SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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Gardens Hotel extension

Acoustic planning report

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Version	Date	Comments	Author	Reviewer
A	8 Aug 16		Matthew Robinson	Helen Sheldon

Summary

Sandy Brown Associates LLP (Sandy Brown) has been commissioned by The Cairn Group to provide acoustic advice in relation to the proposed extension of the existing Gardens Hotel, which is located to the north of the existing Gardens Hotel at 55 Piccadilly.

An environmental noise survey was performed between 13 May 2016 and 20 May 2016. The representative t background sound levels measured during the survey were $L_{A90,15min}$ 56 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

Based on the requirements of the Manchester City 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} 51 dB during the daytime and L_{Aeq} 39 dB during the night.

To the south of the site, the average ambient noise levels measured during the survey were $L_{Aeq,16h}$ 67 dB during the daytime and $L_{Aeq,8h}$ 65 dB at night. To the north of the site, the average ambient noise levels measured during the survey were $L_{Aeq,16h}$ 60 dB during the daytime and $L_{Aeq,8h}$ 58 dB at night.

An initial facade sound insulation assessment has been carried out to determine the required acoustic performance of the facade, and provide guidance on the ventilation strategy. Based on the predicted external noise levels and the required indoor ambient noise level in hotel guestrooms, guidance on example glazing configurations and ventilation strategies capable of meeting the facade sound insulation requirements are provided.

A maximum noise level of L_{AFmax} 90 dB was measured on Little Lever Street which was due to glass bottles being emptied into a bin by staff from Twenty Twenty-Two. Although this could potentially be a regular event, this is an activity that would normally be managed to make sure it occurred outside of night time hours to minimise the risk of disturbance. Therefore, it is not proposed to design the facade to control noise from this activity, and it is recommended that this is brought to the attention of MCC, with a view to placing controls on Twenty Twenty-Two so that it does not occur during the night-time (23:00 – 07:00).

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1 Introduction

Sandy Brown Associates LLP (Sandy Brown) has been commissioned by The Cairn Group to provide acoustic advice in relation to the proposed extension of the existing Gardens Hotel, which is located to the north of the existing Gardens Hotel at 55 Piccadilly, Manchester, M1 2AP.

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 Manchester City Council.The facade sound insulation will be assessed in order to determine the necessary performance required to achieve appropriate internal noise levels for residences set in accordance with the proposed hotel operator criteria.

This report presents the noise survey methods, the results of the survey, a discussion of acceptable limits for noise emission from building services plant, a discussion of amplified music noise egress and minimum sound insulation requirements for the building envelope.

2 Site description

2.1 The site and its surrounding

The site location in relation to its surroundings is outlined in yellow in Figure 1 and is located in Manchester city centre, and currently is empty site.

The site in bounded by Back Piccadilly to the south, Kingsley House to the east, Cavell Street to the north and Little Lever Street to the west.

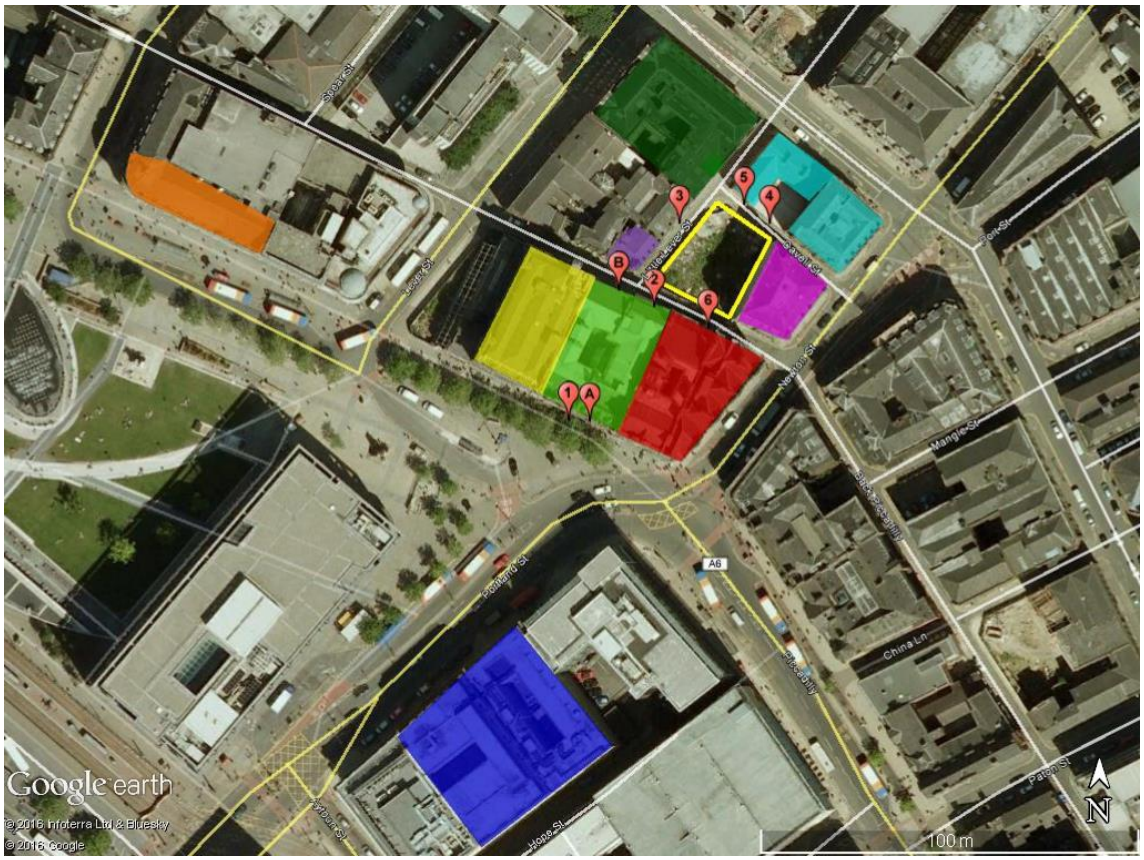


Figure 1 Site map (courtesy of Google Earth Pro)

2.2 Adjacent premises

The site is located in a mixed use area with residential accommodation, retail units, office and hotel accommodation close by.

The nearest residential dwellings are the apartments at the Kingsley House adjacent to the east of the site, these are highlighted in pink in Figure 1. Other noise sensitive premises are the existing Gardens Hotel at 55 Piccadilly approximately 5 m to the south, Portland Hotel at 3-5 Portland Street approximately 95 m to the south and Travelodge at 31 Piccadilly approximately 100 m to the south west. These are highlighted in light green, blue and orange respectively in Figure 1. The Portland Hotel and Travelodge are screened from the proposed development.

In addition, there are offices close to the site, Clayton House on 59-61 Piccadilly and St Margaret Chambers on 5 Newton Street approximately 5 m to the south and Piccadilly House on 49 Piccadilly approximately 15 m to the south west. These are highlighted in red and yellow respectively in Figure 1.

Other office accommodation in the area includes 14 Little lever Street approximately 4 m to the west, 20 Dale Street approximately 10 m to the north west, 22 Dale Street and 21 Newton Street approximately 5 m to the north. These are highlighted brown and light blue respectively. The Mother MAC's pub and the Twenty Twenty-Two bar are highlighted in purple and dark green respectively in Figure 1.

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

Unattended noise monitoring was undertaken at the site over 4 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 11:25 on 29 July 2016 and 11:55 on 2 August 2016. The equipment was installed by Matthew Robinson and Jose M. Gonzalez and collected by Luis Ruivo and Jose M. Gonzalez.

