Comet Hotel, Hatfield

Façade sound insulation design – Condition 18

6206.2

28th November 2017

Revision C

Comet Hotel, Hatfield

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Revision	Description	Issued by	Date
A	First issue	MC	10th September 17
B	Updated with ventilation information	NC	24th November 17
C	Updated following comments	NC	18th November 17

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1 Contents

2 Summary

2.1 This report has been prepared to provide details of the sound insulation scheme to discharge the planning conditions relating to external traffic noise, for the proposed development at Comet Hotel, Hatfield.

2.2 The development has been granted permission for the extension and refurbishment of an existing hotel and erection of new residential blocks for student accommodations.

2.3 Noise levels affecting the proposed development from road traffic have been measured during the day at two monitoring locations. It was found that the daytime measured levels were within 2dB compared to the levels reported previously as part of the planning application, this indicates the levels measured previously are representative.

2.4 A noise model was used to calculate noise levels across the proposed site and these levels were used to determine the potential façade sound insulation treatments to meet the internal noise level requirements.

2.5 Three type of sound insulation treatments are proposed across the site. The specifications details and example of construction are shown in Table 1 and Figure 1 illustrates the relevant façades for each specification.

Specification reference		Glazing	Vent
A	minimum acoustic performance	$R_w + C_{tr}$ 23 dB	$D_{n,e,w}$ 34 dB
	typical construction	4mm/12mm/4mm Pilkington Insulight	e.g. Greenwood 4000 L
B	minimum acoustic performance	$R_w + C_{tr}$ 28 dB	$D_{n,e,w}$ 42 dB
	typical construction	6mm/12mm/6mm Pilkington Insulight	e.g. TITON SF X V75 + 50
C	minimum acoustic performance	$R_w + C_{tr}$ 33 dB	$D_{n,e,w}$ 44 dB
	typical construction	6 mm / 16 mm argon / 6.8 mm Pilkington Optiphon	e.g. TITON SF X V75 + C75

Table 1: Summary of minimum façade sound insulation treatment

Figure 1: Site plan marked with sound insulation treatments

2.6 The proposed sound insulation requirements and specification for the façade, windows and vents are shown to achieve the requirements of the planning condition and demonstrate that the condition can be discharged

2.7 The current ventilation strategy for the residential rooms will be continuous mechanical extract with a normal and boost mode to comply with the ventilation requirements of Part F of the Building Regulations.

2.8 This system will require background ventilators within the façades to provide the make-up air for the continuous ventilation.

2.9 The provision for boost and purge ventilation will be provided via opening windows.

3 Introduction

3.1 Apex Acoustics has been commissioned to undertake a noise survey and provide advice on the sound insulation of the façade to achieve the internal levels required by the planning conditions for the development.

3.2 The development has been granted permission for the extension and refurbishment of an existing hotel and erection of new residential blocks for student accommodation.

3.3 The application decision notice,6/2016/1739/MAJ, includes planning conditions and this report has been prepared for the discharge of Condition 18

