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Leek, Churnet Valley

Planning noise assessment

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A	3 Nov 17		Tom Bonnert	Bob Albon
B	10 Nov 17	Incorporating comments	Tom Bonnert	Bob Albon
C	19 Dec 17	Updated scheme proposals	Tom Bonnert	Gordon Dolbear

Summary

Sandy Brown has been commissioned by Cube LLP on behalf of Moorlands Leek LLP to provide acoustic advice in relation to the proposed development in Leek, Churnet Valley.

An environmental noise survey has been undertaken to establish the existing noise climate surrounding the site, and in the vicinity of the nearby noise sensitive premises so as to determine appropriate limits for noise egress from building services plant. As a result of the site being accessible to the public, it was not possible to leave unattended long-term noise monitoring equipment at the site. As such, an attended shortened survey was conducted during the daytime and night-time.

Continuous monitoring measurements were performed at a fixed position between 14:00 and 17:15 on Thursday 26 October 2017, and 02:30 and 07:00 on Friday 27 October 2017. The roaming sample measurements were carried out on Thursday 26 October 2017 during the daytime, and Friday 27 October 2017 during the night-time.

The measured noise levels of the shortened attended environmental noise survey are summarised within the report herein.

Based on the guidance provided in BS 4142: 2014, and on the results of the noise survey, all plant must be designed such that the cumulative facade noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 44 dB during the daytime and L_{Aeq} 35 dB during the night.

As well as control of plant noise egress, noise egress from any noise generating activities associated with the proposed development such as deliveries/activity noise must also be controlled. A discussion relating to delivery and activity noise is provided herein. Any potential noise impact from the operation of the proposed business uses could be controlled by a planning condition requiring assessment of the specific proposals to BS 4142:2014.

Recommendations have been provided for both the external facade and the glazing of the proposed hotel, in order to ensure that the specified internal noise level criteria outlined in this document are met. As the design progresses, a more detailed facade sound insulation assessment will need to be performed to ensure any specific criteria the hotel operator stipulates is achieved. This could be secured via a suitable planning condition.

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1 Introduction

Sandy Brown has been commissioned by Cube LLP on behalf of Moorlands Leek LLP to provide acoustic advice in relation to the proposed development in Leek, Churnet Valley.

An environmental noise survey has been undertaken to establish the existing noise climate surrounding the site, and in the vicinity of the nearby noise sensitive premises so as to determine appropriate limits for noise egress from building services plant.

It was not possible to leave unattended long-term noise monitoring equipment at the site as a result of the site not being accessible to the public. As such, an attended shortened survey was conducted during the daytime and night-time.

This report presents the survey method, results of the environmental noise survey, and a discussion of acceptable limits for noise emission from building services plant.

An indicative assessment of the facade requirement with regard to noise ingress from external noise sources has also been conducted to determine the minimum sound insulation requirements for the building fabric of the proposed hotel premises.

2 Development proposals

It is understood that a hybrid planning application is to be submitted for a mixed use scheme, comprising retail units and a hotel. It is understood that the planning application seeks full consent for the retail units, and outline consent for a hotel.

The hotel proposal is for a 60 bed premises at circa 2000 m^2 floor area. The four retail units proposed encompass an area of approximately 2750 m^2.

The scheme is to be located to the north west of Leek, Staffordshire, adjacent to a recently constructed Sainsbury's supermarket.

As part of the planning consent for the supermarket (planning ref: *10/00041/RD*), consent was also granted for 3 no. retail units, located in a similar position to those proposed under this new application (in addition to other employment uses to the north east, and residential dwellings in the approximate location of the currently proposed hotel).

The proposed site plan is shown in Figure 1 for reference:

