/2021 13:00	66	76	69	53	75	91	79	56
09/06/2021 13:15	66	74	70	55	75	93	80	58
09/06/2021 13:30	66	79	69	56	75	94	79	57

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF10} ,15min	L _{AF90} ,15min
09/06/2021 13:45	66	74	70	53	74	86	79	52
09/06/2021 14:00	66	78	70	54	75	92	79	52
09/06/2021 14:15	66	79	69	55	75	89	79	59
09/06/2021 14:30	66	74	69	53	76	94	79	59
09/06/2021 14:45	66	83	69	55	75	96	80	54
09/06/2021 15:00	66	77	69	54	75	87	79	56
09/06/2021 15:15	66	78	69	55	75	85	80	56
09/06/2021 15:30	66	90	69	54	74	86	79	56
09/06/2021 15:45	66	76	69	54	75	88	79	56
09/06/2021 16:00	66	76	69	52	75	90	79	57
09/06/2021 16:15	66	75	69	54	75	93	80	55
09/06/2021 16:30	66	76	70	52	75	87	79	55
09/06/2021 16:45	69	93	70	54	75	93	79	56
09/06/2021 17:00	67	87	70	54	76	92	80	59
09/06/2021 17:15	67	81	70	55	75	88	80	62
09/06/2021 17:30	67	79	70	52	77	88	80	62
09/06/2021 17:45	66	74	70	55	76	86	80	57
09/06/2021 18:00	66	75	70	54	76	86	80	59
09/06/2021 18:15	66	76	70	56	75	89	80	56
09/06/2021 18:30	66	75	70	54	75	86	80	53
09/06/2021 18:45	66	74	70	52	75	86	79	55
09/06/2021 19:00	71	98	70	54	75	86	79	54
09/06/2021 19:15	67	82	70	53	74	84	79	53
09/06/2021 19:30	67	86	70	51	74	88	79	51
09/06/2021 19:45	66	75	70	52	74	91	79	51
09/06/2021 20:00	67	90	69	53	74	89	79	52
09/06/2021 20:15	66	89	70	52	74	94	78	52
09/06/2021 20:30	66	86	70	50	72	87	77	50

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AFmax}	L _{AF} 10,15min	L _{AF} 90,15min	L _{Aeq} ,15min	L _{AFmax}	L _{AF} 10,15min	L _{AF} 90,15min
09/06/2021 20:45	65	76	69	49	72	85	77	51
09/06/2021 21:00	66	77	70	52	72	88	77	50
09/06/2021 21:15	65	76	70	50	72	86	76	50
09/06/2021 21:30	64	77	69	50	72	85	77	51
09/06/2021 21:45	64	76	69	48	71	85	76	48
09/06/2021 22:00	64	79	69	49	72	85	77	49
09/06/2021 22:15	63	76	68	48	72	92	76	48
09/06/2021 22:30	65	88	68	44	71	90	75	46
09/06/2021 22:45	64	87	68	46	70	89	73	46
09/06/2021 23:00	62	75	67	46	69	85	73	45
09/06/2021 23:15	62	78	66	43	70	87	75	45
09/06/2021 23:30	59	80	62	41	67	85	71	41
09/06/2021 23:45	57	73	60	39	66	81	71	41
10/06/2021 00:00	60	77	65	42	68	92	72	42
10/06/2021 00:15	57	75	59	40	67	83	71	40
10/06/2021 00:30	61	86	58	38	63	82	64	39
10/06/2021 00:45	56	73	58	37	65	87	67	39
10/06/2021 01:00	54	74	55	37	64	82	68	39
10/06/2021 01:15	58	76	61	39	67	89	70	39
10/06/2021 01:30	59	78	62	37	62	81	65	38
10/06/2021 01:45	55	72	57	36	65	84	66	37
10/06/2021 02:00	58	76	61	37	66	86	66	37
10/06/2021 02:15	55	76	54	37	68	97	66	38
10/06/2021 02:30	54	76	53	35	64	85	66	37
10/06/2021 02:45	55	76	51	38	65	85	66	39
10/06/2021 03:00	56	78	54	37	66	85	66	38
10/06/2021 03:15	55	78	53	36	62	81	61	38
10/06/2021 03:30	57	74	59	37	65	88	64	40

