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Consultants in Acoustics, Noise & Vibration

16354-R01-A

17 August 2016

The Comet, Hatfield

Residential planning noise report

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Summary

Sandy Brown Associates LLP (SBA) has been commissioned undertake a planning assessment for the proposed development at the site of The Comet Hotel, Hatfield.

An environmental noise survey was performed between 16 July 2015 and 21 July 2015. The lowest background sound levels measured during the survey were $L_{A90,15min}$ 51 dB during the daytime and $L_{A90,15min}$ 47 dB at night.

Based on the requirements of the Welwyn Hatfield Council and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 41 dB during the daytime and L_{Aeq} 37 dB during the night.

The average ambient noise levels measured to the northeast of the site during the survey were $L_{Aeq,16h}$ 66 dB during the daytime and $L_{Aeq,8h}$ 63 dB at night.

The average ambient noise levels measured to the southwest of the site during the survey were $L_{Aeq,16h}$ 58 dB during the daytime and $L_{Aeq,8h}$ 56 dB at night.

A PPG24 assessment has been carried out based on the ambient noise levels measured during the survey to assess the suitability of the site in the absence or numerical criteria from NPPF. The site falls into NEC C.

The noise levels have been predicted at the facades of the various proposed buildings using 3D acoustic modelling software. Some of the facades will require mechanical ventilation in order to achieve the overall facade sound insulation performance requirements.

Contents

1 Introduction

Sandy Brown Associates LLP (SBA) has been commissioned to undertake a planning assessment for the proposed development at the site of The Comet Hotel, Hatfield.

An environmental noise survey has been carried out, the purpose of which was to establish the existing ambient and background sound levels in the vicinity of the site and nearby noise sensitive premises.

The background sound levels measured during the survey are used as the basis for setting limits for noise emission from proposed building services plant. These limits are set in accordance with the requirements of the Welwyn Hatfield Council (WHC). In the absence of numerical criteria in the National Planning Policy Framework, the ambient noise levels measured are used to perform an assessment in line with Planning Policy Guidance 24: Planning and Noise (PPG24), to evaluate the suitability of the site for residential development.

The facade sound insulation is assessed to determine the necessary performance required to achieve appropriate internal noise levels for residences set in accordance with BS 8233:2014 *Sound insulation and noise reduction for buildings*, World Health Organisation and the Welwyn Hatfield Council guidelines.

This report presents the noise survey methods, the results of the survey, a discussion of acceptable limits for noise emission from building services plant, the results of a 3D computer model to predict external facade noise levels and minimum sound insulation requirements for the building envelope of the proposed development.

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1.

The main road passing the site is the A1(M) which runs approximately parallel with Comet Way to the southwest of the site. Other roads near to the site include Mosquito Way, Cavendish Way and St Albans Road West which are connected by a series of traffic roundabouts.

The approximate extent of the site for development is highlighted in blue and nearby noise sensitive residential premises are highlighted in red.

Attended measurement locations are denoted by the red markers 1 to 5 and unattended measurement location are denoted by the red markers 'A' and 'B'.

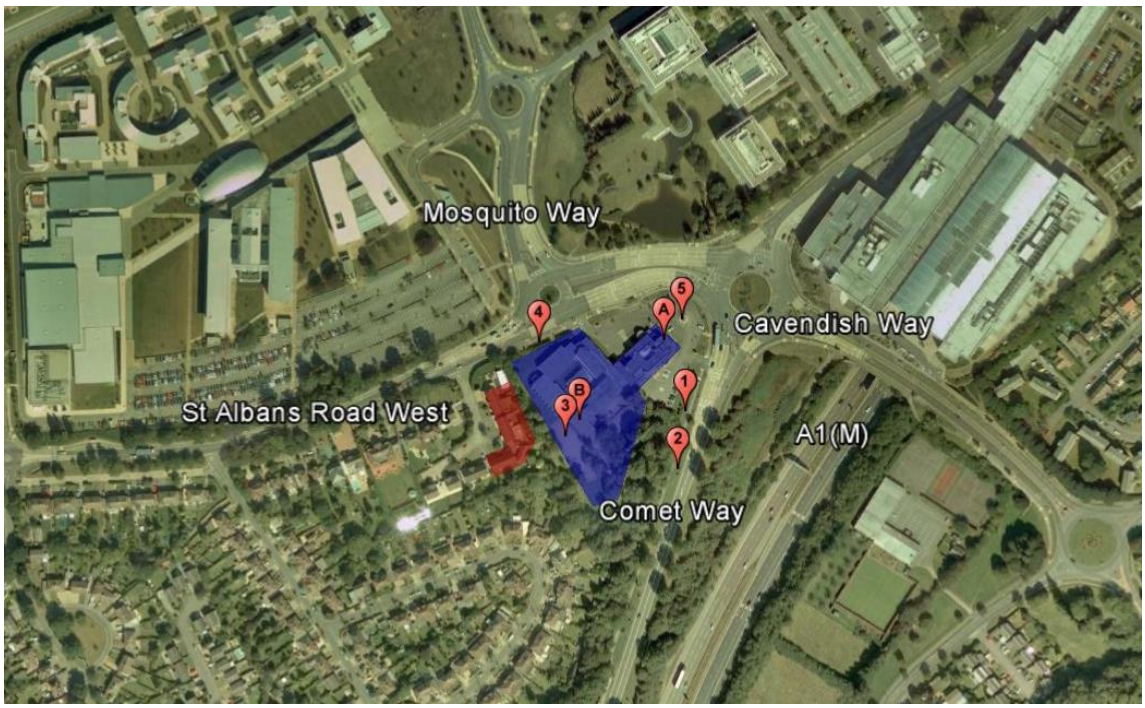


Figure 1 Site map (courtesy of Google Earth Pro, © Get mapping 2015, ©Google 2015)

2.2 Proposed development

It is proposed that part of the existing Comet Hotel is to be demolished and a new extension is to be provided as an independent building with a glazed link to provide a total of 56 serviced apartments. Six separate buildings are to be constructed to the west of the site to provide student accommodation comprising approximately 308 student bedrooms. The existing hotel will provide ancillary accommodation.

Reference should be made to the Design Development information for further details.

3 Method

Details of the equipment used, the noise indices and the weather conditions during the survey are provided in Appendix A. Further information on the specific survey method is provided in this section.

3.1 Unattended measurements

3.1.1 Location 'A' – Front of site

Unattended noise monitoring was undertaken at the front of site over 5 days to determine the existing sound levels in the vicinity.

The unattended measurements were performed over 15 minute periods between 16:34 on 16 July 2015 and 10:49 on 21 July 2015. The equipment was installed and collected by Ben Southgate and James Thurston.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'A'. A photograph showing the measurement location is provided in Figure 2. This location was chosen to be reasonably representative of night time ambient noise levels experienced at the site.

The microphone was positioned approximately 1.5 m above the surface of the roof. The measured noise levels at this location are considered to be free-field.

Figure 2 Photo showing microphone position at unattended measurement location 'A'

3.1.2 Location 'B' – Rear of site

Unattended noise monitoring was also undertaken at the rear of the site over 5 days to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The unattended measurements were performed over 15 minute periods between 16:49 on 16 July 2015 and 10:49 on 21 July 2015. The equipment was installed and collected by Ben Southgate and James Thurston.

The measurement position used during the survey is indicated in Figure 1, denoted by the letter 'B'. A photograph showing the measurement location is provided in Figure 3. This location was chosen to be reasonably representative of the background noise levels experienced at nearby noise sensitive premises as well as a secure and safely accessible location at which to install the equipment.

The microphone was positioned approximately 1.5 m above the surface of the roof. The measured noise levels at this location are considered to be free-field.

Figure 3 Photo showing microphone position at unattended measurement location 'B'

3.2 Attended measurements

Attended sample measurements were performed by Ben Southgate and James Thurston at a number of locations around the site. These are indicated in Figure 1 as positions 1 to 5. The attended measurements were carried out on 16 July 2015 over 5 minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

In each case the microphone was mounted on a tripod approximately 1.5 m above the ground level and at least 3 m from any other reflective surface.

4 Measurement results

4.1 Observations

The dominant noise sources observed at the site during the attended parts of the survey consisted of road traffic noise from Comet Way and the A1(M). Other less frequent, yet significant, noise sources included commercial air traffic.