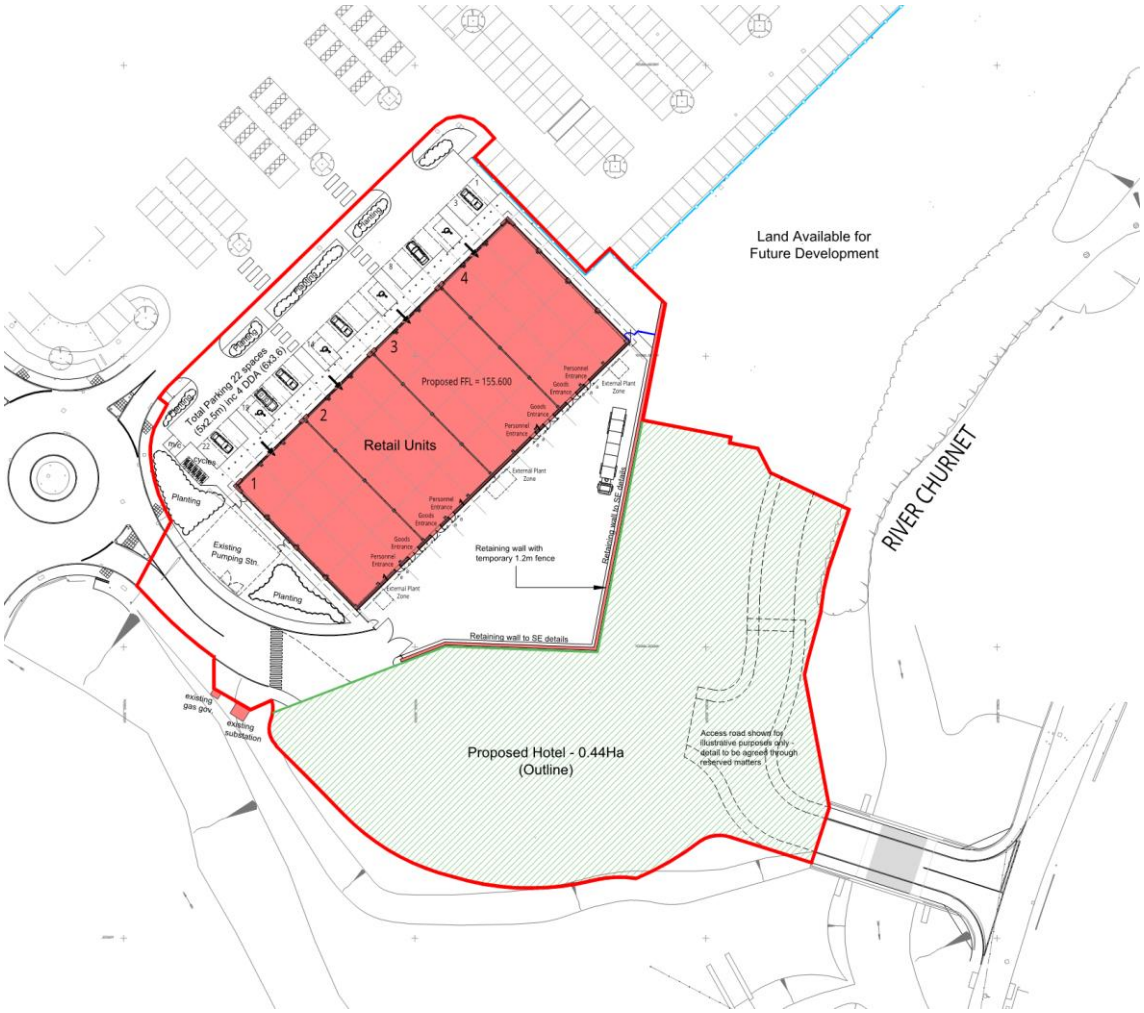


Figure 1 Proposed site plan

2.1 Potential noise sources

The potential noise sources associated with the development can be broadly divided into the following categories:

- Noise egress from fixed items of building services plant
- Noise egress from services/delivery vehicles associated with retail units and/or hotel
- Activity noise from patrons accessing retail units and/or hotel

3 Site description

3.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 2, highlighted in red. The site is located to the north of the A523 and to the west of Abbey Green Road. Park Road is noted to be located to the east of the site, Belle Vue Road and Kiln Lane are both noted to be located to the south of the site.

A continuous noise logging position was used during the environmental noise survey, denoted by the letter 'L' in Figure 2. Two roaming measurement locations were also used during the survey, denoted by the numbers '1' and '2' in Figure 2.



Figure 2 Site map (courtesy of Google Earth Pro)

3.2 Adjacent premises

The site is located next to a number of what are understood to be commercial and/or industrial premises. There are also noted to be two pubs to the south of the site which are highlighted in orange in Figure 2. The nearest/worst affected noise sensitive dwellings surrounding the site are highlighted in blue in Figure 2.

4 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.

4.1 Continuous noise logging measurements

Continuous noise monitoring was undertaken at the site to determine the existing background sound levels in the vicinity of nearby noise sensitive premises.