3.4 The site location is shown in Figure 2, St Albans Rd West is to the north and Comet Way to the south east.

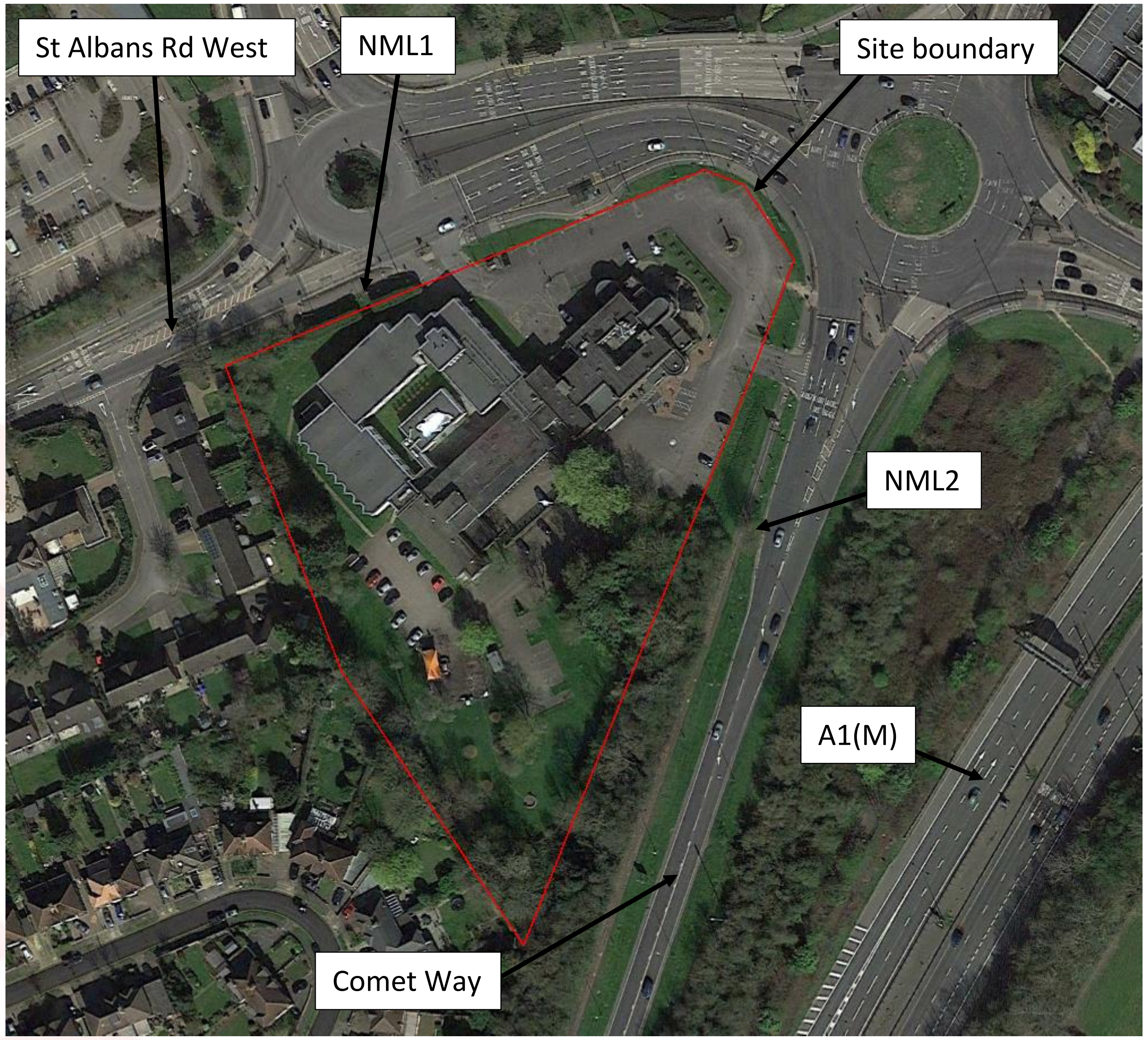

Figure 2: Site location and noise monitoring locations NML1 and NML2

4 Planning conditions requirements and adopted criteria

4.1 **Planning conditions**

4.2 Condition 18 states:

"No construction above ground shall commence until a scheme to protect each building (hotel and student accommodation) from traffic noise has been submitted to and approved in writing by the Local Planning Authority. The scheme shall be completed in accordance with the approved details before each building hereby approved is occupied and shall be maintained thereafter.

The scheme shall ensure the indoor ambient noise levels in living rooms and bedrooms meet the standards in BS 8233:2014. Any associated mechanical ventilation shall meet the requirements of the Noise Regulations 1975 (amended 1988)."

4.3 The condition 18 refers to the Noise Insulation Regulations for mechanical ventilation, however it is proposed as an alternative that the ventilation rates should be designed to meet Part F of the Building Regulations, Reference 7.

4.4 It has been agreed with the local authority that windows can be opened for purge ventilation, as defined in Part F, which is required for the rapid removal of odours and moisture.

4.5 The local authority has requested that details are provided to demonstrate that the rooms can control overheating with the windows closed, but at this stage the overheating assessment has not been completed.

4.6 **BS 8233 - Guidance on sound insulation and noise reduction for buildings**

4.7 Table 4 of BS 8233, Reference 1, provides guidelines for internal ambient noise levels in dwellings for steady external noise sources, as shown in Table 2.