Less significant noise sources observed at the site during the survey consisted of road traffic noise from St Albans Road West, Mosquito Way and Cavendish Way. Other less frequent noise sources included pedestrians walking past and workers using a pressure washer nearby.

Building services plant was in operation on the rooftop during the survey. However, the ambient noise levels are sufficiently high that noise from these items is not considered to have affected the measurements results.

4.2 Daytime attended measurement results

4.2.1 Location 'A' – Front of site

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix B.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 1.

The noise levels measured at location 'A' are considered to be free-field measurements.

Table 1 Ambient noise levels measured during the unattended noise survey at location 'A'

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
16 July 2015	-	66
17 July 2015	67	62
18 July 2015	65	61
19 July 2015	65	62
20 July 2015	67	63
Average	66	63

The minimum background sound levels measured during the unattended survey are given in Table 2.

Table 2 Minimum background sound levels measured during the unattended noise survey at location 'A'

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
16 July 2015	60*	56
17 July 2015	60	54
18 July 2015	59	53
19 July 2015	59	53
20 July 2015	60	54
21 July 2015	63*	-

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 59 dB during the daytime and $L_{A90,15min}$ 53 dB at night.

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, day and night time typical levels have been quantified using statistical analysis from the continuous logging measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 4 and Figure 5.

From this analysis, the representative background sound levels measured during the survey are considered to be $L_{A90,5min}$ 61 dB during the daytime and $L_{A90,5min}$ 54 dB at night.

The maximum noise level typically exceeded during 10-15 measurements periods in a night was L_{AFmax} 75 dB.

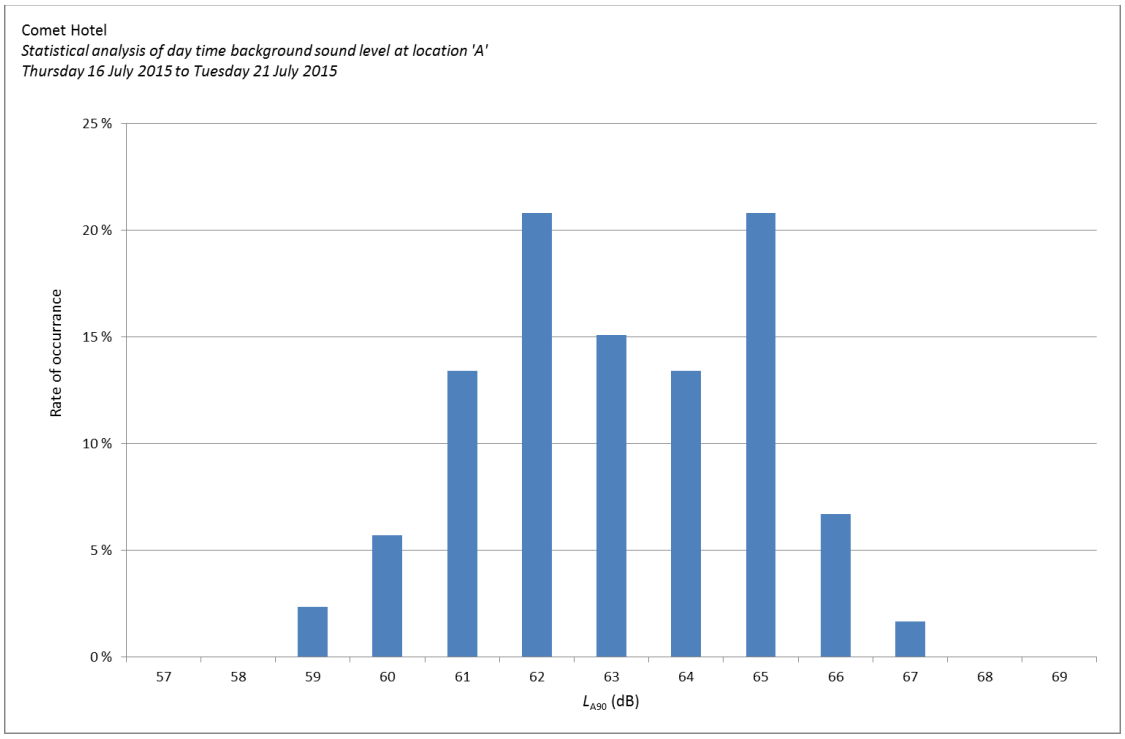


Figure 4 Statistical analysis of measured daytime ambient noise levels at location 'A'

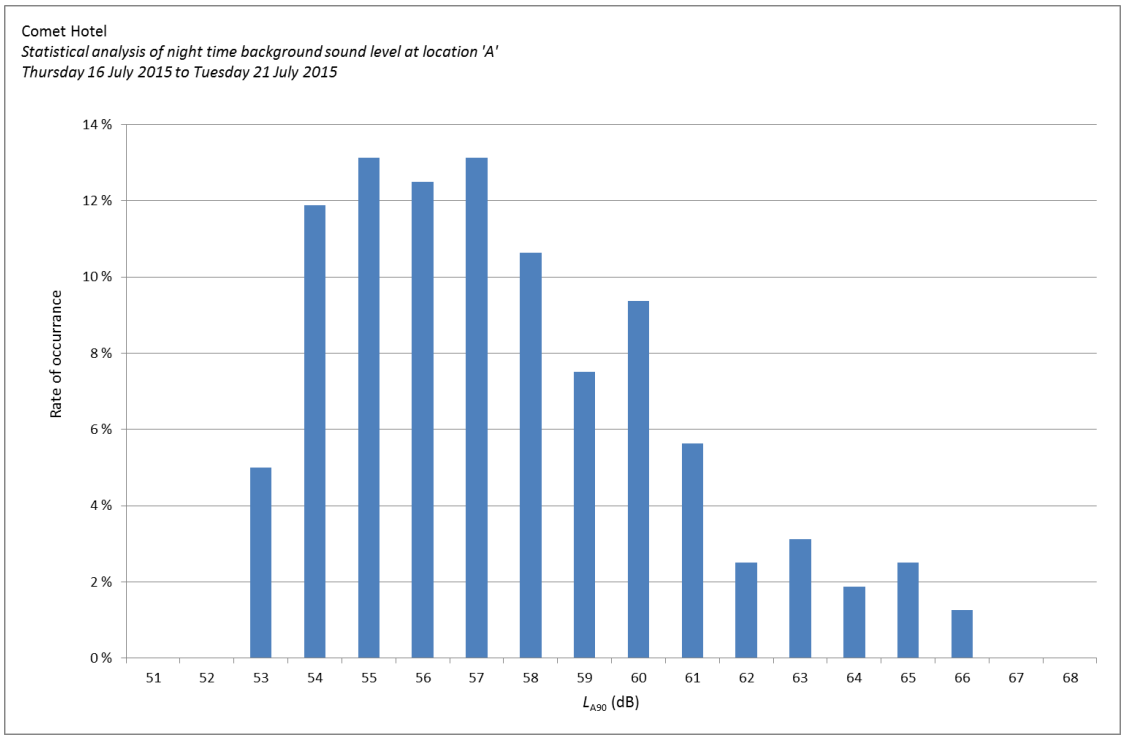


Figure 5 Statistical analysis of measured night-time ambient noise levels at location 'A''

4.2.2 Location 'B' – Rear of site

The results of the unattended noise measurements are summarised in the following tables. A graph showing the results of the unattended measurements is provided in Appendix C.

The day and night time ambient noise levels measured during the unattended survey are presented in Table 3.

The noise levels measured at location 'B' are considered to be free-field measurements.

Table 3 Ambient noise levels measured during the unattended noise survey at location 'B'

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
16 July 2015	-	60
17 July 2015	59	54
18 July 2015	56	53
19 July 2015	57	55
20 July 2015	60	56
Average	58	56

The minimum background sound levels measured during the unattended survey are given in Table 2.

Table 4 Minimum background sound levels measured during the unattended noise survey at location 'B'

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
16 July 2015	51*	47
17 July 2015	51	49
18 July 2015	53	48
19 July 2015	52	48
20 July 2015	51	48
21 July 2015	56*	-

* Measurement not made over full period due to monitoring start and end time

The lowest background sound levels measured during the survey were $L_{A90,15min}$ 51 dB during the daytime and $L_{A90,15min}$ 47 dB at night.

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels, day and night time typical levels have been quantified using statistical analysis from the continuous logging measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 6 and Figure 7.