The continuous monitoring measurements were performed over 15 minute periods between 14:00 and 17:15 on Thursday 26 October 2017, and 02:30 and 07:00 on Friday 27 October 2017. The equipment was installed and collected by Tom Bonnert.

The measurement position used during the survey is indicated in Figure 2, denoted by the letter 'L'. A photograph showing the continuous monitoring measurement location is provided in Figure 3.



Figure 3 Photograph showing the unattended measurement location 'L'

The microphone at logger location 'L' was installed approximately 1.5 m above local ground level, and at least 3 m from any other significant reflective surface. As such, the noise levels measured at location 'L' are considered to be free-field noise levels.

This location is considered to be reasonably representative of those experienced by the nearest and worst affected noise sensitive receptors which are exposed to the same sources of background noise.

4.2 Attended sample measurements

Attended sample measurements were also performed at two locations around the site to assess the variation in noise levels, as well as the expected noise levels at the facades of both the hotel and retail units from road traffic, pedestrians and other significant noise sources in the area. The locations of these are indicated in Figure 2, denoted by the numbers '1' and '2'.

The attended measurements were carried out on Thursday 26 October 2017 during the daytime, and Friday 27 October 2017 during the night-time.

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. As such the noise levels measured at these positions are considered to be free field noise levels.

Photographs showing each of the attended sample measurements are provided in Figure 4.



Figure 4 Photographs showing attended sample measurements – Location '1' (left), location '2' (right)

5 Measurement results

5.1 Observations

At the continuous monitoring location ('L'), the dominant noise source observed was noted to be road traffic from the A523. Less significant noise sources included car and pedestrian movement within the Sainsbury's car park, faint pedestrian speech and footfall noise from car park/A523, as well as faintly audible industrial noise from adjacent warehouse.

At the attended sample measurement location '1', the dominant noise source observed was noted to be cars entering/exiting the Sainsbury's car park. The nearest road within the car park was the main route in and out, therefore cars were travelling at a greater speed than within the main area of the car park. Less significant noise sources included building services plant noise from industrial units to the south west of measurement location '1', intermittent HGVs serving Sainsbury's, pedestrian related noise within the car park, and car doors/boots slamming shut.

At the attended sample measurement location '2', the dominant noise sources observed were noted to be road traffic from the A523, as well as noise from a weir within the adjacent river. Less significant noise sources included cars accessing the Sainsbury's car park, patrons of the adjacent pub to the south of measurement location '2', and occasional pedestrians walking across the site wasteland.

5.2 Continuous noise logging measurement results

The results of the continuous noise logging measurements are summarised in the following section. All results obtained during the continuous monitoring are presented as free field noise levels.

A full table of the measured results from the continuous monitoring is also provided in Appendix B

5.2.1 Daytime continuous monitoring

The highest 15 minute ambient noise level measured during the daytime at location 'L' was $L_{Aeq,15min}$ 49 dB.

The lowest 15 minute background noise level measured during the daytime at location 'L' was $L_{A90,15mni}$ 41 dB.

5.2.2 Night-time continuous monitoring

The highest 15 minute ambient noise level measured during the night-time at location 'L' was $L_{Aeq,15min}$ 48 dB.

The lowest 15 minute background noise level measured during the night-time at location 'L' was $L_{A90,15mni}$ 32 dB.

5.3 Attended sample measurement results

The results of the attended sample measurements obtained during both the daytime and night-time portions of the survey are presented in the following sections. All results are presented as free field noise levels.

5.3.1 Daytime attended measurement results

The sound pressure levels recorded during the attended measurements during the daytime of Thursday 26 October 2017 are summarised in Table 1.

Table 1 Sound pressure levels from attended measurements – daytime measurements

Position	Start time	Sound pressure levels (dB)		
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$
1	14:12	49	70	45
1	14:48	47	67	44
1	15:25	49	62	44
1	15:59	51	69	45
1	16:33	49	59	45
2	14:31	51	69	49
2	15:08	50	61	48
2	15:42	53	74	50
2	16:15	51	66	49
2	16:50	51	64	49

The highest ambient noise level measured at location '1' (approximate location of retail units facade) during the daytime was $L_{Aeq,15min}$ 51 dB. The highest maximum noise level measured at location '1' during the daytime was $L_{AFmax,15min}$ 70 dB.