4.8 The standard states that these values are annual averages and do not have to be achieved in all circumstances, which does suggest that higher levels would be acceptable for short periods, such as during the hottest days of the year.

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

Table 2: Guideline indoor ambient noise levels defined in BS 8233

4.9 **Adopted criteria for Part F extract ventilation rates**

4.10 The adopted criteria for this development, for conditions with windows closed and façade vents open, is consistent with the values given in BS 8233 and is presented in Table 3.

Situation	Adopted upper limits, $L_{Aeq,T}$ / dB
Daytime for living rooms, bedrooms	35
Night time for bedrooms	30

Table 3: Adopted criteria for internal noise levels with windows closed and façade vents open

5 Noise sources and measurements

5.1 Measurements were made during the day, on 15th August 2017 at two noise monitoring locations NML1 and NML2, as shown in Figure 1.

5.2 Both locations were selected to be along St Albans Rd West and Comet Way which are the two roads immediately adjacent to the site.

5.3 Also, NML1 and NML2 were placed at locations nearly identical to two of the positions for which noise levels were reported previously, Reference 2, as part of the planning application.

5.4 Measurements were made with the microphone located at 1.5 m above ground level, away from other reflecting surfaces, such that they are considered to be free field.

5.5 The equipment used is listed in Table 4.

Equipment	Model	Serial no.
Sound Level Meter	XL2	A2A-11062-E0
Calibrator	Larson Davis CAL 200	13403

Table 4: Equipment used

5.6 Both meters and calibrators have current calibration certificates traceable to national standards.

5.7 The temperature was around 25 °C; the wind speed measured was below 1.5 m/s.

5.8 The most significant noise source was road traffic. Other noise sources included sirens, helicopter and a distant pressure washer from a car wash.

5.9 **Measured levels**

5.10 The measured noise levels are shown in Table 5.

Position	Time start	Duration	Measured noise level, $L_{Aeq,T}$ / dB	Measured noise level, $L_{A10,T}$ / dB
NML1	11:23	00:15	68	72
	12:20	00:16	68	73
	13:20	00:15	69	73
NML2	11:02	00:15	73	77
	12:01	00:15	73	77
	13:01	00:15	73	77

Table 5: Measured noise levels

5.11 **Comparison with previous survey**

5.12 The highest $L_{Aeq,T}$ measured levels are 69 dB at NML1 and 73 dB at NML2. In comparison, previously reported measured levels at identical positions were up to 69 dB at NML1 and up to 75 dB at NML2.

5.13 A difference of approximately 2dB is observed between the two surveys, this is an insignificant change and indicates that the levels measured previously are still representative and can be used to design the façade acoustic requirements.

5.14 The representative daytime $L_{Aeq,16h}$ and night-time $L_{Aeq,8h}$ are shown in Table 6, the values are taken from previous long-term measurements of several days in report Reference 2.

Position	Daytime $L_{Aeq,16hr}$ / dB	Night-time $L_{Aeq,8hr}$ / dB
Front of site, facing round about	66	63
Rear of site	58	56

Table 6: Representative daytime and night-time noise levels

6 Calculated noise impact

6.1 A noise model of the site was developed to predict the façade noise levels, taking into consideration height of the building and the shielding provided by the building once it is constructed.

6.2 Noise transmission and propagation is modelled using proprietary software, Cadna/A, Reference 3. This models noise propagation outdoors according to ISO 9613, Reference 4.

6.3 The parameters used, source of data and details are described in Table 7.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Architects drawings	Architects drawings, Reference 12
Topography – within site	Site observations and Google Street view	Modelled with OS Terrain 5 DTM data
Topography – Outside of site	Site observations and Google Street view	Modelled with OS Terrain 5 DTM data
Building heights – proposed buildings	Drawings	Architects drawings
Building heights – outside of site	Site observations and Google Street view	3 m per storey + 2 m roof (residential properties)
Receptor positions	Site observations and Google Street view	On the façades with highest noise levels a height of 9 m
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB
G, Ground factor	ISO 9613-2	Hard ground, G = 0
Max. order of reflections	Apex Acoustics	Three

Table 7: Modelling parameters and assumptions

6.4 Using the daytime $L_{Aeq,16h}$ and night-time $L_{Aeq,8h}$ noise levels to ascribe sound power levels to the surrounding roads, the noise impact at the proposed building façade is calculated.