From this analysis, the representative background sound levels measured during the survey are considered to be $L_{A90,5min}$ 54 dB during the daytime and $L_{A90,5min}$ 49 dB at night.

The maximum noise level typically exceeded during 10-15 measurements periods in a night was L_{AFmax} 64 dB.

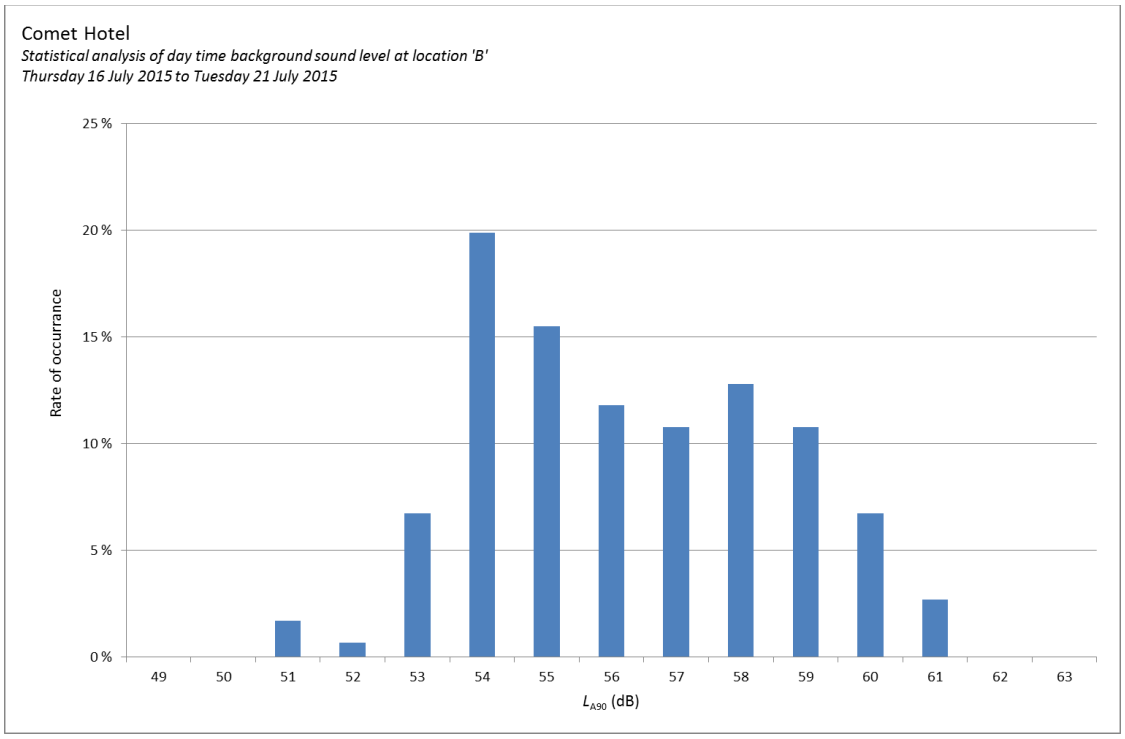


Figure 6 Statistical analysis of measured daytime ambient noise levels at location 'B'

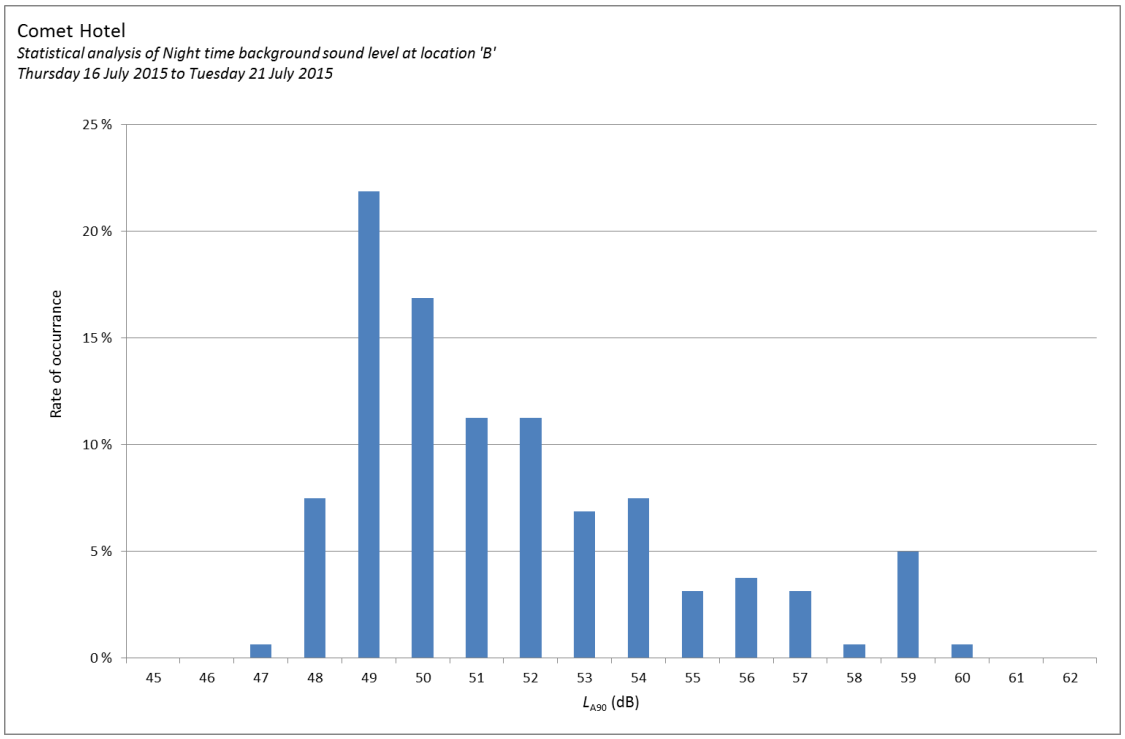


Figure 7 Statistical analysis of measured night time ambient noise levels at location 'B'

4.3 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 5.

All the attended measurements were performed over 5 minute periods.

All the attended measurements are considered to be free-field measurements.

Table 5 Sound pressure levels from attended measurements

Position	Start time	Sound pressure levels (dB)			Noise sources (described in section 4.1)
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
1	17:01	69	76	65	Road traffic on St Albans Road West Road traffic on Cavendish Way Road traffic on A1M
2	17:09	73	82	68	Road traffic on Cavendish Way Road traffic on A1M
3	17:19	58	65	57	Road traffic on Cavendish Way Road traffic on A1M Commercial air traffic Pedestrians walking past
4	17:27	68	77	58	Road traffic on Cavendish Way Road traffic on Mosquito Way Commercial air traffic
5	17:34	65	71	63	Road traffic on St Albans Road West Road traffic on Cavendish Way Road traffic on A1M Commercial air traffic
1	17:40	71	78	66	Road traffic on Cavendish Way Road traffic on A1M
2	17:46	75	93	68	Road traffic on Cavendish Way Road traffic on A1M
3	17:53	59	73	57	Road traffic on St Albans Road West Road traffic on Cavendish Way Road traffic on A1M Commercial air traffic Pedestrians walking past

Position	Start time	Sound pressure levels (dB)			Noise sources (described in section 4.1)
		$L_{Aeq,5min}$	$L_{AFmax,5min}$	$L_{A90,5min}$	
4	18:00	69	85	59	Road traffic on St Albans Road West Road traffic on Mosquito Way Commercial air traffic Pedestrians walking past
5	18:07	64	76	61	Road traffic on St Albans Road West Road traffic on Cavendish Way Road traffic on A1M Commercial air traffic

5 Assessment criteria

5.1 NPPF and NPSE

The National Planning Policy Framework (NPPF) sets out the government planning requirements, and supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

'Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

The NPSE states that its aims are as follows:

'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.'*

As such, although neither of these documents sets out specific acoustic criteria for new residential development, the requirement to control both the effect of existing noise on the new development and the effect of noise from the development on the surroundings needs to be considered.

5.2 PPG 24

In the absence of numerical criteria from NPPF and NPSE, an assessment of the noise levels against the limits given in the superseded PPG24 is considered appropriate to assess the suitability of the site for residential development.