Date & Time (Start)	A33 Position (on eastern boundary)				Rose Kiln Lane Pos. (on western boundary)			
	L _{Aeq} ,15min	L _{AF} max	L _{AF} 10,15min	L _{AF} 90,15min	L _{Aeq} ,15min	L _{AF} max	L _{AF} 10,15min	L _{AF} 90,15min
10/06/2021 03:45	57	77	58	40	65	83	67	41
10/06/2021 04:00	58	76	60	42	66	86	70	44
10/06/2021 04:15	58	77	59	42	64	82	66	43
10/06/2021 04:30	59	75	62	41	67	85	71	42
10/06/2021 04:45	59	78	62	42	67	84	71	42
10/06/2021 05:00	59	74	63	41	69	89	72	42
10/06/2021 05:15	62	77	67	43	69	84	73	44
10/06/2021 05:30	63	77	68	46	71	85	75	49
10/06/2021 05:45	65	80	70	48	72	85	77	49
10/06/2021 06:00	66	83	70	49	73	89	78	48
10/06/2021 06:15	65	77	71	49	73	88	78	49
10/06/2021 06:30	66	78	70	49	74	87	79	51
10/06/2021 06:45	67	77	71	54	75	88	80	54
10/06/2021 07:00	67	83	70	54	75	87	79	52
10/06/2021 07:15	67	77	71	53	75	85	80	51
10/06/2021 07:30	67	76	70	53	75	91	80	55
10/06/2021 07:45	67	78	71	54	76	86	80	60
10/06/2021 08:00	67	80	70	54	75	87	80	60
10/06/2021 08:15	67	77	71	54	76	93	81	56
10/06/2021 08:30	67	77	70	54	76	92	80	58
10/06/2021 08:45	66	75	70	52	75	92	80	54
10/06/2021 09:00	66	73	69	50	-	-	-	-

Figure C.1: Comparison of L_{Aeq},15min sound levels at the two survey locations, dB