The highest ambient noise level measured at location '2' (approximate location of hotel) during the daytime was $L_{Aeq,15min}$ 53 dB. The highest maximum noise level measured at location '2' during the daytime was $L_{AFmax,15min}$ 74 dB.

5.3.2 Night-time attended measurement results

The sound pressure levels recorded during the attended measurements during the night-time of Friday 27 October 2017 are summarised in Table 2.

Table 2 Sound pressure levels from attended measurements – night-time measurements

Position	Start time	Sound pressure levels (dB)		
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$
1	02:30	51	68	38
1	03:05	41	62	36
1	03:40	43	59	37
1	04:14	39	54	36
1	05:09	41	57	39
1	05:43	43	58	39
1	06:17	48	64	44
2	02:48	48	67	46
2	03:22	49	59	47
2	03:57	49	67	47
2	04:31	52	70	48
2	05:26	51	63	49
2	06:00	54	69	49
2	06:34	53	65	50

The highest ambient noise level measured at location ‘1’ (approximate location of retail units facade) during the night-time was $L_{Aeq,15min}$ 51 dB. The highest maximum noise level measured at location ‘1’ during the night-time was $L_{AFmax,15min}$ 68 dB.

The highest ambient noise level measured at location ‘2’ (approximate location of hotel) during the night-time was $L_{Aeq,15min}$ 54 dB. The highest maximum noise level measured at location ‘2’ during the night-time was $L_{AFmax,15min}$ 70 dB.

6 Assessment criteria

6.1 NPPF and NPSE

The National Planning Policy Framework (NPPF) sets out the government's 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 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.

6.2 External noise levels - noise egress

6.2.1 Standard guidance

Guidance for noise emission from proposed new items of building services plant is given in BS 4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'.

BS 4142 provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

6.3 Internal noise level – noise ingress

6.3.1 Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings*, and is also provided by the World Health Organisation. The guidance given by BS 8233 and WHO is shown in Table 3.

Table 3 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)	WHO
Living rooms	35	-	30/35[1]
Dining room	40	-	-
Bedrooms	35	30[2]	30[2]

[1] WHO does not differentiate between different types of living spaces, but recommends L_{Aeq} 30 dB in relation to sleep disturbance and L_{Aeq} 35 dB in relation to speech intelligibility. WHO provides a 16 hour time base when referring to speech intelligibility and an 8 hour time base when referring to sleep disturbance.

[2] 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.

7 Noise egress – building services plant noise

7.1 Plant noise limits

Based on the above criteria and the measurement results, the cumulative noise level resulting from the operation of all new plant associated with the hotel and retail premises at 1 m from the worst affected windows of the nearest noise sensitive premises should not exceed the limits set out in Table 4.

These limits are presented as facade noise levels, therefore a +3 dB correction has been applied to account for the presence of a facade at the assessment location relative to the measurement location.

Table 4 Plant noise limits at 1 m from the nearest noise sensitive premises – plant noise limits

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)
Daytime (07:00-23:00)	44
Night-time (23:00-07:00)	35

It should be noted that in the absence of long term noise monitoring (as a result of there being no secure location to leave equipment) the limiting plant noise levels have been derived from the lowest measured background noise levels.

The limits set out in Table 4 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. This is discussed further in Section 7.1.1.

7.1.1 Attention catching features

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), the plant should be designed to achieve a limit below those set out above, based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible

For noise which is equally both impulsive and tonal, then both features can be taken into account by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment is not appropriate then an objective assessment can be made. A noise source is deemed to be tonal if the time averaged sound pressure level in a one-third octave band exceeds the level in adjacent one-third octave bands by the level differences given below:

- 15 dB in the low frequency one-third octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency one-third octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency one-third octave bands (500 Hz to 10000 Hz)

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.

7.2 Plant noise 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.

Typically, the plant noise limits will be met using the provision of suitable noise mitigation measures to the plant items, such as, in-duct attenuators, acoustic louvres and acoustic enclosures where applicable/required.

8 Noise egress – delivery and activity noise

8.1 Delivery noise

8.1.1 Retail units

Although noise associated with deliveries has the potential to cause disruption to existing residents, the anticipated number of deliveries to the 4 retail units is relatively low, with a single delivery per day to each unit anticipated, increasing to 2 deliveries per day at peak times (ie Christmas).