PPG24 guidance recommends Noise Exposure Categories for assessing the suitability of sites for new residential developments in relation to various types of noise sources, including road and rail traffic, and mixed sources. These are designed to help local planning authorities in their consideration of applications for residential developments near transport related noise sources. PPG24 has been superseded by the National Planning Policy Framework (NPPF), which provides general guidance stating that the impact of noise needs to be controlled.

The categorisation of levels is defined separately at night (23:00 to 07:00) and during the day time (07:00 to 23:00). Noise levels corresponding to the Noise Exposure Categories are shown in Table 6.

Table 6 PPG 24 Noise Exposure Category limits for mixed noise sources

	Noise levels corresponding to the noise exposure categories for new dwellings $L_{Aeq,T}$ (dB)			
	A	B	C	D
Mixed sources				
07:00 – 23:00	<55	55 – 63	63 – 72	>72
23:00 – 07:00*	<45	45 – 57	57 – 66	>66

* Where individual noise events regularly exceed a free field level of 82 dB L_{ASmax} several times in any hour, the site should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$.

Category A represents the circumstances in which noise is unlikely to be a determining factor while Category D relates to the situation in which development should normally be refused. Categories B and C deal with situations where noise mitigation measures may make residential development acceptable.

5.3 External noise levels

5.3.1 Local Authority criteria

WHC specify noise egress criteria from building services plant for which their environmental health officer, Karl Riahi, stated the following:

> *'…we require a BS 4142:2014 assessment and would look for all new plant and equipment to not exceed a noise level of 10 dB below background at the nearest residential property (both existing and proposed).'*

WHC also specify criteria relating to external noise levels for which their environmental health officer stated the following:

> *'…we require external noise levels to meet 55 dB WHO Community Noise Guideline Level.'*

We have interpreted this statement as referring to the WHO guidelines which recommends that sound levels for 'Outdoor living areas' to be $L_{Aeq,16hour}$ 55 dB. WHC have confirmed that the requirements apply to residential amenity areas and would not apply to external seating areas for restaurant functions and similar associated with the hotel, but would apply elsewhere.

5.4 Internal noise level – noise ingress

5.4.1 Local Authority requirements

WHC specify noise ingress criteria to be set as per the guidance set out in BS 8233:2014 *Sound insulation and noise reduction for buildings* for which the indoor ambient noise levels are summarised in Table 7.

Table 7 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level L_{Aeq} (dB)	
	BS 8233 (07:00 to 23:00)	BS 8233 (23:00 to 07:00)
Living rooms	35	-
Dining room	40	-
Bedrooms	35	30[1]

[1] BS 8233 notes that individual noise events can cause sleep disturbance, and that a guideline value may be set depending on the character and number of events per night, although no specific limit is provided. Section 3.4 of the WHO guidelines for community noise suggests that good sleep will not generally be affected if internal levels of L_{Amax} 45 dB are not exceeded more than 10-15 times per night.

6 PPG24 assessment

The noise levels at the site at which the development is proposed vary due to the location of noise sources and the geometry of the existing and proposed buildings. The worst case noise levels are toward the south and east of the site where there is line of sight to the A1(M). Noise levels at other areas across the site are significantly lower.

Based on the noise levels presented in section 4.2 the site lies within NEC C for the daytime period and NEC C for the night time period.

For sites which fall into NEC C, PPG24 gives the following guidance:

> *'Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.'*

In this case, it will be possible with appropriate facade sound insulation and attenuation of ventilation openings, to achieve internal noise levels in line with the recommendations of BS 8233: 2014 *Sound insulation and noise reduction for buildings* and the World Health Organisation's guidelines for community noise.

The facade sound insulation requirements are discussed further in the following sections of this report.

7 Plant noise limits – noise egress

7.1 Limits

7.1.1 Basic limits

Based on the above criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits are set out in Table 8.

Table 8 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)	
	Front of site	Rear of site
Daytime (07:00-23:00)	51	44
Night-time (23:00-07:00)	44	39

The limits set out in Table 8 do not include any attention catching features. The penalties for attention catching features may be significant, and will need to be considered as the building services design progresses.

WHC require that all new plant and equipment is assessed in accordance with BS 4142:2014 which states that '*…Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact*'. As WHC require plant to not exceed a noise level of 10 dB below background noise levels at the nearest residential property, it is considered that plant designed to meet this criteria will have low impact on nearby noise sensitive receivers in line with BS 4142:2014.

Furthermore, BS 4142:2014 provides an assessment procedure for accounting for attention catching features from noise sources. In conjunction with the requirements of WHC, the addition of penalties due to attention catching features may produce unnecessarily onerous, and unachievable limits for plant noise. As such, plant with attention catching features will be assessed with reference to BS 4142:1997 as this follows more closely the requirements of WHC and is likely to produce reasonable and achievable plant noise limits. BS 4142:1997 states:

> '*Apply a 5 dB correction if one or more of the following features occur, or are expected to be present for new or modified noise sources:*
>
> > *-the noise contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum etc);*
> >
> > *-the noise contains distinct impulses (bangs, clicks, clatters, or thumps);*
> >
> > *-the noise is regular enough to attract attention.'*

7.2 Assessment

At this stage, no information is available in relation to the proposed installation of building services plant, and this will need to be assessed in detail as the design progresses. However, all plant items will be designed to achieve the plant noise limits set out above, including any corrections for attention catching features.

8 Facade sound insulation – noise ingress

The PPG24 assessment in section 6 indicates that noise is a factor which should be taken into account at the site, and measures should be employed to ensure that appropriate internal noise levels will be achieved.

This section discusses internal noise level criteria and assesses the required facade sound insulation performance. In principle, the required facade specification depends on two factors – the external noise levels at the site, and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS 8233:2014 as required by WHC, which are set out in Section 5.4.

8.1 External noise levels

The variation in noise levels around the proposed development has been modelled using the 3D computer modelling software CadnaA. The model is based on the principal noise sources being the roads around the site.

The external areas formed between the building masses on the proposal drawings can be considered residential amenity areas. The building masses have been arranged to screen these areas from the traffic noise in the surrounding areas. The predicted noise levels from environmental sources in these areas are consequently below the level of $L_{Aeq,16hour}$ 55 dB identified by WHO as the onset of annoyance and stated to be required by WHC.

The figures in Appendix D show the predicted external facade noise levels around the site in terms of $L_{Aeq,T}$ (dB).

8.2 Facade sound insulation

To achieve the internal noise criteria given in section 5.4 for bedrooms and other living areas, minimum facade sound insulation requirements have been determined, based on the predicted external noise levels at each facade.

The required performances are driven by the night time noise levels.

The minimum sound insulation performances for the different building facades are given in Figure 8. These are composite performances of all facade elements and any ventilation paths.

Section 8.3 provides recommended glazing configurations and ventilation strategies for the different facade performances required.

Some of the facades marked up in Figure 8 will require mechanical ventilation in order to achieve the overall facade sound insulation performance requirements.