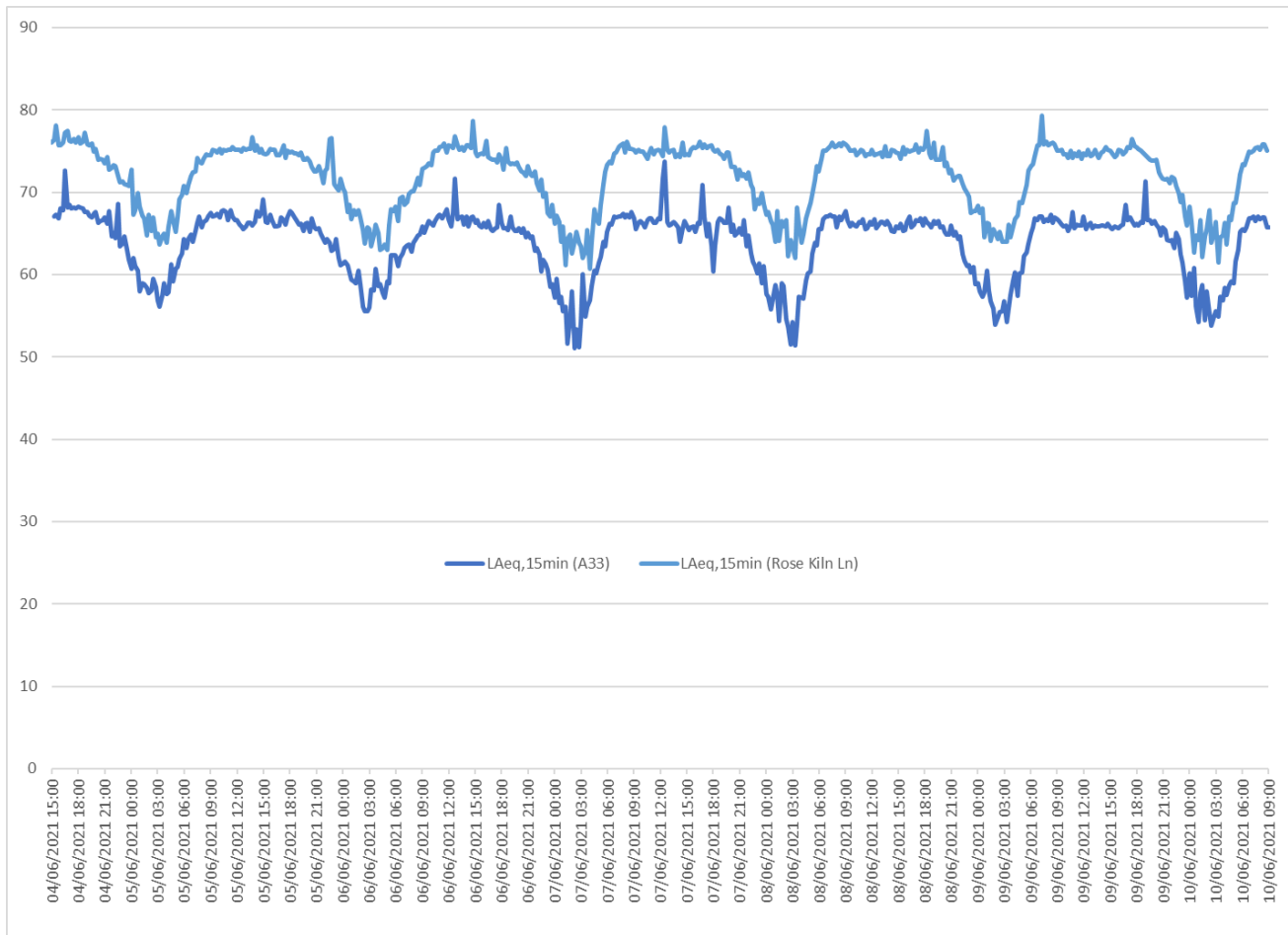


Figure C.2: All data from the A33 survey location (free-field), dB

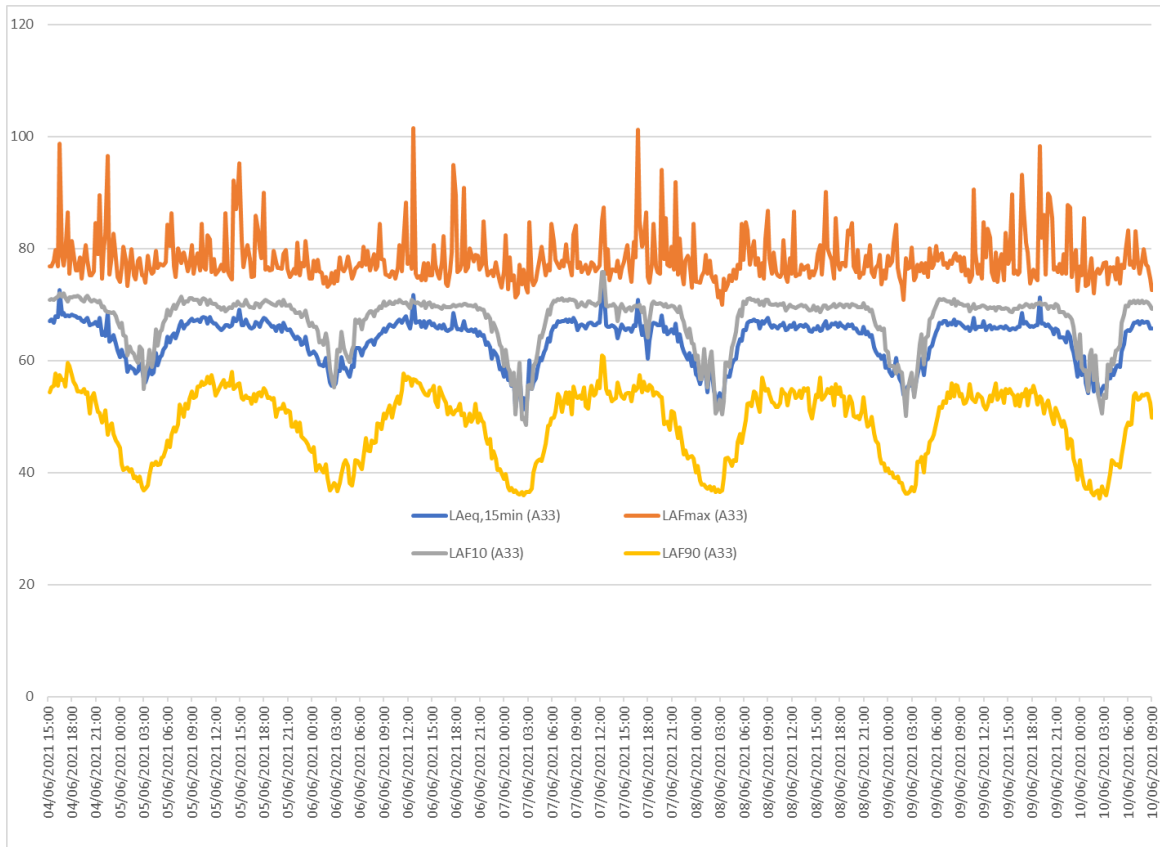
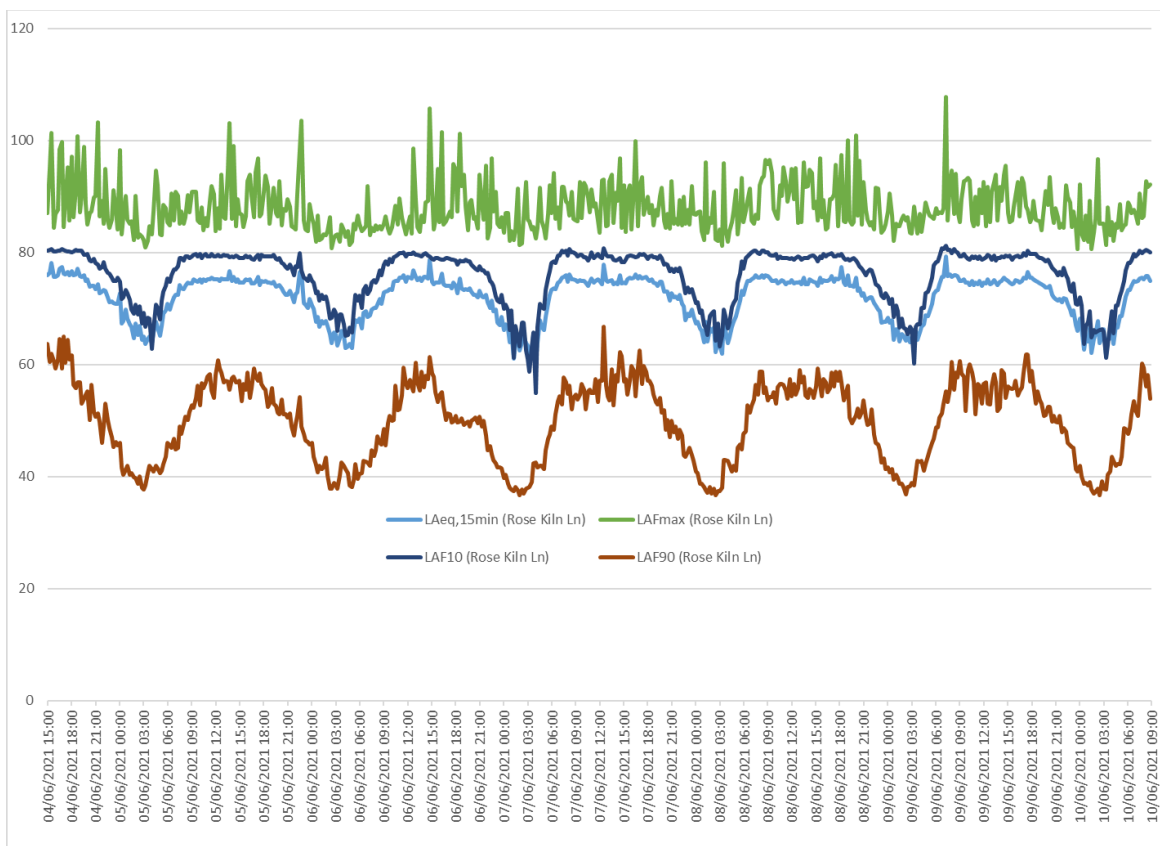