6.5 The tallest proposed residential buildings are approximately 9m high and it was found that predicted noise levels across the site at that height are conservative compared to levels at lower heights. Predictions at 9m heights were therefore used as a prudent assumption for the design of the façade.

6.6 A plan view of the model with the graphical results at 9 m above the ground during the day is shown in Figure 3 and during the night in Figure 4. A 3D view of the noise model is shown in Figure 5.

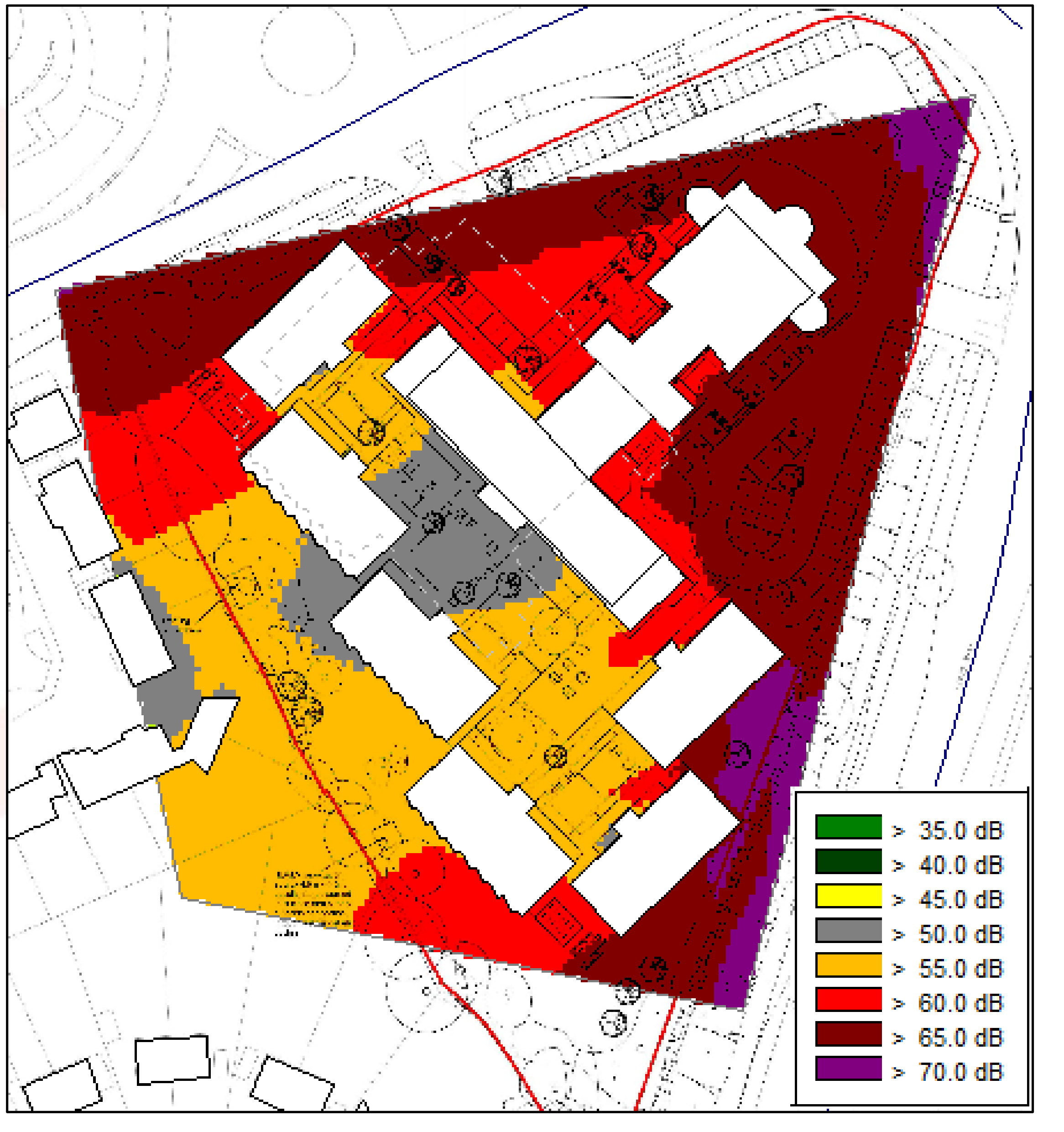

Figure 3: Noise contours at 9 m during Daytime

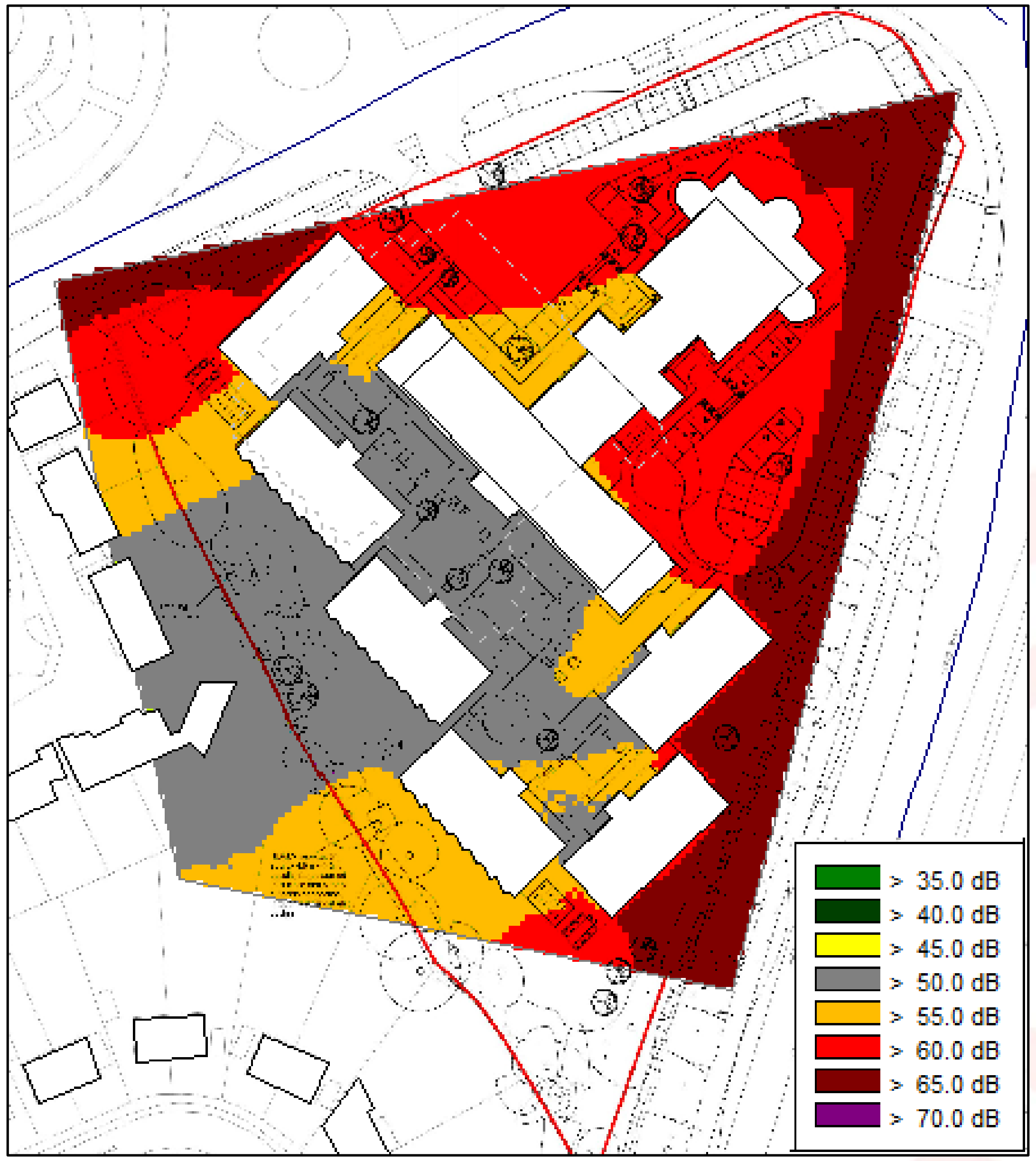

Figure 4: Noise contours at 9 m during Night time

Figure 5: 3D view of the model

6.7 The façade facing both Comet Way and the A1(M) has the highest predictions and is predicted to be exposed to external free field noise levels of 69dB $L_{Aeq,16hr}$ during the daytime and 66dB $L_{Aeq,8hr}$ during the night-time.

7 Facade noise calculations

7.1 The calculation method for façade sound insulation is in accordance with BS 8233 and the principles of BS EN 12354-3, Reference 5, as described in Appendix 1 and detailed in the Apex Method, Reference 6.

7.2 **Ventilation strategy**

7.3 The proposed development will be required to meet Part F of the Building Regulations, with regard to ventilation provision, as described in Approved Document F (AD-F), Reference 7.

7.4 A continuous mechanical extract (MEV), is to be used, where the air inlet is mounted on the facade and the air is extracted via a fan which is ducted to the cooking area and bathroom areas for extraction. This is considered in the calculation by the use of a single facade mounted ventilator.