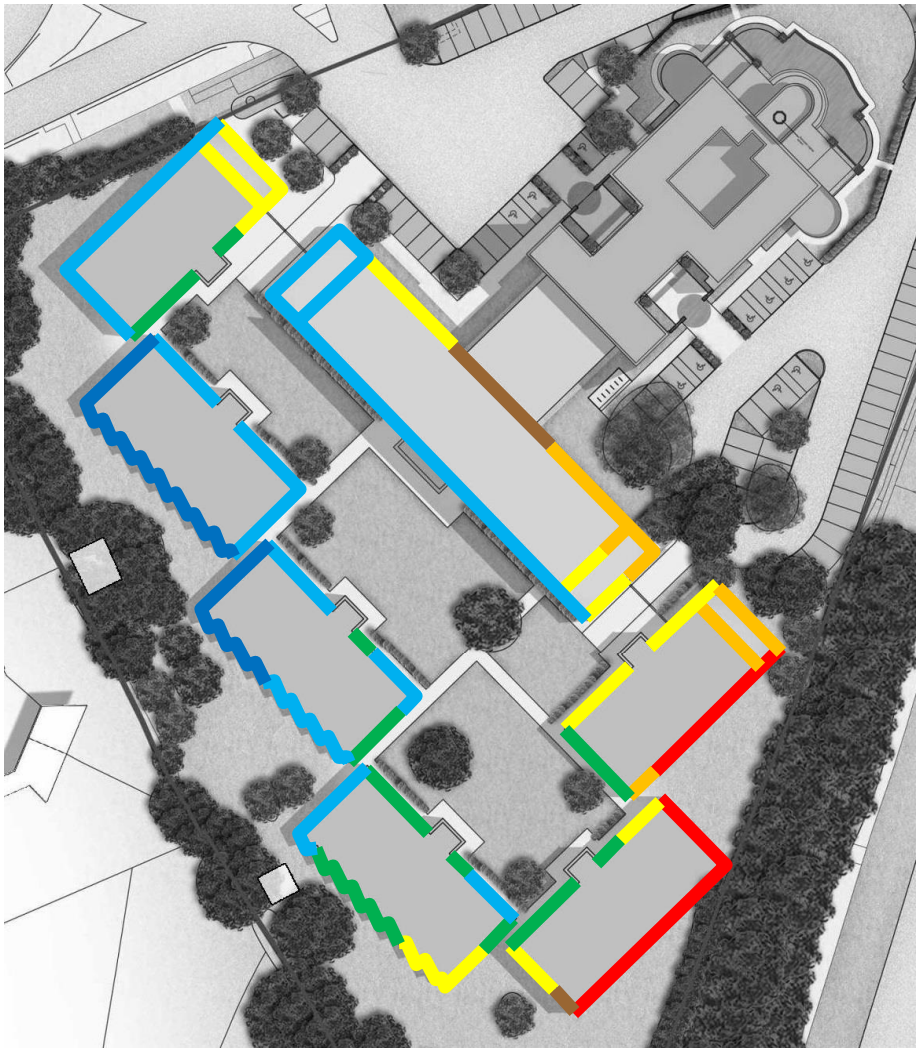


Figure 8 Minimum overall facade sound insulation performance drawing mark-up

Overall facade sound insulation performance	
Criterion	Line colour
$R_w + C_{tr}$ 20 dB	
$R_w + C_{tr}$ 25 dB	
$R_w + C_{tr}$ 30 dB	
$R_w + C_{tr}$ 35 dB	
$R_w + C_{tr}$ 38 dB	
$R_w + C_{tr}$ 40 dB	
$R_w + C_{tr}$ 42 dB	

8.3 Guidance on facade construction, glazing, and ventilation strategy

The following table sets out some examples of glazing build ups and ventilation strategies that could be employed to achieve the required sound insulation performance for the various elevations.

Table 9 Example glazing configurations and ventilation strategies

Sound insulation $R_w + C_{tr}$ (dB)	Example glazing configuration	Ventilation Strategy
15-29	6 mm/12 mm/6 mm	Attenuated passive ventilation (eg, trickle vents)
30-32	6.4 mm/12 mm/6 mm	Attenuated passive ventilation
33-35	6.4 mm/12 mm/10 mm	High performance acoustically attenuated passive ventilation
36-38	12.8 mm/12 mm/10 mm	Mechanical ventilation (eg, whole house ventilation)
39-41	12.8 mm/20 mm/10 mm	Mechanical ventilation (eg, whole house ventilation)
42-44	This represents a very high sound insulation performance. The highest performance typically achievable using double glazing is around R_w+C_{tr} 42 dB (16.8 mm/20 mm/16.8 mm). For higher performances, a substantial facade construction, limited glazing area, and mechanical ventilation will be required.	

The performance required by each element will depend on the construction of the solid elements, the glazing specification, the relative areas of the solid and glazed elements, and the ventilation strategy (including the acoustic performance of the trickle ventilators and the number of ventilators required to serve individual rooms, if applicable).

As the design progresses, a more detailed facade sound insulation assessment will need to be performed, taking into account the factors listed above, to ensure that the overall performance requirements will be met.

Appendix A

Survey details

Equipment

A Svantek 957 sound level meter and a Rion NL-32 sound level meter were used to undertake the unattended measurements. The attended measurements were carried out using a Rion NL-52 sound level meter. The calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	SVAN957/12327	Svantek	25 Oct 15	1310490
Microphone	ACO7052H/43273	Svantek	25 Oct 15	1310490
Pre-amp	SV12L/13569	Svantek	25 Oct 15	1310490
Calibrator	SV30A/7451	Svantek	24 Oct 15	1310484
Sound level meter	NL-32/00623769	Rion	18 Sep 15	1309425
Microphone	UC-53A/319244	Rion	18 Sep 15	1309425
Pre-amp	NH-21/36677	Rion	18 Sep 15	1309425
Calibrator	NC-74/34336009	Rion	12 Sep 15	1309410
Sound level meter	NL-52/00242702	Rion	4 Jun 17	1506331
Microphone	UC-59/06185	Rion	4 Jun 17	1506331
Pre-amp	NH-25/32730	Rion	4 Jun 17	1506331
Calibrator	CAL200/4499	Larson Davis	4 Jun 17	1506327

Calibration of the sound level meters used for the tests is traceable to national standards. The calibration certificates for the sound level meters used in this survey are available upon request.

The sound level meters and microphones were calibrated at the beginning and end of the measurements using their respective sound level calibrators.

Noise indices

The equipment was set to record a continuous series of broadband sound pressure levels. Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

The L_{A90} is considered most representative of the background sound level for the purposes of complying with any local authority requirements.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Weather conditions

During the attended measurements carried out on 16 July 2015, the weather was generally clear and dry and no rain occurred. Wind speeds varied between approximately 0 m/s and 10 m/s.

Table A2 summarises the weather conditions during the unattended noise measurements between 16 July 2015 and 21 July 2015.

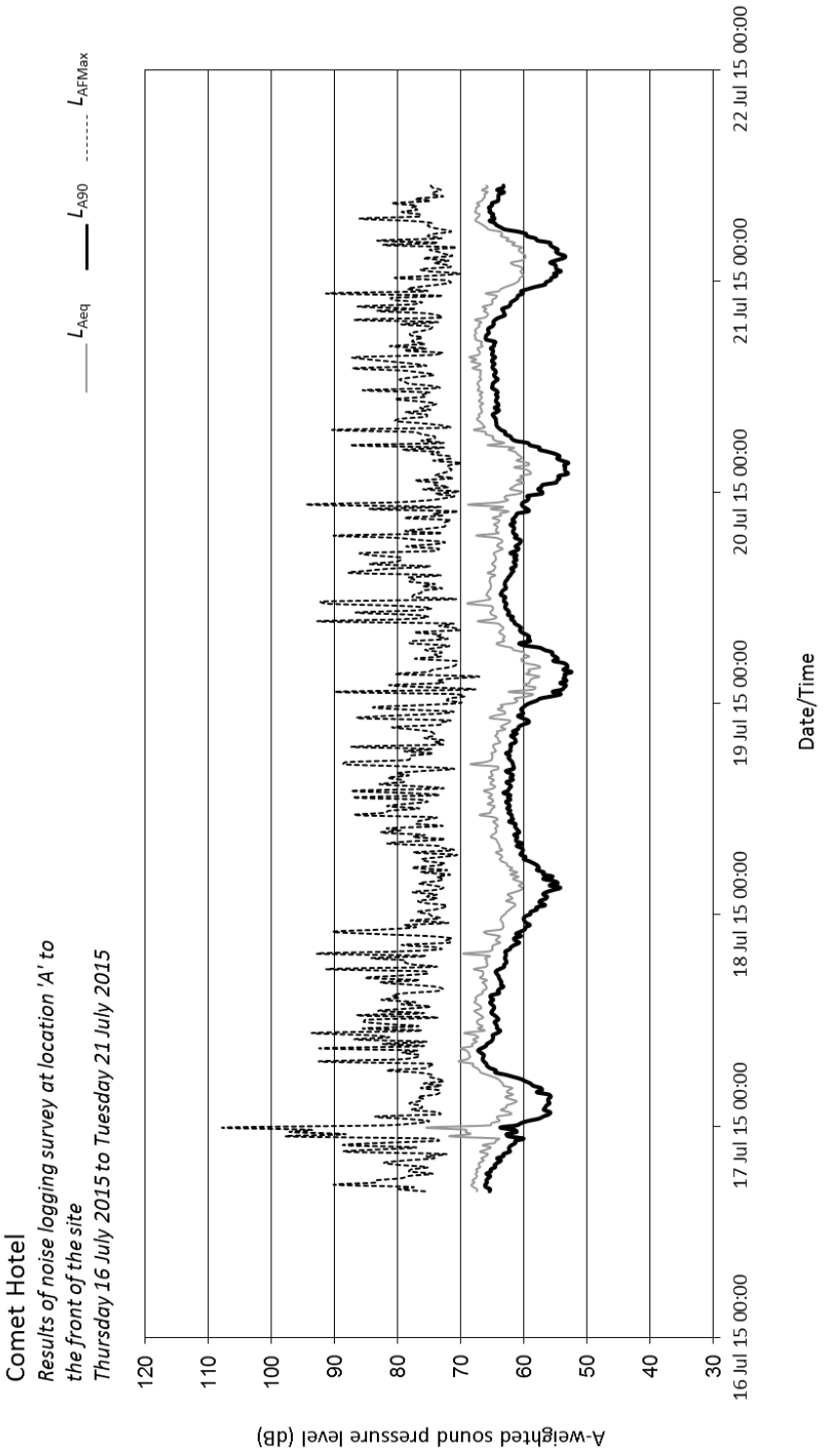
Table A2 Weather conditions during survey