Planning condition 31, attached to the previous planning decision notice for the wider site places restrictions on the site, stated:

> *'Other than the supermarket, no night time deliveries or other activities in external areas are permitted at any of the other commercial premises on the site, including the employment units. Night time deliveries are defined as taking place between 23:00 and 07:00 hours*
>
> *Reason:- To avoid the risk of disturbance to neighbouring dwellings from noise during unsocial hours'*

On the basis that the previous planning consent was for retail units located at a similar location to those currently proposed, it is considered that a restriction on deliveries as discussed above should provide a suitable level of control to these noise sources and it is recommended that this restriction is placed on the currently proposed retail units.

8.1.2 Hotel

The number of deliveries to the hotel has not been confirmed, however based on a typical delivery schedule (taken from a Premier Inn specification) approximately 4 deliveries per day would be anticipated.

Excessive noise created by deliveries at night would result in an unacceptable impact on guests staying at the hotel, therefore delivery noise will need to be carefully managed by the hotel.

It is therefore considered that given the management, the noise impact on existing residents could be controlled via the use of localised screening and orientation of building massing.

On this basis, it is recommended that there are no restrictions on delivery times to the hotel.

8.2 Activity noise

Activities associated with the proposed development which are considered capable of generating significant noise have been identified as:

- Retail units
  - Patrons
- Hotel
  - Vehicle movements
  - Noise from terraces / external amenity areas

8.2.1 Retail units

The retail units are orientated so that the entrances are located in the northern facades. There will therefore be significant screening provided by the units themselves between patron activity and the nearest noise sensitive receivers to the east.

As a result, the noise impact of customers / patrons on the nearest noise sensitive receptors is likely to be negligible.

8.2.2 Hotel

Full details of the building massing and car parking provisions are not currently known.

Although the number of total car parking spaces is likely to be in excess of the car parking provisions for the business units, the vehicle movements are still likely to be infrequent during night-time hours.

Additionally, vehicle movements are likely to be staggered, with guests arriving and departing at different times during the day/evening and morning. As a result the impact of the car park is not likely to be significant.

Although detailed plans are not available, there is potential for the hotel to have a terrace for external eating and drinking. It is considered that noise egress from this source could be suitably controlled by orientating the terrace so that the building massing provides screening to the nearest noise sensitive receptors to the east. Localised barrier screening could also be used.

Additionally, it is recommended that use of any terrace is restricted to daytime hours only (07:00-23:00) to minimise disruption on both the hotel guests and on the existing noise sensitive receptors.

It is considered that provided the space is suitably managed (which would be required to minimise disruption on guests) the impact on the surrounding residential receptors should not be significant.

9 Noise ingress – facade sound insulation

This section discusses internal noise level criteria and assesses the required facade sound insulation performance for the proposed hotel. 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 within the potential hotel development. It should be noted that the facade performance will need to be reviewed as the design progresses to ensure that any internal noise criteria specified by the hotelier are achieved. Given the outline nature of the application, details of room dimensions and areas of glazing are not currently known, therefore typical room dimensions / glazing areas have been used for this facade assessment.

9.1 External noise levels

To allow a robust assessment, the highest noise levels at the approximate location of the hotel facade, as provided in Table 1 and Table 2, have been used to assess noise ingress to the hotel.

Table 5 presents the predicted facade noise levels at the potential hotel development during the night-time. Compliance with the internal noise criteria during the night-time is considered more onerous based on the noise levels at the site, and the night time criteria. Compliance based on these noise levels would also be expected to ensure compliance with the daytime criterion.

Table 5 Predicted facade noise levels at exposed facades

	Predicted facade noise levels	
	$L_{Aeq,15min}$ (dB)	L_{AFmax} (dB)
Hotel facade	57	73

9.2 Facade sound insulation

On the basis of the calculated noise levels in Table 5, the facade performance is recommended to apply throughout all hotel facades of the development. The minimum sound insulation performances for the building facades required to achieve the internal noise criteria are given in Table 6.

Table 6 Minimum facade sound insulation performance requirements – All floors

	Minimum external wall sound insulation performance $R_w + C_{tr}$ (dB)	Minimum glazing sound insulation performance $R_w + C_{tr}$ (dB)	Minimum ventilator sound insulation performance $D_{n,e,w} + C_{tr}$ (dB)
All hotel facades	40	27	30

9.3 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 7 Example glazing configurations and ventilation strategies

Sound insulation $R_w + C_{tr}$ (dB)	Example glazing configuration	Ventilation Strategy
27	6 mm/12 mm/6 mm	Attenuated passive ventilation (eg, trickle vents)

Based on the existing noise climate of the proposed site, a natural ventilation strategy via trickle ventilators would be suitable and compatible with achieving the internal noise criteria within the potential hotel.