7.5 Vents have been assessed with manufacturer's acoustic data for the element normalised level difference, $D_{n,e,w}$. The acoustic data for Greenwoods 4000 L, TITON SF X V75 + C50 and TITON SF X V75 + C75 are sourced from References 9, 10 and 11. Other acoustic vents may also be assessed for suitability.

7.6 It should be emphasised that the above is not intended to constitute a ventilation strategy design, which is the responsibility of the mechanical engineers. Assumptions regarding the ventilation strategy are required in order to carry out the acoustic assessment.

7.7 If the details vary from those described above, the proposed details should be reassessed for acoustic performance.

7.8 **Reverberation time**

7.9 From ISO 16283, Reference 8, the reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room. This value is used for both living rooms and bedrooms.

7.10 **Dimensions and unit descriptions**

7.11 The most exposed rooms are those with the largest ratio of window area to room volume, as well as those closest and most exposed to the noise sources. The studio rooms from the new student blocks buildings A, E and F have a large ratio and are the most exposed so the dimensions from these rooms was used as a prudent assumption to assess all rooms across the site.

7.12 A window area of 5 m^2 and a volume of 43 m^3 have been measured from the architect's plans and elevations, Reference 12.

7.13 **Glazing**

7.14 The acoustic performance of the proposed glazing listed in the summary table is taken from Pilkington Optiphon Glass, Reference 13 and Pilkington Insulight Glass, Reference 14.

7.15 **Rooms most exposed to noise ingress**