Date	Maximum temperature (°C)	Minimum temperature (°C)	Average wind speed (m/s)	Maximum wind speed (m/s)
16 July 2015	24	12	4	7
17 July 2015	24	14	4	10
18 July 2015	22	10	4	7
19 July 2015	23	13	4	10
20 July 2015	24	10	3	10
21 July 2015	25	12	5	7

It is considered that the survey was of sufficient duration to include weather conditions suitable to obtain representative measurements.

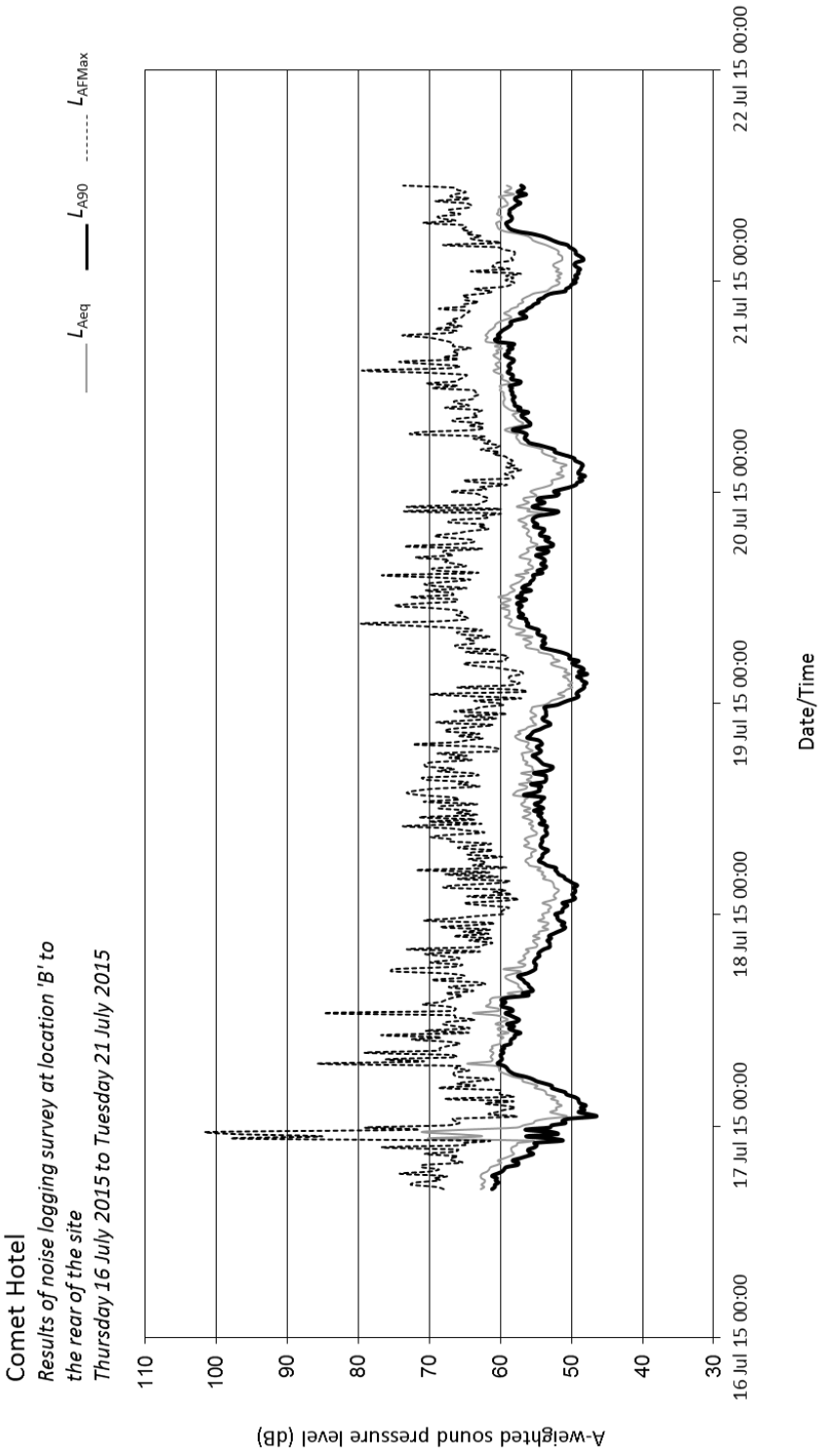
Appendix B

Results of unattended measurements at Location 'A'


Comet Hotel
Results of noise logging survey at location 'A' to the front of the site
Thursday 16 July 2015 to Tuesday 21 July 2015
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
120
110
100
90
80
70
60
50
40
30
16 Jul 15 00:00
17 Jul 15 00:00
18 Jul 15 00:00
19 Jul 15 00:00
20 Jul 15 00:00
21 Jul 15 00:00
22 Jul 15 00:00
Date/Time

Appendix C

Results of unattended measurements at Location ‘B’


Comet Hotel
Results of noise logging survey at location 'B' to the rear of the site
Thursday 16 July 2015 to Tuesday 21 July 2015
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
16 Jul 15 00:00
17 Jul 15 00:00
18 Jul 15 00:00
19 Jul 15 00:00
20 Jul 15 00:00
21 Jul 15 00:00
22 Jul 15 00:00
Date/Time

Appendix D

Images from 3D computer modelling

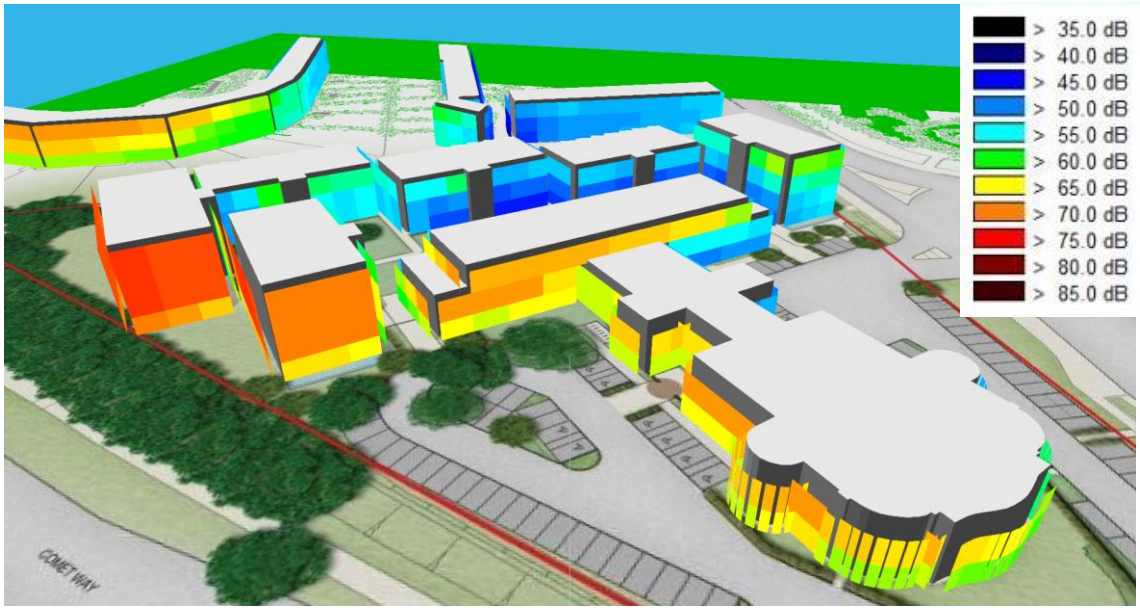


Figure D1 Predicted external facade noise levels around the site during the daytime, $L_{Aeq,16hour}$ (dB)