Figure C.3: All data from the Rose Kiln Lane survey location (free-field), dB



APPENDIX D

3D NOISE MODEL CONSTRUCTION

3D noise model construction

The model was constructed as follows. Details of the calibration of the model are presented in the following sub-section.

Calculation standards: At the route of the modelling are the calculation procedures of the [Calculation of Road Traffic Noise \(CRTN\)](#)² and [ISO 9613-2](#)³.

Ground cover/absorption: As worst case (but of limit significant to the model in question), all ground cover is assumed to acoustically hard/reflective.

Reflections: Buildings have been assumed to possess an absorption coefficient of 0.37 (equivalent to a “structured façade” and a reflection loss of 2 dB), with a maximum order of reflection of two.

Topography: LiDAR Composite DTM 1 m height points were downloaded from the Defra data services platform, imported into the noise model, and converted into contour lines at 1 m intervals.

Roads: Exported from OpenStreetMap and imported directly into the noise model. Flows are applied to Rose Kiln Lane and the A33 only, as per the model calibration exercise described below.

Existing (non-application) buildings: Exported from OpenStreetMap, with a global height of 8 m applied. Given the application building is not screened by any intervening buildings, the actual building heights are of limited consequence.

Proposed buildings: Modelled as per the 2D plan and section drawings provided by Pozzoni Architecture Limited.

Existing fencing: The existing fence along the boundary of the site with the A33 has been discounted from the model, since it is not an acoustic barrier and the acoustic performance cannot be guaranteed, nor or in the future.

Existing acoustic barrier: The acoustic barrier on the other side of the A33 has been included in the model for completeness, which has been taken to be an absorptive type of barrier and 2.5 m in height. The height is not material to the model.

Assessment receiver points: Receiver points (known as Building Evaluation points within the software) were generated evenly around the application building to represent windows. The mid-points of the ground and first floor windows were taken to be 1.5 m and 4.5 m above ground level, respectively. The points are located a notional 10 cm from the façade (which is not to be confused with a “façade” location, which is not applicable here), with the software setup to discount any acoustic reflection from the building at this distance. In other words, in keeping with the assessment criteria, the calculated levels are free-field levels.

Model calibration

In keeping with the assessment criteria, the model is required to determine the typical ambient ($L_{Aeq,T}$) and maximum (L_{Amax}) noise levels around the application building. The calculation of these metrics requires different approaches, which are described below. The following was conducted with the site modelled as per the current arrangement.