7.16 As night-time noise levels are calculated to be less than 5 dB below the daytime noise levels, the façade sound insulation design is limited by the night-time noise level upper limit of 30 dB(A).

7.17 Calculations are carried out for three rooms representative of the worst-case noise levels within three noise contours bands.

7.18 The contour bands were spaced every 5dB, at intervals 66 dB (highest night-time levels), 61dB and 56dB.

7.19 **Calculated noise impact**

7.20 Façade noise calculations are carried out in octave bands between 125 Hz and 4 kHz since technical data from glazing and trickle vent manufacturers is typically not available outside of this range.

7.21 The spectra used in the façade noise calculations are shown in Table 8.

Specification reference	Parameter	dB(A)	Octave Band Centre Frequency / Hz					
			125	250	500	1k	2k	4k
A	Daytime $L_{Aeq,T}$	**69**	48	54	60	66	63	53
	Night time $L_{Aeq,T}$	**66**	45	50	56	63	59	50
B	Daytime $L_{Aeq,T}$	**64**	44	50	56	62	58	48
	Night time $L_{Aeq,T}$	**61**	41	46	52	59	54	45
C	Daytime $L_{Aeq,T}$	**59**	39	45	51	57	53	41
	Night time $L_{Aeq,T}$	**56**	36	41	47	54	49	38

Table 8: A-weighted external free-field noise levels used to calculate façade sound insulation

7.22 A summary of the calculated internal levels is shown in Table 9.

Specification reference	Calculated internal level, $L_{Aeq,T}$ / dB		Full calculation
	Daytime	Night time	
A	33	29	Table 10 of Appendix 1
B	33	30	Table 11 of Appendix 1
C	31	28	Table 12 of Appendix 1

Table 9: Summary of calculated worst case internal noise levels

7.23 Three type of sound insulation treatments are proposed across the site. The specification details and example of construction are shown in Table 1 and Figure 1 illustrates the relevant façade locations for each specification.