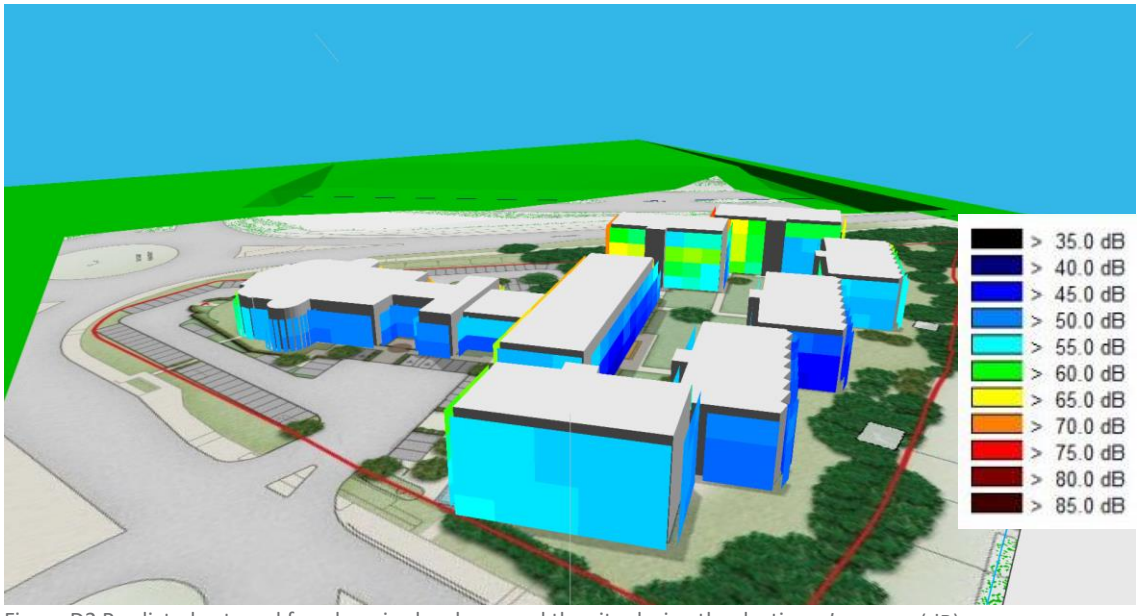


Figure D2 Predicted external facade noise levels around the site during the daytime, $L_{Aeq,16hour}$ (dB)

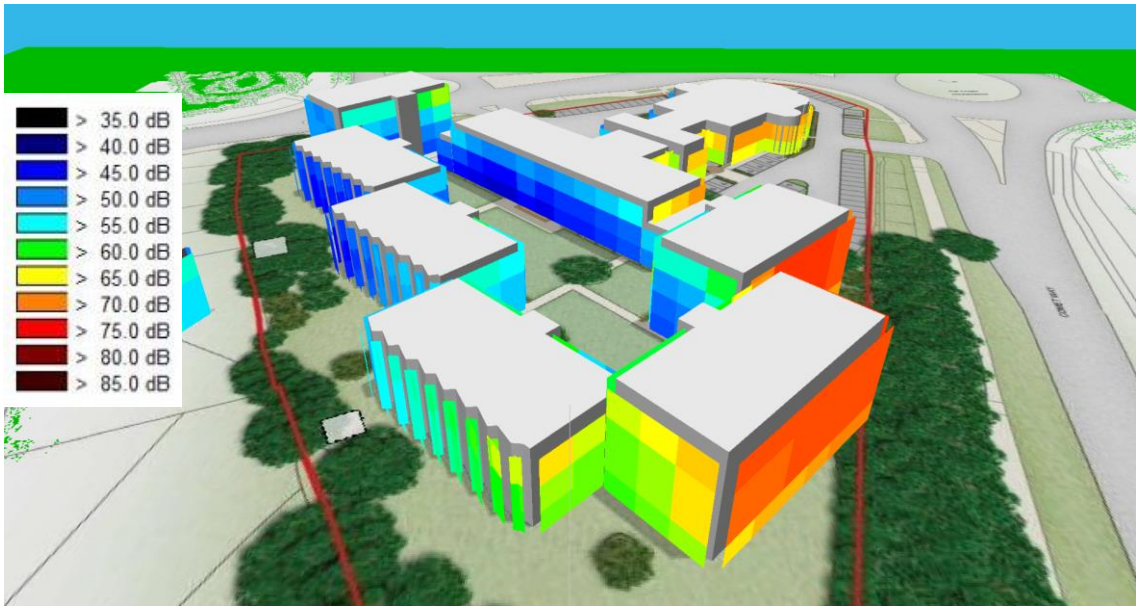


Figure D3 Predicted external facade noise levels around the site during the daytime, $L_{Aeq,16hour}$ (dB)

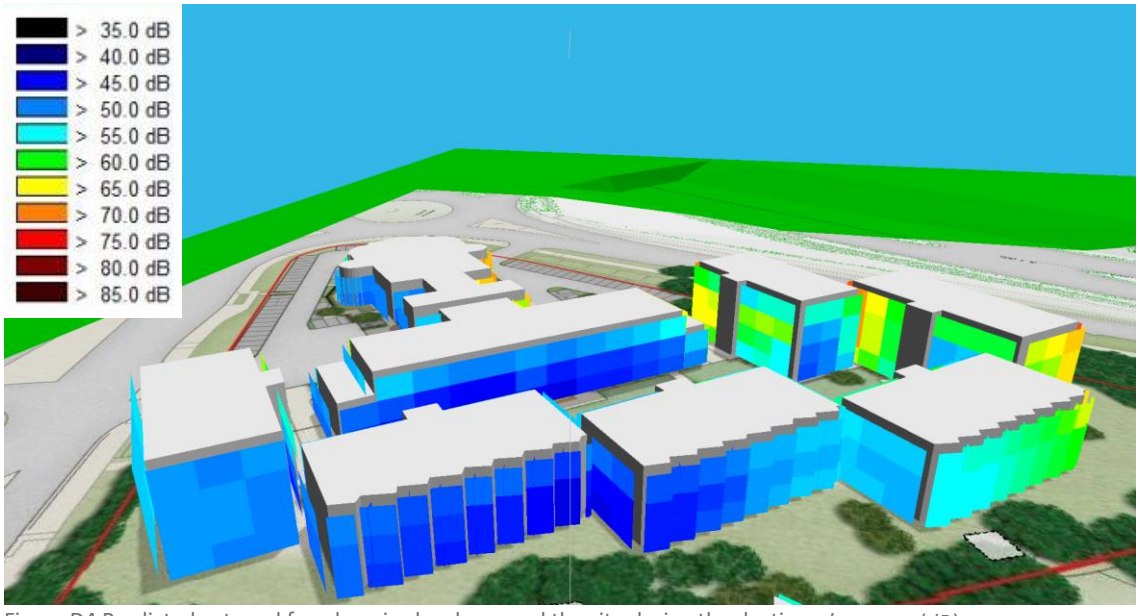


Figure D4 Predicted external facade noise levels around the site during the daytime, $L_{Aeq,16hour}$ (dB)