The measurement positions used during the survey are indicated in Figure 1 denoted by A and B.

At position A the microphone was positioned out a fourth floor window of the Garden Hotel building and approximately 17 m above the ground level. The microphone was extended approximately 1 m out of the window and had an unobstructed view of Piccadilly.

At position B the microphone was positioned out of a fifth window of the Garden Hotel building and approximately 20 m above the ground level. The microphone was extended approximately 0.5 m out of the window and had an unobstructed view of Back Piccadilly.

Photographs showing the unattended measurement locations are provided Figure 2.

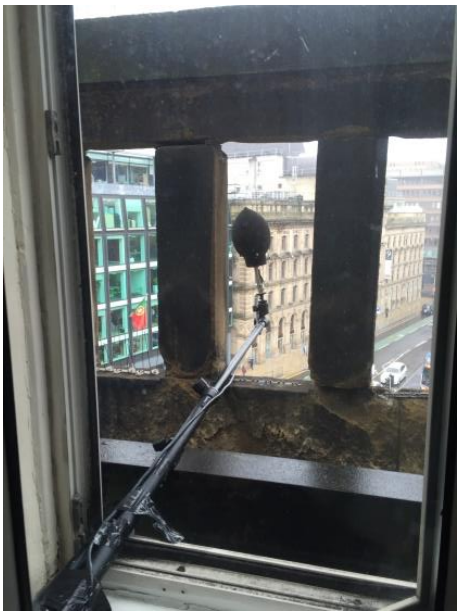



Figure 2 Measurements location of the unattended measurements, Location A (left), Location B (right)

These locations were chosen to be reasonably representative of the noise levels experienced by the nearest noise sensitive premises.

3.2 Attended measurements

3.2.1 Daytime attended measurements

Attended sample measurements were performed by Jose M. Gonzalez at 4 locations around the proposed development. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out between 19:25 and 20:41 on 29 July 2016, 12:10 and 16:00 on 1 August 2016 and between, 11:41 and 12:00 on 2 August 2016 over 15 minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

Measurements of the kitchen extracts were also performed at 2 locations around the proposed development. These are indicated in Figure 1 as positions 5 and 6. Measurements at position 5 were carried out on 1 August 2016 and measurements at position 6 were carried out on 2 August 2016 over 1 min period.

The locations of the measurements are indicated in Figure 1. For locations 1 to 4, in each case the microphone was mounted on a tripod approximately 1.5 m above the local ground level.

For positions 5 and 6 the microphone was mounted on a tripod and held approximately 1 m from the noise source and approximately 1.5 m above the local ground level.

3.2.2 Night time attended measurements

Attended sample measurements were performed by Jose M. Gonzalez at 4 locations around the proposed development. These are indicated in Figure 1 as positions 1 to 4. The attended measurements were carried out between 23:25 and 00:40 on 29 July 2016, over 15 minute periods, with the purpose of determining the existing noise levels from road traffic, pedestrians and other significant noise sources in the area.

The locations of the measurements are indicated in Figure 1. For locations 1 to 4, in each case the microphone was mounted on a tripod approximately 1.5 m above the local ground level.

4 Measurement results

4.1 Observations

During the daytime, the dominant noise sources observed at the site during the survey consisted of road traffic noise on Portland Street, Newton Street, pedestrians passing by and the kitchen extracts.

During the daytime, the dominant noise sources observed at the site during the survey consisted of road traffic noise on Portland Street, Newton Street, pedestrian passing by and noise from existing Twenty Twenty-two club on Little Lever Street.

Less significant noise sources included aircraft and helicopter overhead.

4.2 Unattended measurement results

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.

4.2.1 Piccadilly (Location A)

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

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

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 29 July 2016	69*	68
Saturday 30 July 2016	69	67
Sunday 31 July 2016	66	62
Monday 1 August 2016	67	63
Tuesday 2 August 2016	66*	
Average	67	65

* Measurement not made over full period due to monitoring start and end time, the measurement on 29 July 16 was over 11.3 hours, and on 2 August 16 over 3.6 hours); not included in the average

A summary of the maximum noise data measured during the night-time survey at location A is presented in Table 2.

Table 2 Maximum noise levels measured during the survey at location A

Date	Maximum noise level exceeded 15 times during the night-time period (23:00 – 07:00), $L_{AFmax,15min}$ (dB)
Friday 29 July 2016	80
Saturday 30 July 2016	81
Sunday 31 July 2016	75
Monday 1 August 2016	77

The maximum noise level not normally exceeded more than 15 times during the night at location A is considered to be L_{AFmax} 81 dB.

The minimum background sound levels measured during the unattended survey are given in Table 3.

Table 3 Minimum background sound levels measured during the survey at location A

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Friday 29 July 2016	62*	54
Saturday 30 July 2016	57	54
Sunday 31 July 2016	54	51
Monday 1 August 2016	57	51
Tuesday 2 August 2016	59*	-

* Measurement not made over full period due to monitoring start and end time, the measurement on 29 July 16 was over 11.3 hours, and on 2 August 16 over 3.6 hours.

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

Daytime and night-time statistical analyses of representative values for the site are given in Figure 3 and Figure 4.