8 Conclusion

8.1 Noise levels affecting the proposed development from road traffic have been measured during the day at two monitoring locations. It was found that the daytime measured levels were within 2dB compared to the levels reported previously as part of the planning application, this indicates the levels measured previously are representative.

8.2 A noise model was used to calculate noise levels across the proposed site and these levels were used to determine the potential façade sound insulation treatments to meet the internal noise level requirements.

8.3 Three type of sound insulation treatments are proposed across the site. The specifications details and example of construction are shown in Table 1 and Figure 1 illustrates the relevant façade locations for each specification.

8.4 The proposed sound insulation requirements and specification for the façade, windows and vents are shown to achieve the requirements of the planning condition and demonstrate that the condition can be discharged.

9 References

1 BS 8233: 2014, Guidance on sound insulation and noise reduction for buildings.

2 Sandy Brown report 16354-R01-A, The Comet, Hatfield - Residential planning noise report, August 2016.

3 Cadna/A environmental noise modelling software, version 4.6, Datakustik GmbH.

4 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors

5 BS EN 12354-3:2000, Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound.

6 Practical Acoustic Design – the Apex Method, Proceedings of the Institute of Acoustics Vol 36 Pt 3 2014. Full paper and Poster presentation at Institute of Acoustics Conference 2014, available to download from www.apexacoustics.co.uk

7 Approved Document F 2010 Edition, The Building Regulations 2000.

8 BS EN ISO 16283-1:2014 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation.

9 Greenwood technical data sheet, October 2001

10 Titon technical data sheet, April 2015 for TITON SF X V75 + C50

11 Titon technical data sheet, April 2015 for TITON SF X V75 + C75

12 Stride Treglown drawings dated March 2017 for COMET project with classification references 01030, 01010, 01021, 02020, 02031 and 02033.

13 Pilkington Optiphon™ Laminated Glass for noise control, Pilkington, 8222 – June 2014

14 Pilkington Insulight™ Laminated Glass for noise control, Manufacturer datasheet, January 2001.

10 Appendix 1: Calculation of façade noise ingress

10.1 The noise level in a room due to sound penetrating a façade element may be calculated according to BS EN 12354-3 and BS 8233 from:

$$L_2 = L_{1,in} - R + 10 \times Log\left(\frac{S}{V}\right) + 10 \times Log(T) + 11$$ Equation 1.

Where:

- L_2 = noise level in room due to sound through façade portion of area S and mean sound reduction index R, dB
- L_1, in = external free-field noise level at the position of the façade, dB.
- R = sound reduction index of portion, dB
- S = area of façade portion, m^2.
- V = room volume, m^3
- T = reverberation time, s.

10.2 For small façade components, such as ventilators, the noise level in a room may be calculated according to the same standards as above from:

$$L_2 = L_{1,in} - D_{n,e} - 10 \times Log(V) + 10 \times Log(T) + 21$$ Equation 2.

Where:

- $D_{n,e}$ = element-normalised sound level difference of the ventilator.

Other components have the same meaning as above.

10.3 The sound reduction of the masonry portion of the facade is much higher than that of the glazing and ventilation provision. Therefore noise penetration through the masonry is disregarded as insignificant compared to noise penetration through the glazing and ventilation provision.

10.4 The noise penetration through the vents and the glazing is calculated as above and then combined in each frequency band to give an overall internal level from the external sources by these routes. Calculations are carried out in octave bands as indicated in BS 8233.