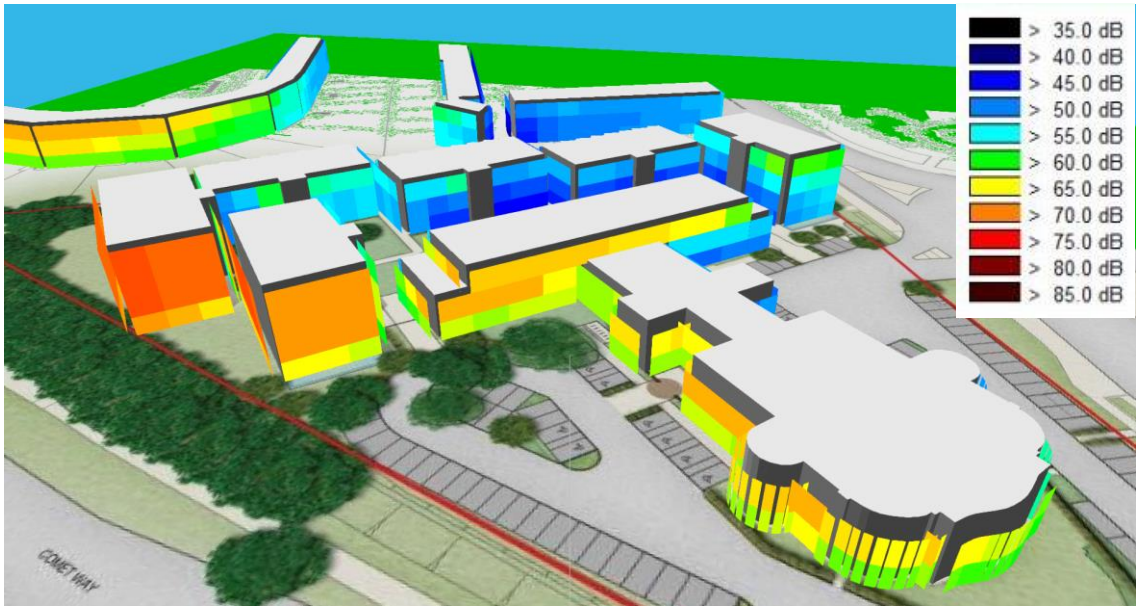


Figure D5 Predicted external facade noise levels around the site during the night-time, $L_{Aeq,8hour}$ (dB)

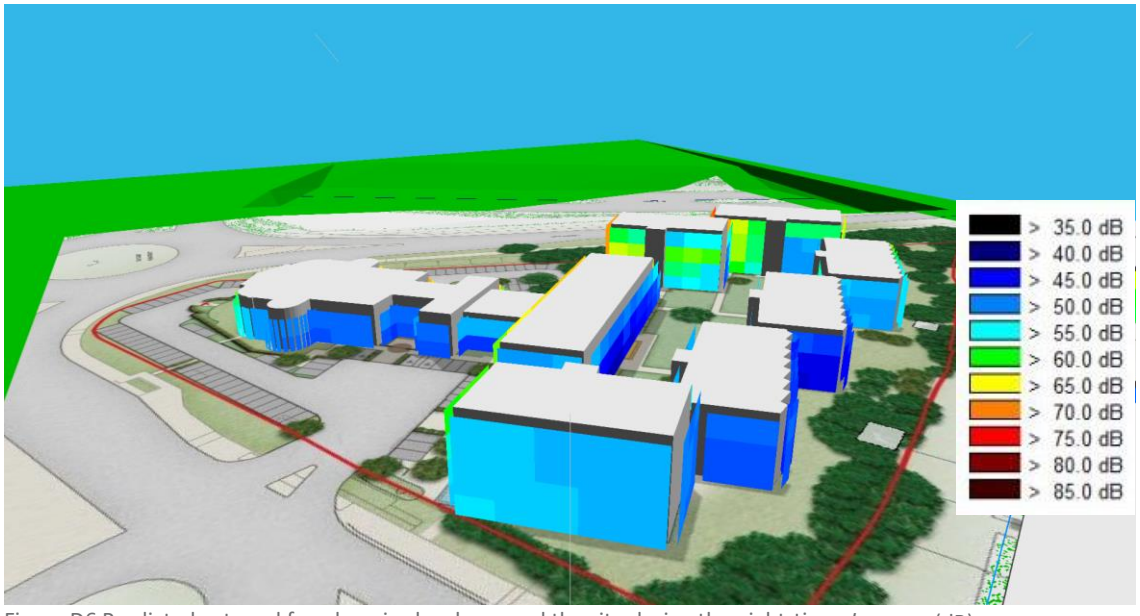


Figure D6 Predicted external facade noise levels around the site during the night-time, $L_{Aeq,8hour}$ (dB)

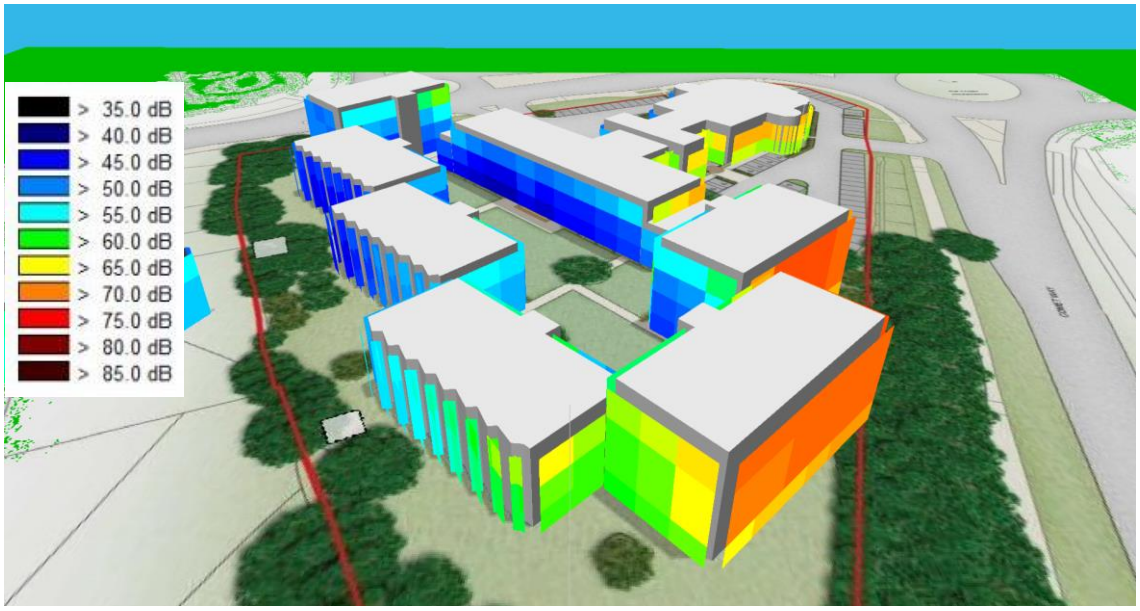


Figure D7 Predicted external facade noise levels around the site during the night-time, $L_{Aeq,8hour}$ (dB)

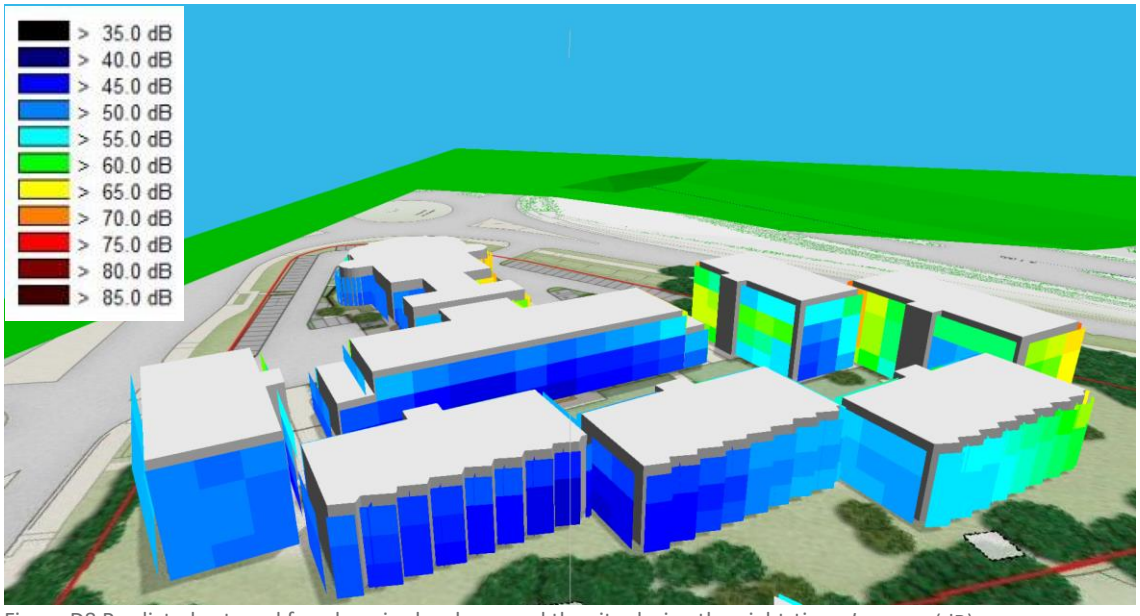


Figure D8 Predicted external facade noise levels around the site during the night-time, $L_{Aeq,8hour}$ (dB)