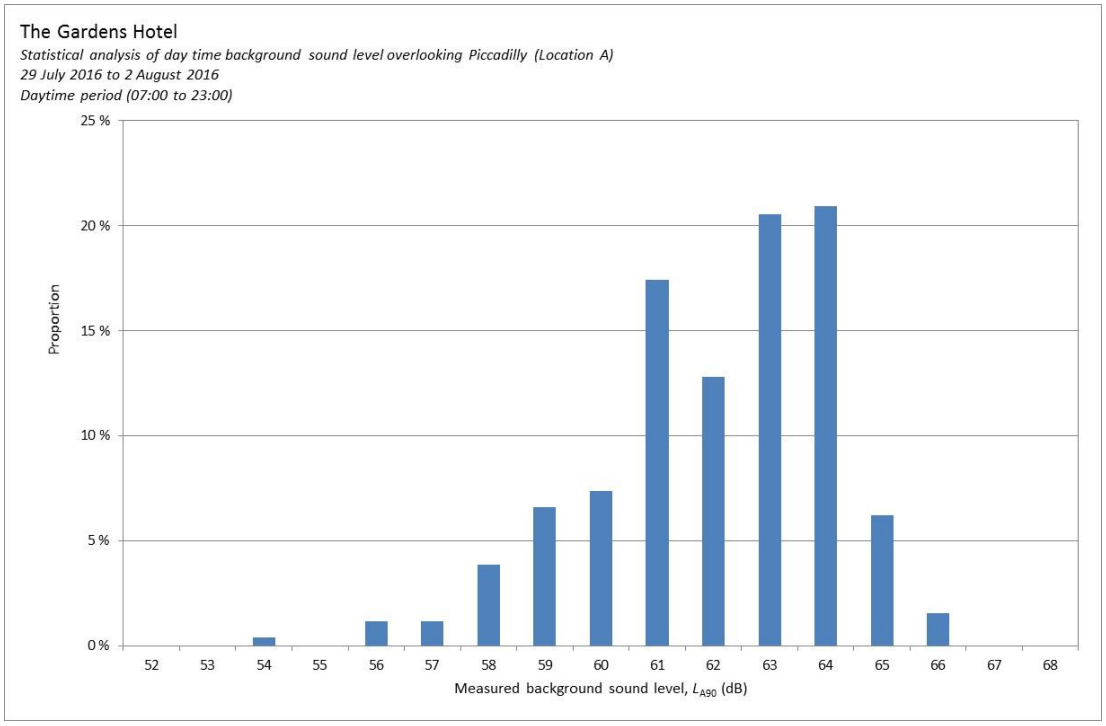


Figure 3 Daytime statistical analysis of background sound levels at location A

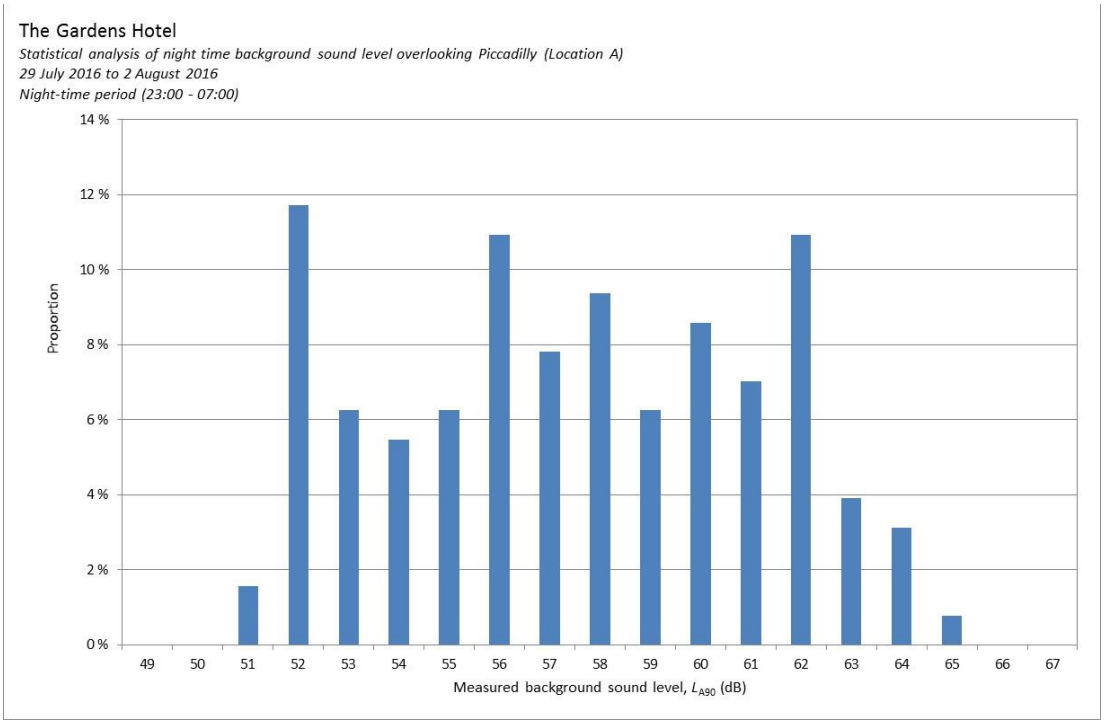


Figure 4 Night-time statistical analysis of background sound levels at location A

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 61 dB during the daytime and $L_{A90,15min}$ 52 dB at night.

The corresponding octave band levels are provided in Table 4.

Table 4 Representative measured background sound levels in octave bands at location A

	Representative background sound levels (dB) Octave band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	63	62	58	57	55	54	48
Night time(23:00 – 07:00)	53	54	50	49	48	47	40

4.2.2 Back Piccadilly (location B)

The daytime and night-time ambient noise levels measured during the unattended survey at position B are presented in Table 5

Table 5 Ambient noise levels measured during the survey at location B

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Friday 29 July 2016	60*	62
Saturday 30 July 2016	61	60
Sunday 31 July 2016	59	53
Monday 1 August 2016	61	55
Tuesday 2 August 2016	60*	-
Average	60	58

* Measurement not made over full period due to monitoring start and end time, the measurement on 29 July 16 was over 11.5 hours, and on 2 August 16 over 3.6 hours); not included in the average

A summary of the maximum noise data measured during the night time survey at location B are presented in Table 6.

Table 6 Maximum noise measured during the survey at location B

Date	Maximum noise level exceeded 15 times during the night-time period (23:00 – 07:00), $L_{AFmax,15min}$ (dB)
Friday 29 July 2016	80
Saturday 30 July 2016	78
Sunday 31 July 2016	72
Monday 1 August 2016	72

The maximum noise level not normally exceeded more than 15 times during the night at location B is considered to be L_{AFmax} 80 dB.

The minimum background sound levels measured during the unattended survey are given in Table 7.

Table 7 Minimum background sound levels measured during the survey at location B

Date	Daytime (07:00 – 23:00) $L_{A90,15min}$ (dB)	Night (23:00 – 07:00) $L_{A90,15min}$ (dB)
Friday 29 July 2016	62*	54
Saturday 30 July 2016	57	54
Sunday 31 July 2016	54	51
Monday 1 August 2016	57	51
Tuesday 2 August 2016	59*	-

* Measurement not made over full period due to monitoring start and end time, the measurement on 29 July 16 was over 11.5 hours, and on 2 August 16 over 3.6 hours.

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

Daytime and night-time statistical analyses of representative values for the site are given in Figure 5 and Figure 6.