Operable windows will be acceptable within the hotel to give the customers the option to open them if desired, however they should not be relied upon as the primary method of ventilation.

The required sound insulation of the solid sections of the hotel facade are not considered to be very onerous and could be achieved by a lightweight facade.

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).

The scheme proposes retail premises to be constructed adjacent to the hotel. The facade sound insulation will need to be reviewed as the design progresses (and the exact location of the hotel is known) to ensure control of noise ingress from deliveries and activities associated with the retail premises to the hotel. The glazing sound insulation performance may need to be increased to mitigate this. Additionally, depending on the requirements of the hotelier, mechanical ventilation may be required, which would negate the need for trickle ventilators and/or openable windows.

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, as well as any specific criteria of the hotel operator.

10 Conclusion

Based on the guidance provided in BS 4142: 2014, and on the results of the noise survey, all plant must be designed such that the cumulative facade noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 44 dB during the daytime and L_{Aeq} 35 dB during the night.

As well as control of plant noise egress, noise egress from any noise generating activities associated with the proposed development such as deliveries/activity noise must also be controlled. A discussion relating to delivery and activity noise is provided within the body of this report.

Recommendations have been provided for both the external facade and the glazing of the hotel, in order to ensure that suitable internal noise levels are achieved. As the design progresses, a more detailed facade sound insulation assessment will need to be performed to ensure any specific criteria the hotel operator stipulates are achieved. This could be secured via a suitable planning condition.

Appendix A

Survey details

Equipment

A Rion NL-32 sound level meter was used to undertake the continuous monitoring noise measurements. The attended sample measurements were carried out using a Bruel & Kjaer 2250 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	NL-32/00423757	Rion	23 Aug 18	1608434
Microphone	UC-53A/319229	Rion	23 Aug 18	1608434
Pre-amp	NH-21/36632	Rion	23 Aug 18	1608434
Calibrator	SV30A/10558	Rion	17 Aug 18	1608426
Sound level meter	2250/3009968	Bruel & Kjaer	01 Sep 18	09413
Preamplifier	ZC0032/24957	Bruel & Kjaer	01 Sep 18	09413
Microphone	4189/2689268	Bruel & Kjaer	01 Sep 18	09413
Calibrator	4231/3001923	Bruel & Kjaer	31 Aug 18	09408

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 daytime measurements carried out on Thursday 26 October 2017, the weather was generally clear and dry and no rain occurred. Weather reports for the area indicated that temperatures varied between 12°C at the start of the measurements and 9°C by the end. Wind speeds varied between approximately 1 m/s and 3 m/s.

During the night-time measurements carried out on Friday 27 October 2017, the weather was generally clear and dry and no rain occurred. Weather reports for the area indicated that temperatures varied between 6°C at the start of the measurements and 4°C by the end. Wind speeds varied between approximately 1 m/s and 3 m/s.

These weather conditions are considered suitable for obtaining representative measurements.

Appendix B

Table of results of continuous measurements at location ‘L’

Table 8 Continuous noise monitoring results - daytime

Position	Start time	Sound pressure levels (dB)		
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$
	14:00	45	76	41
	14:15	44	66	41
	14:30	44	57	42
	14:45	44	58	41
	15:00	44	58	41
	15:15	44	60	41
'L'	15:30	46	67	41
	15:45	44	56	42
	16:00	49	65	41
	16:15	45	57	43
	16:30	44	54	42
	16:45	45	64	42
	17:00	46	71	43

Table 9 Continuous noise monitoring results – night-time

Position	Start time	Sound pressure levels (dB)		
		$L_{Aeq,15min}$	$L_{AFmax,15min}$	$L_{A90,15min}$
	02:15	51	80	34
	02:30	48	58	34
	02:45	45	72	32
	03:00	39	59	33
	03:15	39	59	34
	03:30	41	59	35
	03:45	38	49	35
	04:00	38	51	35
	04:15	37	47	35
'L'	04:30	39	55	35
	04:45	39	47	37
	05:00	40	49	38
	05:15	41	50	39
	05:30	44	55	40
	05:45	43	53	39
	06:00	45	60	40
	06:15	44	55	42
	06:30	46	56	43
	06:45	45	77	41