Typical ambient ($L_{Aeq,T}$) noise levels – road traffic

Whilst some traffic flow data are available for the A33 and Rose Kiln Lane, it is likely to be more reliable to calibrate the road sources against the baseline conditions (assuming the topography and other elements are suitably checked and appropriate). It is possible to enter into the model emission levels for each road or road section, and for the day and night-time periods. The same values have been entered for each carriageway until the daytime and night-time baseline levels for the monitoring positions have been matched. Since the A33 is the dominant source, the process was started with this road before calibrating to the Rose Kiln Lane position. As stated in the report, however, it was subsequently deemed necessary to

² [Calculation of Road Traffic Noise](#), 1988

³ [ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation](#)

apply a 3 dB correction to the sources value for Rose Kiln Lane to account for the possible reduction in noise from this road during the ongoing pandemic compared to 2017 conditions.

Typical maximum (L_{Amax}) noise levels – road traffic

It is typically assumed that, in terms of ambient conditions (considered above), which are considered over the course of a day or night, roads act as “line” sources, whereby individual sources (i.e. vehicles and their associated sources of noise) effectively merge into a line of sources following the road. This dictates a particular set of calculation procedures (as per CRTN). In terms of maximum noise levels, however, which are relevant to sleep disturbance, individual events are of interest, and the highest levels would typically occur at the closest point of the road to the location in question. Such sources, therefore, are not treated as line sources, but “point” sources; which are, in practice, moving point sources. One difference being that levels are not additive (the L_{Amax} level from one source doesn’t add to the level from another source), whilst different calculation procedures apply (as per [ISO 9613-2](#)). This means that the $L_{Aeq,T}$ and L_{Amax} levels cannot be plotted together, and that L_{Amax} noise contour plots cannot be produced for multiple sources in the same way as for $L_{Aeq,T}$ levels. The neighbouring point sources (along the road) would combine to misrepresent the individual levels applicable to the assessment criteria.

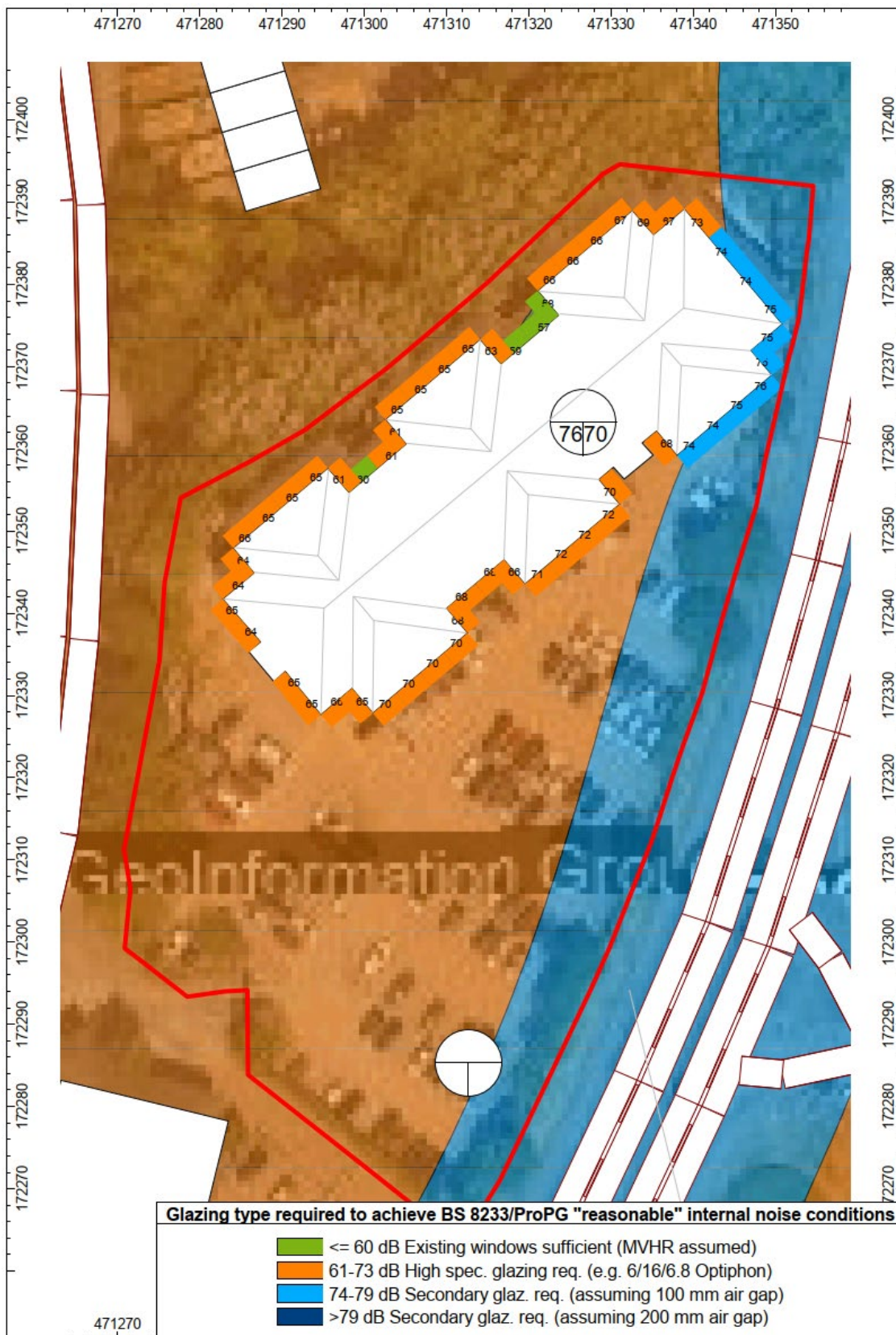
To calibrate the noise model, a point source was entered into the model at the nearest point of the nearest section of road to the baseline survey locations, at a height of 0.5 m above ground level. A sound power level has been assigned to the point source such that the typical L_{Amax} level from **Table 5.2** of this point was matched at the survey location.