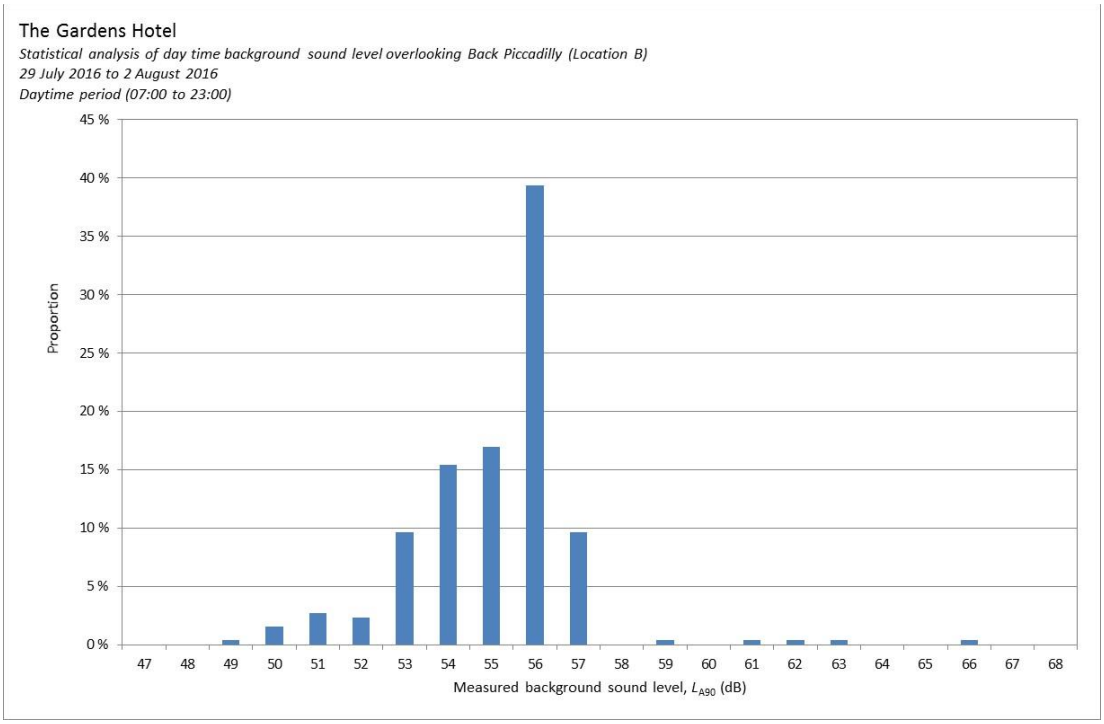


Figure 5 Daytime statistical analysis of background sound levels at location B

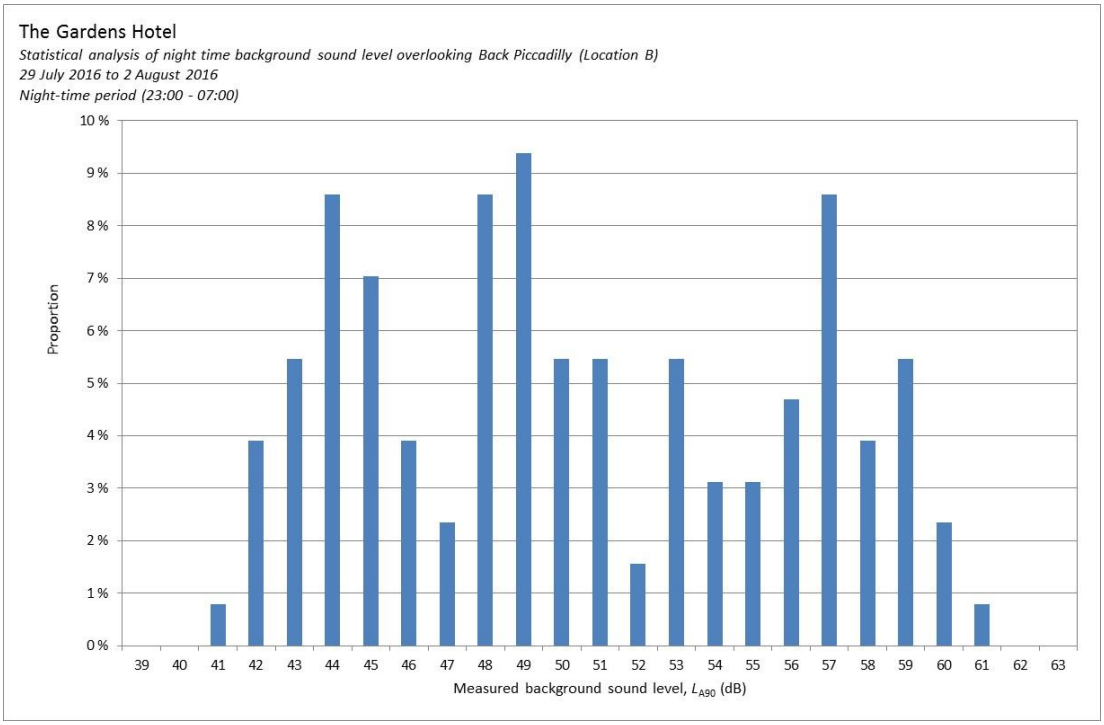


Figure 6 Night-time statistical analysis of background sound levels at location B

From this analysis, the representative background sound levels measured during the survey were $L_{A90,15min}$ 56 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

The corresponding octave band levels are provided in Table 4.

Table 8 Representative measured background sound levels in octave bands at location B

	Representative background sound levels (dB) Octave band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	61	60	56	51	51	48	42
Night time (23:00 – 07:00)	50	49	45	40	38	35	27

4.3 Attended measurement results

The sound pressure levels recorded during the attended measurements are summarised in Table 9 and Table 10. The dominant noise sources noted during the measurements are also described in and Table 9 and Table 10. The attended measurements at position 1 to 4 were performed over 15 minute periods, and the attended measurement at position 5 and 6 were performed over 1 minute periods.

Table 9 Sound pressure levels from attended measurements daytime

Position	Date	Start time	Sound pressure levels (dB)			Noise sources
			$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
1	29/07/16	19:25	69	90	63	Road traffic on Portland Street (including buses), road traffic on Piccadilly taxi rank, distant drums, pedestrians passing by, distant car horn
	1/08/16	12:10	68	85	63	Road traffic on Portland Street (including buses), road traffic on Piccadilly taxi rank, pedestrians passing by with luggage trolleys, distant siren on Portland Street, distant slamming door at taxi rank
	1/08/16	15:45	66	81	62	

Position	Date	Start time	Sound pressure levels (dB)			Noise sources
			$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
2	29/07/16	19:55	60	80	57	Distant road traffic on Newton Street, pedestrians passing by, distant car horn, car passing by, distant glass bottles drop in rubbish bin, distant constant kitchen extract
	1/08/16	13:31	60	84	56	Distant road traffic on Newton Street, distant car slamming door, car passing by, pedestrians passing by, distant building work (painting, circular saw cutting, plastering), distant drops in rubbish bin
	1/08/16	14:31	59	72	56	Distant road traffic on Newton Street, pedestrians passing by, distant rubbish truck, distant building work (painting, circular saw cutting, plastering) distant constant kitchen extract
3	29/07/16	20:10	67	92	57	Distant road traffic from Dale Street, distant constant kitchen extract on Cavell Street, distant siren, cars passing by, distant glass bottles drop in rubbish bin, distant metal door closing

Position	Date	Start time	Sound pressure levels (dB)			Noise sources
			$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
3	1/08/16	13:13	58	71	57	Distant road traffic on Dale Street, distant constant kitchen extract on Cavell Street, pedestrians passing by, distant slamming door
	2/08/16	11:41	62	86	58	Distant road traffic on Dale Street, distant constant kitchen extract on Cavell Street, distant truck reverse beeping, helicopter overhead, distant dropping on truck metal tail lift
4	29/07/16	20:26	65	92	61	Distant road traffic on Newton Street, distant constant kitchen extract on Cavell Street, distant siren
	1/08/16	12:40	63	75	61	Distant road traffic on Newton Street, distant constant kitchen extract on Cavell Street, helicopter overhead, distant car slamming door
	1/08/16	14:58	63	80	61	
5	1/08/16	13:02	76	77	75	Kitchen extract on Cavell Street at 1 m from atmospheric side connection.
	1/08/16	13:03	76	78	75	
6	2/08/16	11:58	66	70	65	Kitchen extract on Back Piccadilly at 1 m from atmospheric side connection, *L_{Amax} from distant siren on Newton Street
	2/08/16	11:59	67	76*	65	

Table 10 Sound pressure levels from attended measurements night-time

Position	Date	Start time	Sound pressure levels (dB)			Noise sources
			$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$	
1	29/07/16	23:25	69	63	62	Road traffic on Portland Street (including buses), road traffic on Piccadilly taxi rank, pedestrians passing by, siren on Portland Street, distant bin changing
2	29/07/16	23:41	61	93	62	Distant road traffic on Newton Street, distant constant kitchen extract, pedestrians passing by, distant glass bottles drop in rubbish bin, distant people queuing outside Twenty Twenty-Two, distant car slamming door
3	30/07/16	00:10	64	90	58	Distant road traffic on Dale Street, people outside and in smoking area at Twenty Twenty-Two, distant amplified music from Twenty Twenty-Two, distant car slamming door, glass bottles drop in rubbish bin (causing maximum noise level)
4	30/07/16	00:25	69	82	66	Noise from smoking area at Twenty Twenty-Two, distant amplified music from at Twenty Twenty-Two, distant car horn on Newton Street, pedestrians passing by

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 Local Authority criteria

5.2.1 External noise criteria (plant noise)

Manchester City Council (MCC) provides guidance in relation to plant noise emissions in their *Planning and Noise Technical Guidance* document dated December 2015. The following criteria are stipulated:

a) *'achieve a noise level (L_{Aeq}) of at least 5 dB below the typical background noise levels (L_{A90}) at the nearest noise sensitive location at the quietest time the equipment will be in operation; and*

b) *not contain any discernible tonal characteristics at the nearest noise sensitive location at the quietest time the equipment will be in operation.*

Where the product data suggests there may be a tonal element to the noise (i.e. the octave band noise data shows a peak at a particular frequency) it will be required to demonstrate that noise from the equipment will be at least 5 dB below the typical background noise level (L_{90}) in each octave band at the nearest noise sensitive location at the time the equipment will be in operation, the assessment will be carried out in line with BS4142:2014.'