Studio -Specification A	
Volume, V / m^3	43
Window area, S / m^2	5
Reverberation Time, T / s	0.5
Number of vents required	1

Octave centre frequency	**dB(A)**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**
Daytime free-field noise, L_{1in} / dB(A) L_{eq}	**59**	**39**	**45**	**51**	**57**	**53**	**41**
4/12/4 double glazing, R / dB		24	20	25	35	38	35
Equation 1, L_2 / dB(A) L_{eq}	**28**	14	24	25	20	14	5
Greenwoods 4000 L trickle vent, Dn,e / dB		39	36	34	31	34	38
Equation 2, L_2 / dB(A) L_{eq}	**28**	3	11	18	27	20	5
Combined noise through all building elements / dB(A) L_{eq}	**31**						

Octave centre frequency	**dB(A)**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**
Night time free-field noise, L_{1in} / dB(A) L_{eq}	**56**	**36**	**41**	**47**	**54**	**49**	**38**
4/12/4 double glazing, R / dB		24	20	25	35	38	35
Equation 1, L_2 / dB(A) L_{eq}	**25**	11	20	21	17	10	2
Greenwoods 4000 L trickle vent, Dn,e / dB		39	36	34	31	34	38
Equation 2, L_2 / dB(A) L_{eq}	**25**	0	7	15	24	16	2
Combined noise through all building elements / dB(A) L_{eq}	**28**						

Table 10: Calculations for rooms with Specification A

Studio - Specification B	
Volume, V / m^3	43
Window area, S / m^2	5
Reverberation Time, T / s	0.5
Number of vents required	1

Octave centre frequency	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Daytime free-field noise, L_{1in} / dB(A) L_{eq}	**64**	**44**	**50**	**56**	**62**	**58**	**48**
6/12/6.4 PVB double glazing, R / dB		20	19	29	38	36	45
Equation 1, L_2 / dB(A) L_{eq}	**33**	23	30	26	23	21	1
TITON SF X V75 + C50 vent, Dn,e / dB		40	37	34	43	50	53
Equation 2, L_2 / dB(A) L_{eq}	**26**	6	15	23	21	10	-3
Combined noise through all building elements / dB(A) L_{eq}	**33**						

Octave centre frequency	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Night time free-field noise, L_{1in} / dB(A) L_{eq}	**61**	**41**	**46**	**52**	**59**	**54**	**45**
6/12/6.4 PVB double glazing, R / dB		20	19	29	38	36	45
Equation 1, L_2 / dB(A) L_{eq}	**29**	20	26	22	20	17	-2
TITON SF X V75 + C50 vent, Dn,e / dB		40	37	34	43	50	53
Equation 2, L_2 / dB(A) L_{eq}	**22**	3	11	19	18	6	-6
Combined noise through all building elements / dB(A) L_{eq}	**30**						

Table 11: Calculations for rooms with Specification B

Studio - Specification C	
Volume, V / m^3	43
Window area, S / m^2	5
Reverberation Time, T / s	0.5
Number of vents required	1

Octave centre frequency	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Daytime free-field noise, L_{1in} / dB(A) L_{eq}	**69**	**48**	**54**	**60**	**66**	**63**	**53**
6 mm / 16 mm argon / 6.8 mm, R / dB		22	27	35	42	41	48
Equation 1, L_2 / dB(A) L_{eq}	**31**	25	26	24	23	21	4
TITON SF X V75 + C75 vent, Dn,e / dB		37	37	36	47	49	55
Equation 2, L_2 / dB(A) L_{eq}	**28**	13	19	26	21	15	-1
Combined noise through all building elements / dB(A) L_{eq}	**33**						

Octave centre frequency	dB(A)	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Night time free-field noise, L_{1in} / dB(A) L_{eq}	**66**	**45**	**50**	**56**	**63**	**59**	**50**
6 mm / 16 mm argon / 6.8 mm, R / dB		22	27	35	42	41	48
Equation 1, L_2 / dB(A) L_{eq}	**28**	22	22	20	20	17	1
TITON SF X V75 + C75 vent, Dn,e / dB		37	37	36	47	49	55
Equation 2, L_2 / dB(A) L_{eq}	**24**	10	15	22	18	12	-4
Combined noise through all building elements / dB(A) L_{eq}	**29**						

Table 12: Calculations for rooms with Specification C