The point source was then duplicated along the relevant sections of the nearest roads at 5 m intervals. Whilst it is not possible to generate a single noise contour plot showing the effect of all points sources (since the noise would combine as stated above, which is not applicable in terms of the assessment criteria), it is possible to determine the level from each point source at each receiver location in order to determine what is the highest level for comparison with the criteria.

APPENDIX E

NOISE CONTOUR PLOTS

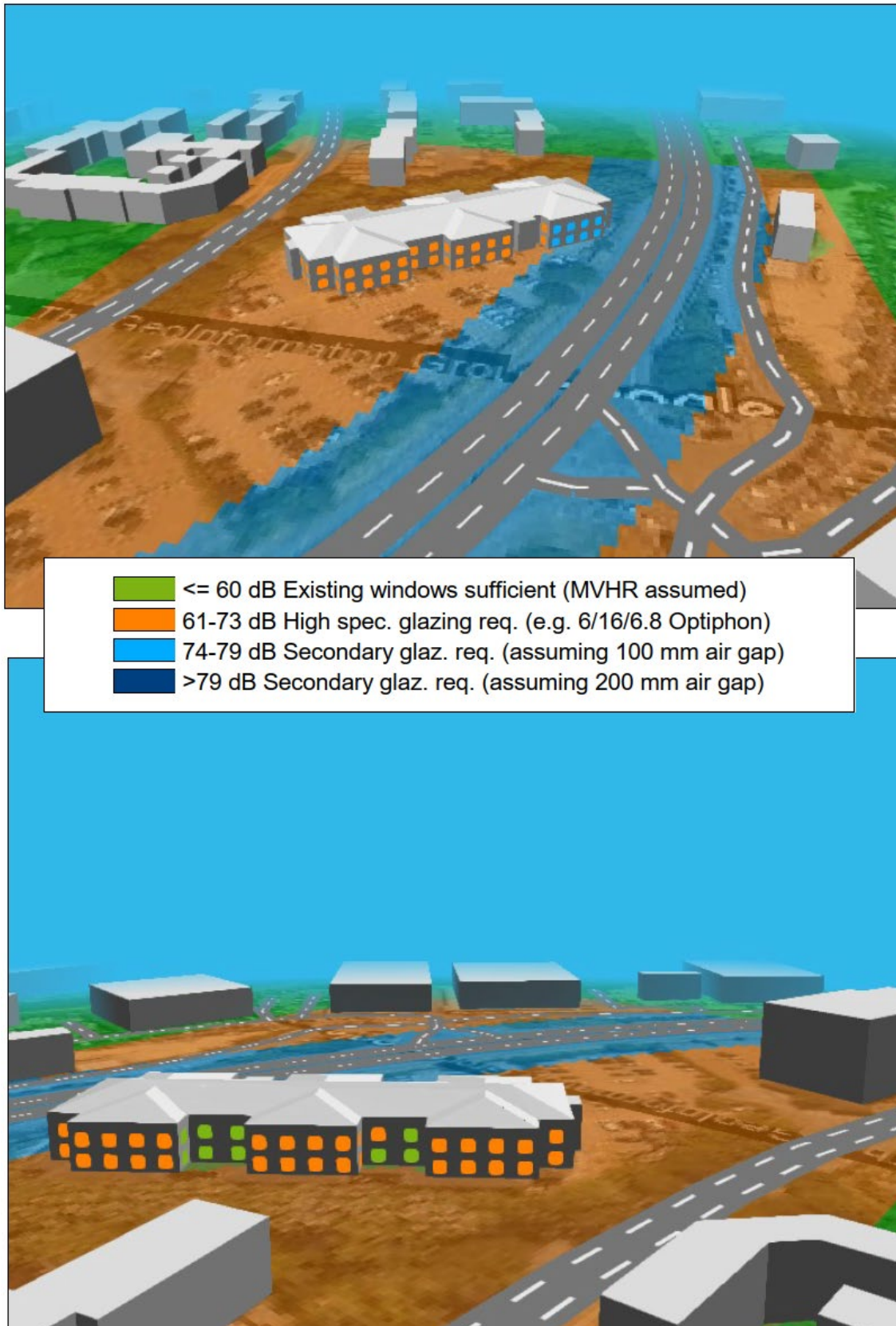
Figure E.1.1: Daytime $L_{Aeq,16h}$ Noise Contour Plot (at 1.5 m above the ground)



Note 1: Since no screening is assumed between the roads and building, the first floor levels are essentially the same as the ground floor levels shown above.