5.2.2 Internal noise criteria

Based on the latest MCC Planning & Noise Technical Guidance (December 2015) and further to discussion with Richard Knightley (EHO for MCC), it is understood that there is no specific internal noise criteria for hotel accommodation and that MCC indoor ambient noise levels criteria in Planning & Noise Technical Guidance only applies for residential accommodation. For hotel developments, controlling noise ingress on the basis for any operator requirements is acceptable.

5.3 IHG Intercontinental Hotel Group

5.3.1 Internal ambient noise criteria

IHG Design & Engineering Department - Technical Handbook (July 2015 v2.0), specifies the following in indoor ambient noise level criteria due to external noise ingress. Noise from internal building services is assessed separately.

Table 11 IHG Intercontinental Hotel Group ambient noise level criteria

Room	External intrusion noise levels to be achieved	Comments/ notes
Reception/Lobby	L_{Aeq} 50 dB	
Atrium	L_{Aeq} 50 dB	
Lobby bar	L_{Aeq} 45 dB	
All day dinning	L_{Aeq} 45 dB	
Fine dinning	L_{Aeq} 40 dB	
Meeting rooms	L_{Aeq} 35 dB L_{Aeq} 40 dB	20-100 person meeting room 100 + meeting room
Guestroom	$L_{Aeq,1h}$ 30 dB $L_{Aeq,1h}$ 30 dB L_{AFmax} 45 dB	Day time (07:00 – 23:00) Night time (23:00 – 07:00)
Retail space	L_{Aeq} 50 dB L_{Aeq}	
Gym/fitness	L_{Aeq} 45 dB L_{Aeq}	
Spa/relaxation	L_{Aeq} 35 dB L_{Aeq}	
Heart of House	L_{Aeq} 45 dB L_{Aeq}	Includes offices

6 Plant noise – noise egress

6.1 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 5 dB below the typical broadband (L_{A90}) external noise level. The limits for the nearest noise sensitive premises to the south of the site are set out in table set out in Table 12.

Table 12 Plant noise limits at 1 m from the nearest noise sensitive premises

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

Where an item of plant contains tonal characteristic, the limits should not exceed 5 dB below the typical external background sound level in octave bands. These limits set out in Table 13.

Table 13 Octave band plant noise limits at 1 m from the nearest noise sensitive premises

Location/Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, L_{eq} (dB) Octave band centre frequency (Hz)						
	63	125	250	500	1k	2k	4k
Daytime (07:00 – 23:00)	56	55	51	46	46	43	37
Night time (23:00 – 07:00)	45	45	39	35	33	30	22

6.2 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.

7 Facade sound insulation – noise ingress

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.

7.1 3D noise modelling

A 3D computer model of the site and its surroundings has been generated using CadnaA (version 4.2) software by Datakustik. This allows for an assessment of noise ingress by incorporating the screening that proposed buildings will provide when completed.

The software carries out calculations using a ray tracing technique. This takes account of the effects of topography, reflections, screening and distance attenuation for noise sources to predict noise levels in three dimensions. Calculations are carried out in accordance with ISO 9613 *Attenuation of sound during propagation outdoors.*

The 3D noise model has been based on the results of the noise survey that has been carried out around the site and the proposed hotel layouts.

Figure 7 and Figure 8 show a plan view of the daytime and night-time noise model of the Gardens Hotel.

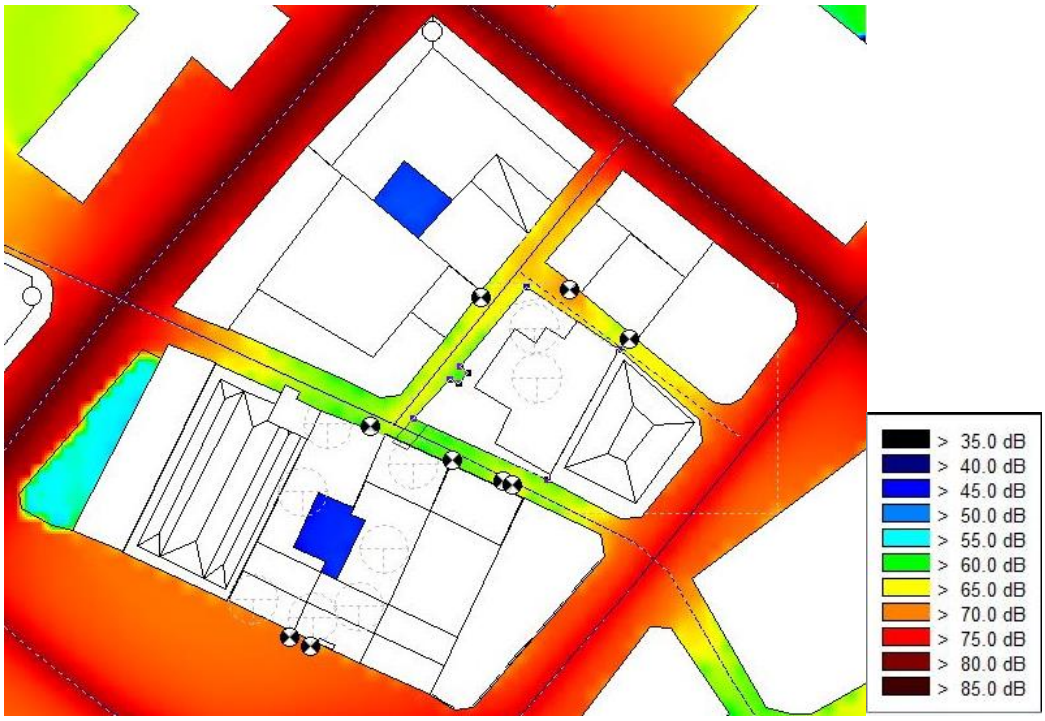


Figure 7 3D noise model showing predicted daytime noise levels (grid at 1.5m above ground level)

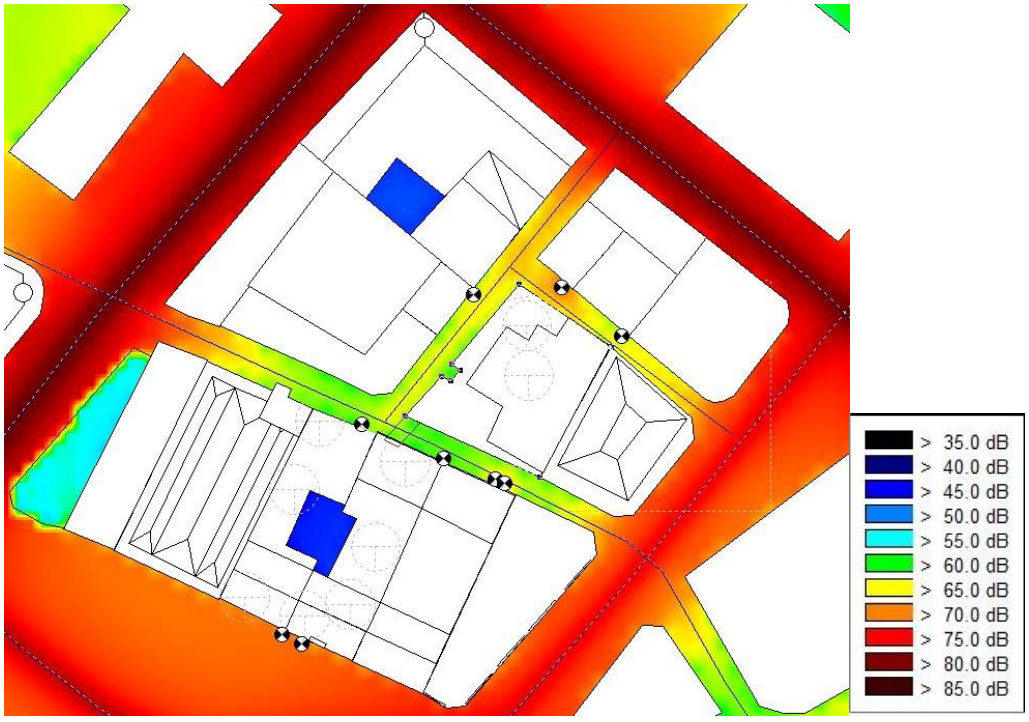


Figure 8 3D noise model showing predicted night-time noise levels (grid at 1.5m above ground level)

7.2 External noise levels at the facade

Based on the results of the environmental noise survey and the 3D model, and in order to allow an assessment of the worst case scenario, the highest external noise levels predicted at each of the proposed facades in the 3D model have been used to assess noise ingress.

The predicted external noise levels at each of the proposed facade zones are set out in the facade zone key in Table 14.

Based on the results of the environmental noise survey, maximum noise level level not normally exceeded is considered to be L_{AFmax} 82 dB for hotel guestrooms facing Little Lever Street and Cavell Street, and L_{AFmax} 80 dB for hotel guestrooms facing Back Piccadilly.

A maximum noise level of L_{AFmax} 90 dB was measured on location 3 (Little Lever Street) which was due to glass bottles being emptied into a bin by staff from Twenty Twenty-Two. Although this could potentially be a regular event, this is an activity that would normally be managed to make sure it occurred outside of night time hours to minimise the risk of disturbance. Therefore, it is not proposed to design the facade to control noise from this activity, and it is recommended that this is brought to the attention of MCC, with a view to placing controls on Twenty Twenty-Two so that it does not occur during the night-time (23:00 – 07:00).

Table 14 External noise levels at proposed faced zones

Facade zone (refer to Figures 9 to 11)	External noise level, L_{Aeq} (dB)
A	69-71
B	66-68
C	63-65
D	59-62
E	56-58
F	53-55

On this basis, the predicted external noise levels at the facades of the proposed development are set out in shown in Figure 9 and Figure 11 for the day-time.



Figure 9 Predicted facade noise levels for ground floor, first floor and second floor (daytime)



Figure 10 Predicted facade noise levels for third floor, fourth floor and fifth floor (daytime)

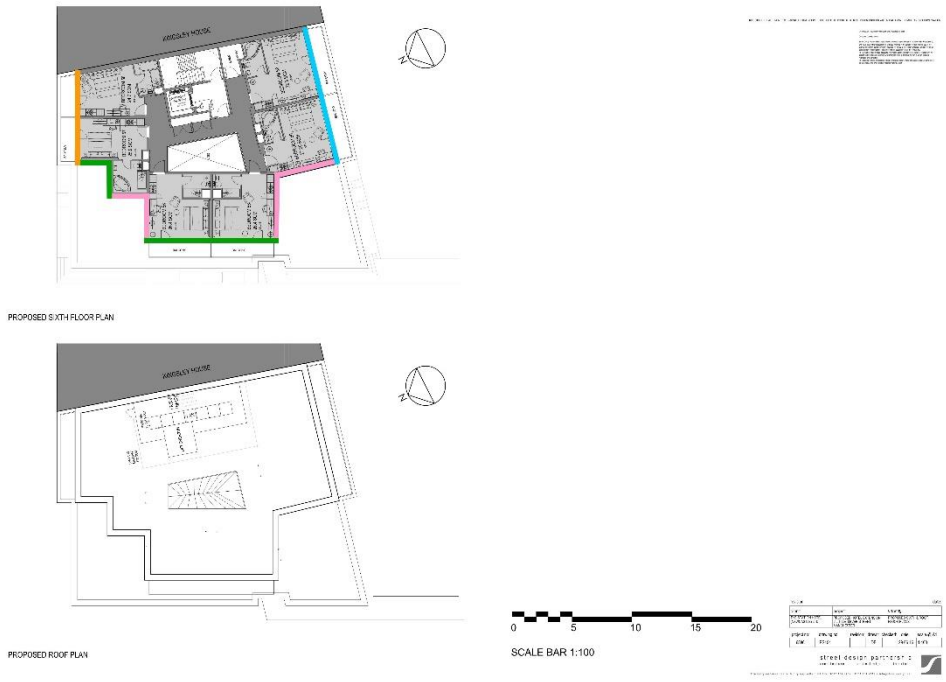


Figure 11 Predicted facade noise levels for sixth floor (daytime)

Figure 12 and Figure 14 show the predicted external noise levels at the facades of the proposed development during the night time.



Figure 12 Predicted facade noise levels for ground floor, first floor and second floor (night time)



Figure 13 Predicted facade noise levels for third floor, fourth floor and fifth floor (night time)

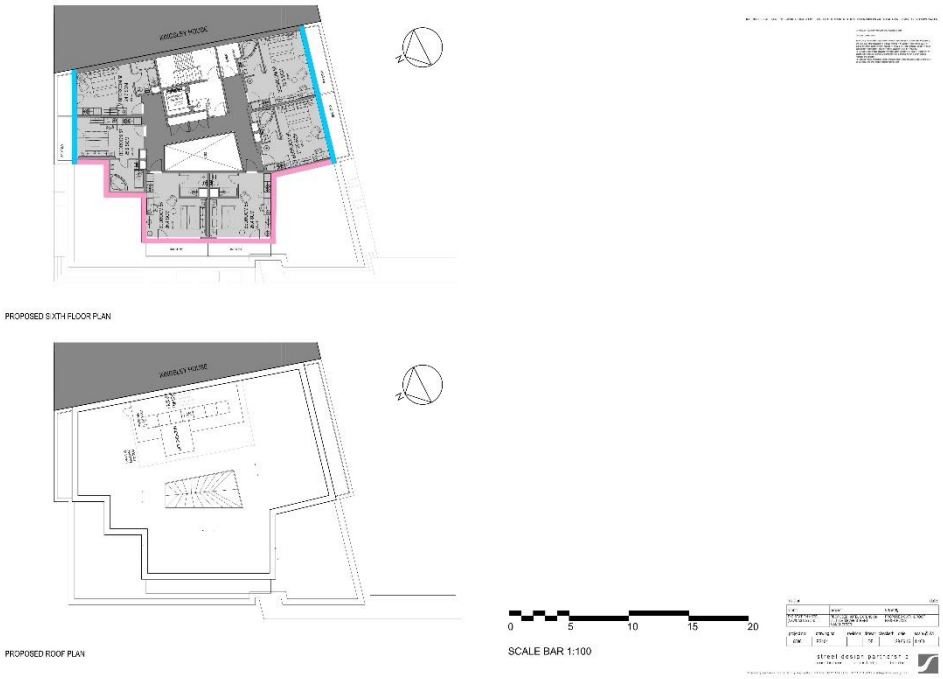


Figure 14 Predicted facade noise levels for sixth floor (night time)

7.3 Facade sound insulation performance

The required facade specification depends on the following two factors.