Note 2: Since the night-time levels are either 5 of 6 dB below the daytime levels, and the equivalent criterion is 5 dB below, the daytime levels shown above are sufficiently representative of the night-time situation.

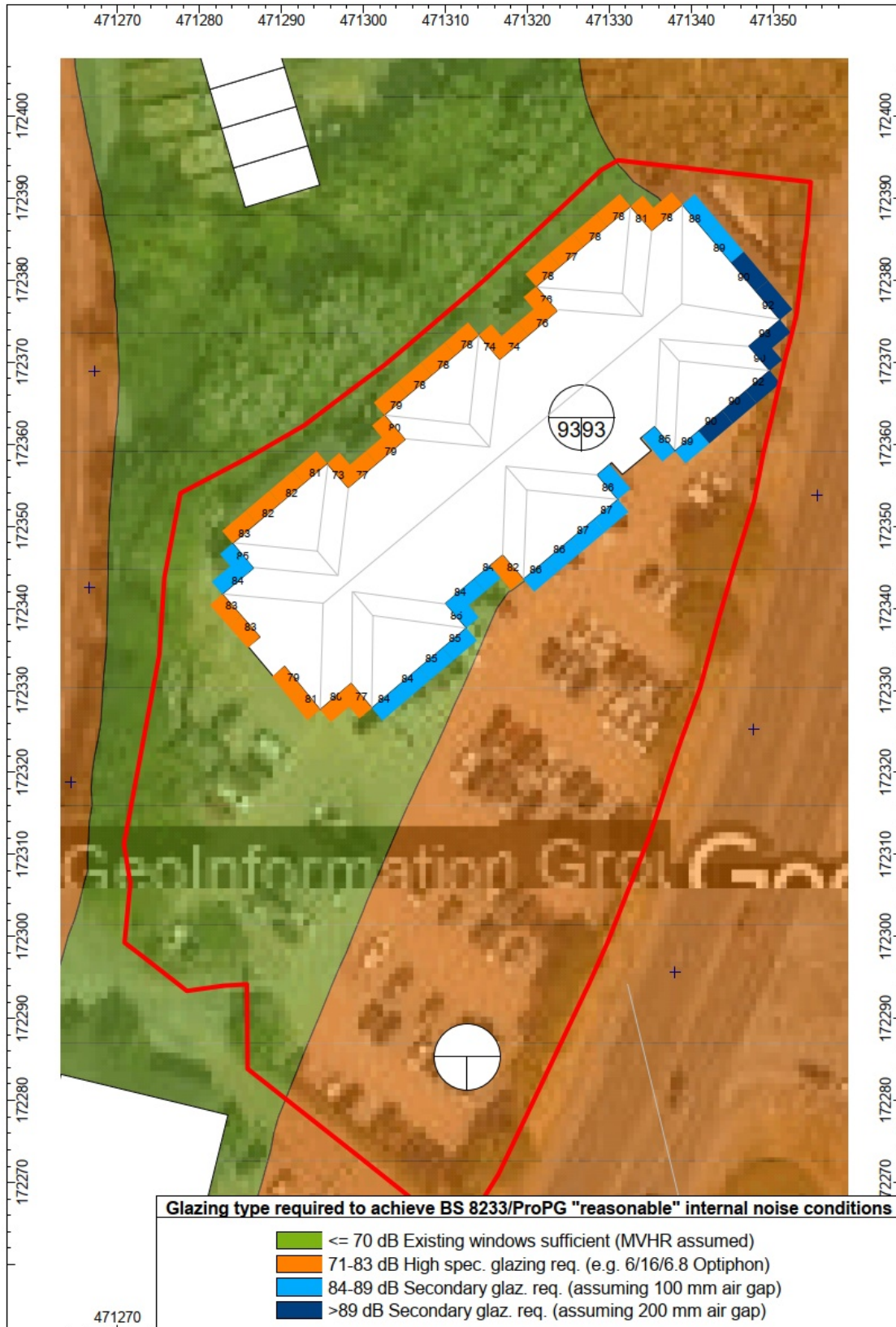
Figure E.1.2: Daytime $L_{Aeq,16h}$ Noise Contour Plot (at 1.5 m above the ground) – 3D views



Note 1: Since no screening is assumed between the roads and building, the first floor levels are essentially the same as the ground floor levels shown above.