- The external noise level at the site
- The internal noise criteria

The following assessment is based on achieving the internal noise levels for hotel guest rooms recommended in Section 5.3. The guidance set out in the following sections is based on the current layouts, should these change the requirements may need to be revised.

7.3.1 Guestroom overall minimum faced sound insulation performance

The minimum overall sound insulation requirements for the different facade zones are provided in Table 15. The sound insulation requirements are generally determined by the predicted night-time maximum facade noise levels.

Table 15 Facade sound insulation performance requirements

Facade	Overall sound insulation performance R'_w+C_{tr} (dB)	
	Hotel guestrooms facing Little Level Street and Cavell Street	Hotel guestrooms facing Back Piccadilly
A	41	41
B	38	38
C	37*	35*
D	37*	35*
E	37*	35*
F	37*	35*

* Minimum overall sound insulation performance based on controlling external noise ingress to meet the internal night-time maximum noise level criterion.

7.4 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 16 Example glazing configurations and ventilation strategies

Sound insulation R'_w+C_{tr} (dB)	Example glazing configuration	Ventilation Strategy
33-35	6.4 mm laminate glazing/12 mm air-space/10 mm glazing	High performance acoustically attenuated passive ventilation
36-38	12.8 mm laminate glazing/12 mm air-space/10 mm glazing	Mechanical ventilation (eg, whole house ventilation)
39-40	12.8 mm laminate glazing/20 mm air-space/10 mm glazing	Mechanical ventilation (eg, whole house ventilation)
41-42	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 glazing/20 mm air-space/16.8 mm glazing. For higher performances, a substantial facade construction, limited glazing area, and mechanical ventilation is likely to 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).

For any rooms with dual aspect (ie, corner rooms), the minimum sound insulation performances would be increased by 3 dB, which would result in very high sound insulation performances being required. Typically the glazing sound insulation performance could be reduced by reducing the area of glazing and providing a non-glazed element with a sound insulation performance 10 dB greater than the overall minimum performance required.

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.

8 Conclusion

A noise survey has been carried out to determine the existing background sound levels in the vicinity of the site and surrounding noise sensitive premises.

The representative background sound levels measured during the survey were $L_{A90,15min}$ 56 dB during the daytime and $L_{A90,15min}$ 44 dB at night.

Based on the requirements of Manchester City Council and on the results of the noise survey, the cumulative noise level from plant at 1 m from the worst affected window of the nearby noise sensitive premises is to be at least 5 dB below the typical background noise level measured.

These limits are cumulative, and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features the limits should not exceed 5 dB below the typical external noise level in octave bands. These limits are set out in Table 13. At this stage, no detailed information is available in relation to the proposed installation of building services plant, and this will need to be assessed in details as the design progresses.

A 3D environmental noise model has been developed, using survey data, and has been used to assess the facade sound insulation performance requirements for the development. Based on the predicted external noise levels and the required indoor ambient noise level in hotel guestrooms, guidance on example glazing configurations and ventilation strategies capable of meeting the facade sound insulation requirements are provided. For the majority of hotel guestrooms high performance double glazing and mechanical ventilation would be required.

A maximum noise level of L_{AFmax} 90 dB was measured on location 3 (Little Lever Street) which was due to glass bottles being emptied into a bin by staff from Twenty Twenty-Two. Although this could potentially be a regular event, this is an activity that would normally be managed to make sure it occurred outside of night time hours to minimise the risk of disturbance. Therefore, it is not proposed to design the facade to control noise from this activity, and it is recommended that this is brought to the attention of MCC, with a view to placing controls on Twenty Twenty-Two so that it does not occur during the night-time (23:00 – 07:00).

Appendix A

Survey details

Equipment

A Rion NL-52 sound level meter was used to undertake the unattended measurements. The attended measurements were carried out using a Norsonic 118 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	Nor118/31754	Norsonic	2 Mar 17	08241
Microphone	40AF/62396	Gras	2 Mar 17	08241
Pre-amp	1206/30873	Norsonic	2 Mar 17	08241
Calibrator	1251/31322	Norsonic	20 Feb 17	08208
Sound level meter	NL-52/00932326	Rion	24 Feb 17	1502114
Microphone	UC-59/035549	Rion	24 Feb 17	1502114
Pre-amp	NH-25/32354	Rion	24 Feb 17	1502114
Calibrator	NC-74/34125432	Rion	24 Feb 17	1502110
Sound level meter	NL-52/00242704	Rion	7 Jun 18	1606292
Microphone	UC-59/06187	Rion	7 Jun 18	1606292
Pre-amp	NH-25/32732	Rion	7 Jun 18	1606292
Calibrator	CAL200/4501	Larson Davis	23 May 18	1605268

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. No significant deviation in calibration occurred.

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 29 July 2016, the weather was generally clear and dry, but occasional rain occurred during the evening. Wind speeds varied between approximately 0 m/s and 2 m/s.

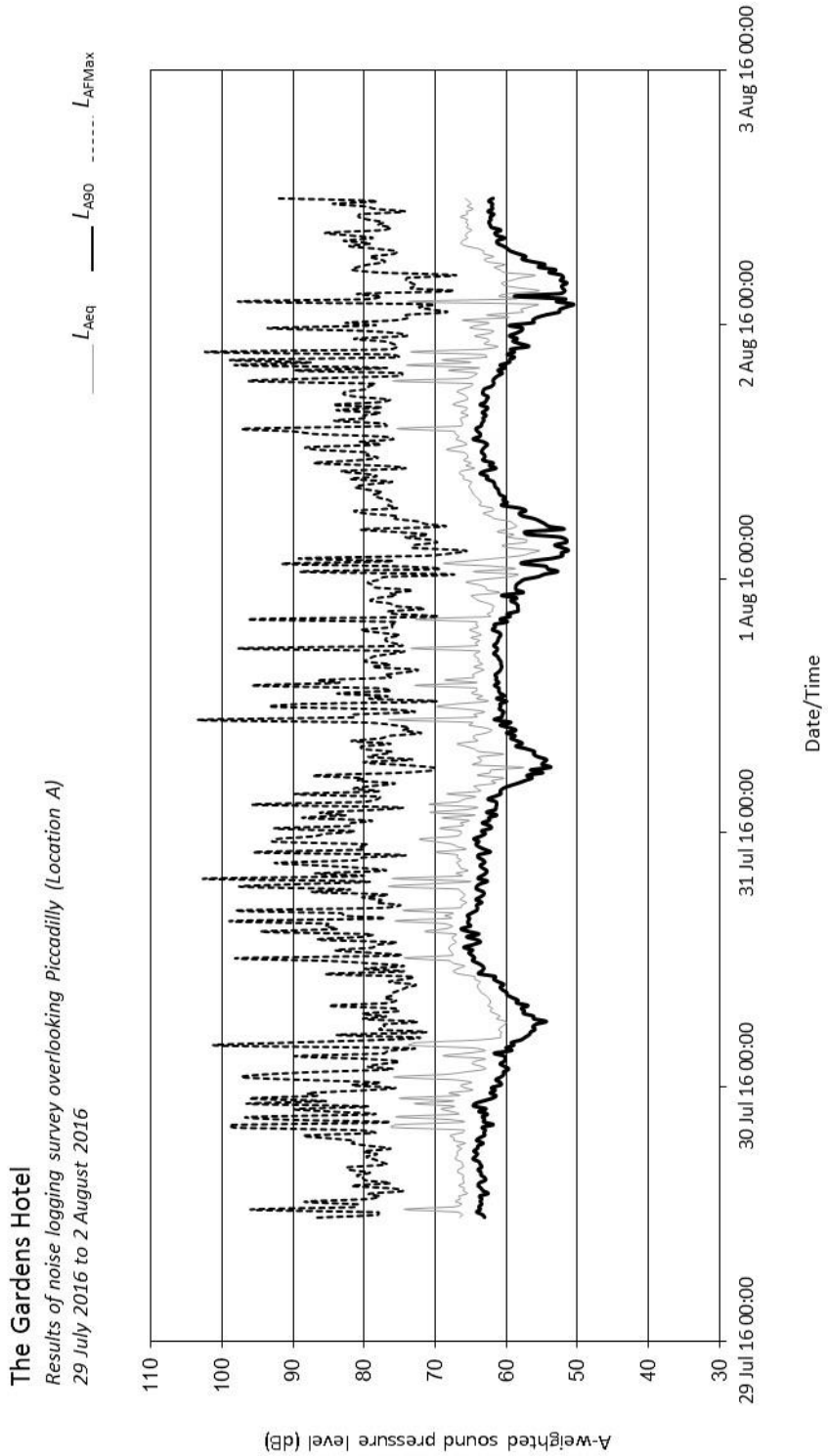
During the attended measurements carried out on 30 July 2016, 1 August 2016 and 2 August 2016 the weather was generally clear and dry and no rain occurred. Wind speeds varied between approximately 0 m/s and 2 m/s.

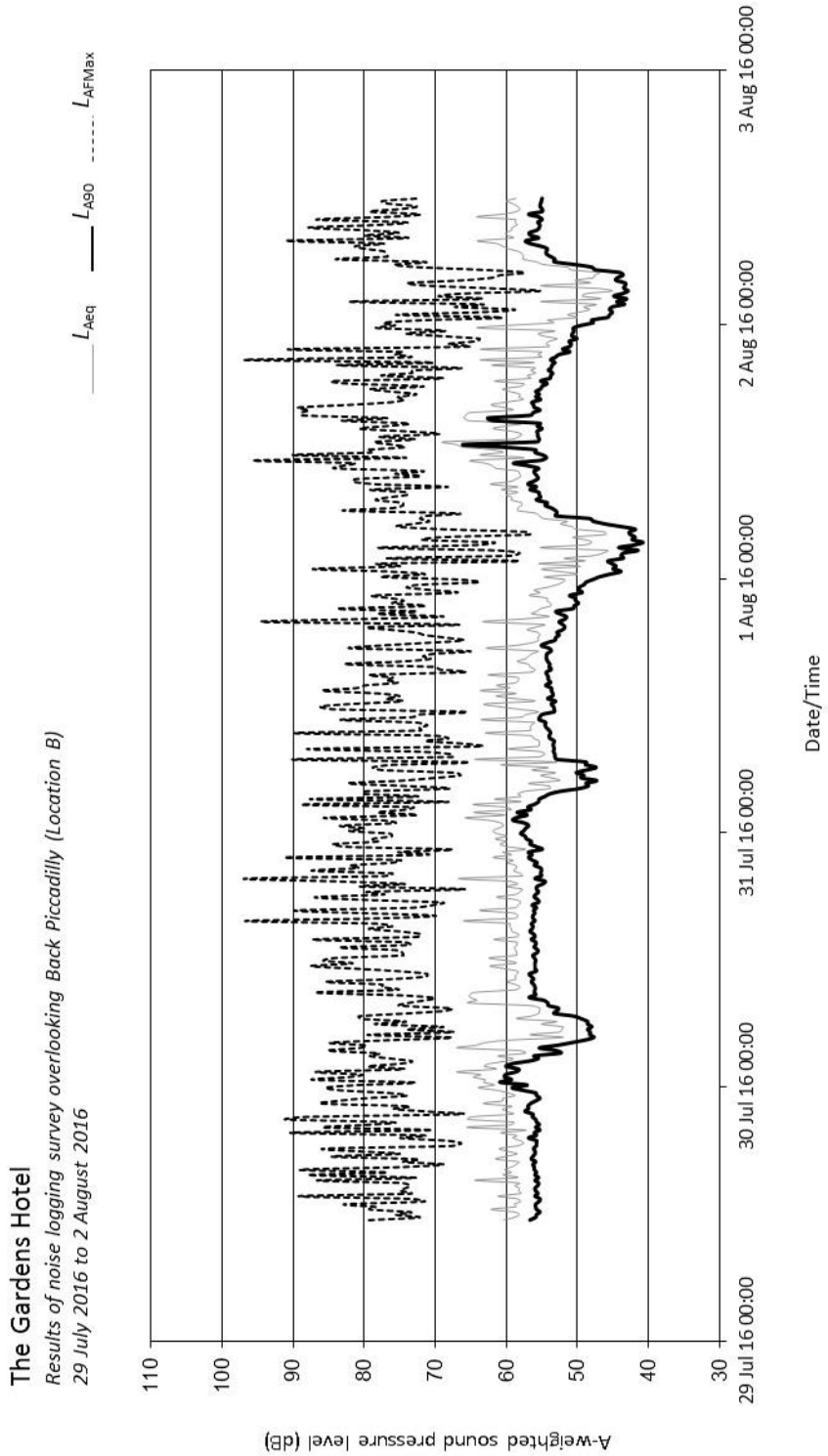
During the unattended noise measurements between 29 July 2016 and 2 August 2016, weather reports for the area indicated that temperatures varied between 10°C at night and 20°C during the day, and the wind speed was less than 3 m/s.

Occasional rain occurred on 29 July 2016, and 31 August 2016, however, the survey duration was sufficiently long to include periods unaffected by adverse weather and no variation in noise levels was seen to correlate with the weather. These measurements are consequently considered to have obtained a representative sample of noise data.

Appendix B

Results of unattended measurements


The Gardens Hotel
Results of noise logging survey overlooking Piccadilly (Location A)
29 July 2016 to 2 August 2016
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
29 Jul 16 00:00
30 Jul 16 00:00
31 Jul 16 00:00
1 Aug 16 00:00
2 Aug 16 00:00
3 Aug 16 00:00
Date/Time


The Gardens Hotel
Results of noise logging survey overlooking Back Piccadilly (Location B)
29 July 2016 to 2 August 2016
L_{Aeq}
L_{A90}
L_{AFMax}
A-weighted sound pressure level (dB)
110
100
90
80
70
60
50
40
30
29 Jul 16 00:00
30 Jul 16 00:00
31 Jul 16 00:00
1 Aug 16 00:00
2 Aug 16 00:00
3 Aug 16 00:00
Date/Time