Note 2: Since the night-time levels are either 5 or 6 dB below the daytime levels, and the equivalent criterion is 5 dB below, the daytime levels shown above are sufficiently representative of the night-time situation.

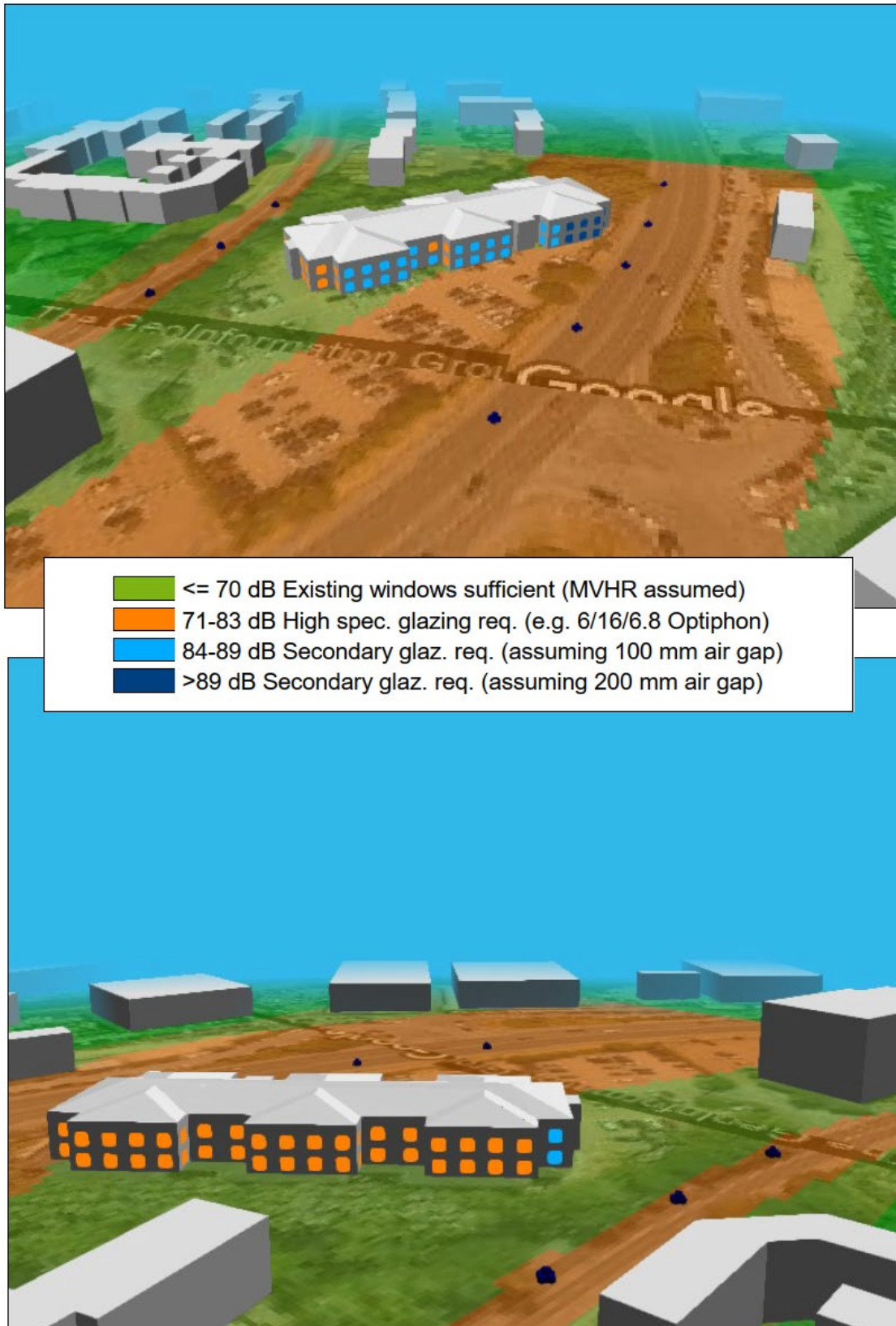
Figure E.2.1: Night-time L_{AFmax} Noise Contour Plot (at 1.5 m above the ground)



Note 1: Since no screening is assumed between the roads and building, the first floor levels are essentially the same as the ground floor levels shown above.

Note 2: Only a sample of point sources are included in the generation of the above plot such that the potential for noise to combine at receptor locations is minimised. See also the related discussion towards the end of **Appendix D**. The plot, therefore, is for indicative purposes only.

Figure E.2.2: Night-time L_{AFmax} Noise Contour Plot (at 1.5 m above the ground) – 3D views



Note 1: Since no screening is assumed between the roads and building, the first floor levels are essentially the same as the ground floor levels shown above.

Note 2: Only a sample of point sources are included in the generation of the above plot such that the potential for noise to combine at receptor locations is minimised. See also the related discussion towards the end of **Appendix D**. The plot, therefore, is for indicative purposes only.

REPORT END